



Vital Surveys

70 Daniel Close, Warrington
WA3 6QL

01925 387 029

Client: Shrewsbury House

37 Langrove Street, Everton, Liverpool, L5 3PE

Job No: VBS-0126 L5 3PE Phase 2

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Mechanical Performance specification

Name	William Harrop
Email	info@vitalbuildingservices.co.uk
Contact Number	07850 249 676
Checked By	W.Harrop

Revision Schedule

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1. INTRODUCTION

1.1. General

- 1.1.1. This document details the works for the Mechanical Services installation for the undertaking of carrying out the plant room refurbishment, subsequent distribution pipework and electrical installation and modifications at Shrewsbury House Youth Centre 37 Langrove Street, Everton, Liverpool, L5 3PE on behalf of Jon France & Vicki Parker.
- 1.1.2. The Mechanical Services Contractor, hereafter referred to as the Contractor, shall modify or divert existing services as necessary and install, design, co-ordinate, supply, test, commission, and set-to-work the new Mechanical and Electrical services installation including all enabling works as described in the main contract documentation, this document, and as are shown on the drawings.
- 1.1.3. This document shall be read in conjunction with the following:
 - VBS Doc A Electrical Workmanship Specification.
 - VBS Doc B Mech & PH Workmanship Specification.
 - VBS-0126 L5 3PE BMS Specification
 - VBS-0126 L5 3PE 2.1 Electrical Performance Specification
 - VBS Doc D Tender Summary
 - **Electrical services drawings**
 - L5 3PE-ZZ-SC-E-5001-Plant Room Electrical Strip Out
 - L5 3PE-ZZ-SC-E-5002-Plant Room Electrical Installation
 - **Mechanical services drawings**
 - P2-L5 3PE-ZZ-PL-M-001-LTHW Layout
 - P2-L5 3PE-ZZ-SC-M-002-LTHW Schematic
 - P2-L5 3PE-ZZ-SC-M-003-Strip out 1/2
 - P2-L5 3PE-ZZ-SC-M-004-Strip out 2/2
 - P2-L5 3PE-ZZ-PL-M-005-Domestic water services
 - All Installation drawings and associated Information.
- 1.1.4. The specification and the associated information used for the project does not relieve the Contractor of his responsibilities for the detailed design and provision of any part of the installation not specifically detailed, but as would be necessary to achieve a complete working installation or which will require specialist final design portions or co-ordination.
- 1.1.5. All general and specialist design input is required for and is to be included within the Contractors price and he shall employ a specialist for the detailed design of the works.
- 1.1.6. Where Commodities are specified to conform to British Standards, they shall be clearly indelibly marked with the reference specified. Where this is impractical the relevant advice and delivery notes shall include the BS reference with which they comply.
- 1.1.7. Where commodities are specified as manufactured by a BSI Kitemark Licensee or where commodities/services are specified to be by Registered Firms (under BSI Assessment Schemes) the manufacturer/firm must be a current participant in the relevant scheme.
- 1.1.8. The installation shall be complete in every respect, including all equipment, parts, ancillaries, fixings, and works, whether specifically mentioned in this document or not, necessary for the systems to be complete and tested, balanced, commissioned, and to perform correctly.
- 1.1.9. Any items excluded from the specification or drawings, but which are required to ensure a complete installation to Statutory Authority requirements and to provide fully functional systems shall be included at no additional cost to the Contract.
- 1.1.10. The Contractor is deemed to have allowed within his price for all items necessary to ensure that the installation is complete in every respect and in accordance with the design.
- 1.1.11. Where trade names are used, the intention is to indicate a quality standard that must be adhered to. Equipment of equivalent manufacture and performance may be included, provided such equipment is submitted for review and is subsequently approved for use by the Client in writing.

- 1.1.12. If any discrepancies or anomalies are discovered between any of the specification documents or between the specification documentation and any design drawings, the Contractor shall immediately seek guidance from the Consultant.
- 1.1.13. The Contractor shall be responsible for the submission of all drawings and calculations as necessary for the Building Control and Fire Officer to obtain necessary Statutory approvals for the installation of the services.
- 1.1.14. The specification does not absolve the Contractor from his/her responsibility to visit the site and refer to all governing factors which may affect the content and program of works, and method of construction. No claim for additional costs or extension of time will be entertained resulting from lack, or misinterpretation, of information.
- 1.1.15. The sequence of the works shall be agreed with the Main Contractor and all relevant parties. This may necessitate the installation being carried out in multiple areas simultaneously. Any major shutdown of the site supply shall be agreed with the Client, the Main Contractor and Contract Administrator
- 1.1.16. It is the responsibility of the Contractor to ensure that the Mechanical installation is installed in an efficient manner and that energy efficiency and conservation are a priority. The Contractor is expected to be proactive with regards to the Mechanical installation and is invited to offer proposals for alternatives which will result in a cost saving for the Client whilst maintaining the level of performance and quality detailed in this performance specification. These proposals must be presented for explicit and written approval prior to adoption/incorporation into the scheme. Failure to obtain approval may result in the Contractor having to rectify works at his own cost.
- 1.1.17. The Mechanical installation shall comply in all ways with the edition current at the time of construction, of all relevant Codes of Practice, Regulations, Local Authority Requirements, Byelaws, Utility Company requirements, British Standards, European Norm documents, and Building Regulations.
- 1.1.18. The Contractor shall be responsible for the full design and installation of all systems. The Contractor shall allow for liaising fully with the Electrical, Controls and Fire alarm Contractors for establishing their requirements and co-ordination of services design and layouts.

2. PROJECT DESCRIPTION

2.1. General

- 2.1.1. Shrewsbury House youth centre is a 1970s construction comprising of a youth centre, Church, hostel house and vicarage. The House and vicarage have been partitioned off and are no longer connected to the building services installation. The youth centre consists of a sports hall, several cellular offices to the north and east elevations, along with larger open spaces and a small kitchen. These facilities are spread across 2 floors. The church are consists of a large meeting space and double height congregational area that is also equipped with a glazed corridor the to the central courtyard. The hostel consists of several single occupancy bedrooms across 2 floors with a central common area and catering facilities
- 2.1.2. The project is to replace the existing heating boiler and modify the plant room pipework, controls and electrical installation.
- 2.1.3. The Contractor shall install one additional matching Vaillant ecoTEC plus 80kW boiler onto the existing Vaillant cascade mount system. This shall be complete with additional flue, gas pipework and all ancillary equipment required to ensure adequate operation.
- 2.1.4. The contractor shall strip out and remove the LTHW pipework within the plant room leaving the existing circuits distributing LTHW to the building ready for reconnection.
- 2.1.5. The contractor shall identify label, strip out and remove all redundant Gas, LTHW and public health pipework from the plant room and cap off any redundant services at the point the services enter or leave the plant room area.
- 2.1.6. The contractor shall strip out and remove the 100mmØ gas pipework from the existing gas meter to the plant room.
- 2.1.7. The contractor shall design, supply, install test and commission new gas pipework from the gas meter to the plant room. The contractor shall validate all remaining gas pipework within the building and identify gas appliances so the pipework shall be sized to accommodate all the gas-fired equipment on site.
- 2.1.8. The contractor shall design, supply, install test and commission new gas solenoid valve, gas proving and control system that interlocks the gas supply to the existing fire alarm and proposed new BEMS control system. The interlock shall incorporate all required safety devices. (knock off, thermal links etc.)
- 2.1.9. The contractor shall include for additional interfaces with the two No. existing Rinnai gas fired water heaters to ensure that these shut down when the gas valve closes.

- 2.1.10. The contractor shall design, supply, install test and commission new primary LTHW pipework from the Vaillant Cascade plate heat exchanger to a vertical low loss header. The primary pipework shall be complete with air/dirt separation, chemical dosing pot and required isolation and drain valves.
- 2.1.11. The contractor shall design, supply, install test and commission and new vertical low loss header sized to suit the heating load within the building. There shall be 4No. secondary circuit connections equally sized to include for future expansion.
- 2.1.12. The contractor shall design, supply, install test and commission 1 new Constant Temperature (CT) circuit from the proposed new low loss header. This shall be complete with 2No. new pumps with auto changeover sized for and to connect to the existing CT within the building. This circuit shall be complete with isolation valves, commissioning set and all appropriate and required ancillary equipment such as auto air vents, drain cocks etc.
- 2.1.13. The contractor shall design, supply, install test and commission 1 new Variable Temperature (VT) circuit from the proposed new low loss header. This shall be complete with 2No. new pumps with auto changeover sized for and to connect to the existing VT within the building. This circuit shall be complete with isolation valves, commissioning set and all appropriate and required ancillary equipment such as auto air vents, drain cocks etc.
- 2.1.14. The contractor shall design, supply, install test and commission 4No. 2 port motorised zone control valves to be installed in the existing CT circuit to allow for zone controls of the sports hall, offices, church and hostel.
- 2.1.15. The contractor shall design, supply, install test and commission 2No. automatic pressurisation units serving the primary side and secondary side of the plate heat exchanger. These shall be complete with all ancillary equipment required.
- 2.1.16. The contractor shall design, supply, install test and commission a full BMS control system controlling all LTHW plant and equipment in the building. The BMS system shall include remote monitoring within the property's local computer network. The BMS shall also interlock with the fire alarm, Gas valve controller and water heaters.
- 2.1.17. The contractor shall design, supply, install test and commission 2No. heat meters installed on pipework serving the Church and Hostel. The heat meters shall be MID Class 2 accuracy standard (EN1434) and report back to the proposed new BMS system detailed above. These heat meters shall be used for billing purposes and monitoring shall be provided.

3. SCOPE OF WORKS

3.1. General

- 3.1.1. The Mechanical Contractor shall be responsible for the entire design detailing, supply, installation, testing, and commissioning of the complete Mechanical installation to the standards and regulations specified, together with all planning and management necessary to ensure the logical, efficient and satisfactory execution of the works.
- 3.1.2. Unless with prior written agreement of the project manager, the Contractor shall ensure that works do not interfere with, or interrupt services to, in any way shape or form, the other occupants, areas, or services within the building without prior permission.
- 3.1.3. The Contractor shall be responsible for all alterations, disconnections, making safe, stripping out and disposal of existing services as required to accommodate the new Mechanical installation.
- 3.1.4. The Contractor shall be responsible for submitting all relevant information to the statutory authorities and obtaining their approval. Copies of all approvals shall be submitted to the Contract Administrator, Project Manager, and Building Services Consulting Engineer.
- 3.1.5. The project shall include the installation of, but not limited to, the following new services, the detail of which is provided within the later respective sections:
 - Validate and pressure test existing pipework that is to be retained and reused.
 - Validate existing services that are retained within the plant room and adjacent spaces.
 - Validate existing domestic hot water generators for correct operation and maintenance.
 - Validate and repair existing fan coil heat emitters throughout the complex. Where repairs cannot be made a replacement fan coil unit shall be provided.
 - Validate and repair existing LTHW heat emitters throughout the complex replacing TRVs where required.

- Validate the electrical submain distribution for the electrical services within the plant room.
- Validate the fire alarm system to include for interlock controls within the plant room.
- Validate existing ventilation within plant room.

- Undertake enabling works (including temporary supplies and disconnecting and removing of all existing equipment no longer required and flushing of existing LTHW services).

- Strip out and remove existing redundant services within the plant room.
- Strip out and remove gas distribution pipework.
- Strip out and remove redundant tanked cold-water pipework within the plant room and adjacent spaces. Capping off where services cannot be fully removed.
- Strip out and remove existing redundant controls installation including containment, control valves and outlets.
- Strip out and remove plant room fuse panel and make safe.

- Modification of existing LTHW heating system within the plant room.
- Modification of existing public health systems within the plant room.

- Provision of new electrical distribution board within plant room to serve electrical requirements of the plant and equipment.
- Provision of new fire alarm interface to BEMS panel and gas interlock.
- Provision of new lighting installation within the plant room.
- Provision of new electrical power installation within the plant room.
- Provision of all electrical containment with plant room.
- Provision of new gas installation including gas valve, interlock, controls and electrical interconnections and integration.
- Provision of new BMS controls systems within the plant room and property including cabling, containment and associated equipment.
- Provision of new heat meters, associated controls and interconnection to BEMS on circuits serving hostel and church spaces.
- Provision of new Vaillant gas boiler and flue to connect to existing cascade skid mounting system, pipework, plate heat exchanger.
- Provision of 2 new chemical dosing pots.
- Provision of 2 new water pressurisation units & expansion vessels.
- Provision of new circulation pumps serving new primary and secondary CT & VT circuits.
- Provision of new water treatment chemicals.
- Provision of new heat meters.
- Provision of secondary support steelwork and access platforms/ ladders associated with the electrical services, together with associated builders work details

- Witnessing and Acceptance Tests for system equipment
- Liaison and co-ordination with all other trades, between mechanical and electrical services, and with the Client, Principal Contractor, Project Team, other Contractors and Sub-Contractors
- Testing & commissioning of all installations.
- Training of incoming personnel in respect of installed systems
- Demonstration to the end-user/client of the installed services.
- Provision of specialist design for systems.
- Provision of as installed drawings.
- Provision of operating & maintenance manuals.
- Provision of onsite Logbook for new systems
- Provision of 12-month defects liability period.

3.1.6. The above summary is intended for the general guidance of the Contractor, items not listed but which are required for a complete and fully coordinated and operational system are deemed to be included and shall relieve the Contractor of his obligation to carry out the whole of the works required and as hereinafter described.

3.1.7. The Contractor shall ensure that the Mechanical Services installations shall fully comply with the current agreed versions of all regulations in force at the time of tender, including, but not limited to the requirements set out in the

- VBS Doc A Electrical Workmanship Specification.
- VBS Doc B Mech & PH Workmanship Specification.
- VBS-0126 L5 3PE BMS Specification

3.1.8. The Contractor shall include for all equipment deliveries and storage (off and on site) access equipment, specialist equipment, staff welfare, test equipment and tools as necessary to undertake the works described.

3.1.9. The existing Mechanical installation being replaced shall be stripped out in its entirety as the project progresses. The Contractor shall allow within the tender for all disconnection, making safe, stripping out, and disposal of existing services associated with the contract works.

3.1.10. The Contractor shall allow for full liaison and co-ordination with all other trades and between Public Health, mechanical and electrical services, with the Client, Principal Contractor, Project Design Team, other Contractors and sub-Contractors.

3.1.11. As part of the works, the Contractor shall assist the Client and Main Contractor in obtaining Building Regulations approval, which shall include compliance with Part L.

3.1.12. The Contractor shall ensure that the works shall comply in all respects with the current editions (including all amendments) of all relevant legislation, statutory instruments, Approved Codes of Practice, British Standards, European and International standards adopted as British Standards, and the requirements of all statutory authorities and enforcing bodies applicable at the time of design and installation. This shall include, but not be limited to, the following:

3.1.12.1. General Legislation

- Health and Safety at Work etc. Act 1974
- Construction (Design and Management) Regulations 2015
- Workplace (Health, Safety and Welfare) Regulations 1992
- Management of Health and Safety at Work Regulations 1999
- Control of Substances Hazardous to Health Regulations 2002 (as amended)
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR)

3.1.12.2. Electrical

- Electricity at Work Regulations 1989 (as amended)
- BS 7671 (IET Wiring Regulations), current edition including all amendments
- IET Guidance Notes as applicable
- BS EN 61439 (LV switchgear and control gear assemblies) where applicable

3.1.12.3. Building Regulations

- Building Regulations 2010 (as amended) and all relevant Approved Documents, including but not limited to:
 - Part B – Fire Safety
 - Part F – Ventilation
 - Part G – Sanitation, hot water safety and water efficiency
 - Part L – Conservation of fuel and power
 - Part M – Access to and use of buildings
- All works shall be to the satisfaction of the Building Control Body.

3.1.12.4. Mechanical, Gas and Water Installations

- Gas Safety (Installation and Use) Regulations 1998 (as amended)
- Water Supply (Water Fittings) Regulations 1999
- Pressure Systems Safety Regulations 2000 (where applicable)
- Clean Air Act 1993

3.1.12.5. Construction Products and Fire Performance

- Construction Products Regulations 2013 (as amended), including UKCA and/or CE marking requirements as applicable
- Reaction to fire classification in accordance with BS EN 13501 series
- Cables to achieve minimum Euroclass Cca unless otherwise specified

3.1.12.6. Environmental and Pollution Control

- Environmental Protection Act 1990
- Control of Pollution Act 1974 (as amended)
- Control of Noise at Work Regulations 2005 (where applicable)

3.1.12.7. Standards

- All relevant current British Standards (BS), BS EN and BS EN ISO standards.
- Relevant IEC standards where no equivalent British Standard exists.
- CIBSE Guides and Technical Memoranda where applicable

3.1.12.8. Authorities and Insurers

- The Building Control Body
- The Fire and Rescue Authority
- Statutory Undertakers
- The Employer's insurers
- Any other relevant enforcing authority

3.1.13. The Contractor shall notify all authorities in accordance with their regulations and obtain any required approvals for the Installation.

3.1.14. Refer to Appendix B for a full list of standards and regulations.

3.1.15. Where no specific design, performance or installation standards are quoted the following shall apply to ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.

- All documentation, regulations, guides, technical memoranda etc. produced by the Chartered Institution of Building Services Engineers.
- Construction (Design and Management) Regulations 2015
- BS EN 50110 Operation of electrical installations. General requirements
- Provision and Use of Work Equipment Regulations
- Personal Protective Equipment at Work Regulations
- The Construction (General Provisions) Regulations
- The Construction (Lifting Operations) Regulations
- Other relevant Safety Regulations
- Public Utility Company and/or Statutory Authority regulations, specifications, and requirements
- British Standards and Codes of Practice
- Local Authority Regulations and approvals.
- BSRIA Commissioning Codes
- Manufacturer's stipulations and recommendations for installation, testing, commissioning and maintenance.
- Equality Act.
- Clean Air Act
- IET Wiring Regulations.
- Building & Engineering Services Associations Specifications
- DW172, 143 and 144
- All relevant IGEM – UP Guidance Documents and Associated Appendices

3.1.16. Where published documents are included in the above list the Contractor is to ensure that the installation of the works complies with the current edition of said document.

- 3.1.17. The Contractor shall allow for the complete testing, commissioning, and handover of the complete installed systems.
- 3.1.18. The Contractor shall allow for instructing the client or their representatives in operating, maintaining, and servicing the installed systems.
- 3.1.19. The client's representative (Contract Administrator) will give written notice of requirements for this instruction to commence. Training shall only be given once Practical Completion has been achieved but before the full occupation of the building takes place.
- 3.1.20. The Contractor shall provide training for a minimum of {two} persons on each system and shall obtain signatures from those that receive the training to confirm that it has been completed to their satisfaction. A copy of the training form is to be included in the building logbook and a copy be provided to the Engineer and Contract Administrator
- 3.1.21. Provision of fully comprehensive Operation & Maintenance Manuals complete with As Installed Drawings to cover all the installed, modified and existing Mechanical Services systems.

4. DESIGN BASIS

4.1. General

- 4.1.1. This section defines the design intent parameters, engineering assumptions, and performance criteria upon which the mechanical services design has been developed at Stage 3.
- 4.1.2. The Mechanical Contractor shall adopt this Design Basis when undertaking the detailed design and shall notify the Contract Administrator of any deviations or incompatibilities prior to progressing the detailed design.

5. PROVISION OF INFORMATION

5.1. General

- 5.1.1. The design shall be undertaken with due consideration to the detailed guidance given in these specifications, the design intent drawings, British Council for Offices guidance, relevant CIBSE codes, BS7671, and IET Guidance Notes. Refer to Appendix B for a full list of standards and regulations.
- 5.1.2. All calculations are to be undertaken using industry recognised calculation software packages.
- 5.1.3. Copies of design calculations and drawings upon request shall be submitted to the Building Services Consultant Supervising Engineers by the Mechanical Contractor prior to ordering of materials and commencement of installation or related structure. Notwithstanding this, the Mechanical Contractor shall be responsible for any error, discrepancy or omission in any calculation or design drawing prepared by him or on his behalf, whether or not such calculation or design has been passed 'No Comment' by the supervising engineers.
- 5.1.4. A margin of 15% shall be designed into the heating system to cater for start-up conditions.
- 5.1.5. Calculations shall comprise but not be limited to the following:
 - LTHW plant sizing
 - Pressurisation unit and expansion vessel calculations
 - Pipework Pressure drop calculations
 - LTHW pipework sizing
 - Hot and cold-water services pipework sizing
 - Above ground drainage pipework sizing
- 5.1.6. Design drawings shall comprise, but not be limited to the following:
 - External mechanical services layout, including incoming gas and water supplies (Drawing scale TBC according to site dimensions)
 - All main heating and domestic services distribution routes 1:50
 - Co-ordinated drainage layouts 1:50
 - Co-ordinated plans showing plant area and plant room layouts 1:20

- Heating distribution schematic NTS
- Domestic Hot & Cold-Water schematic NTS

5.1.7. The Mechanical Contractor shall utilise the following procedure for the selection of plant and equipment manufacturers associated with the Mechanical services installations. This procedure shall be utilised for all items of plant and equipment, including ancillary items such as switches, electrical accessories, etc.

5.1.7.1. Issue of a technical submission to the Building Services Consultant Supervising Engineers that shall fully describe the particular item of plant and equipment. This shall include written confirmation that the item is fully specification compliant together with clarifying any particular options that are proposed to be incorporated as part of the item of plant and equipment. The technical submission shall therefore also need to incorporate the full manufacturers' literature, selection details and relevant wiring diagrams including any specific BMS monitoring requirements.

5.1.7.2. Upon request the Contractors calculations and installation drawings will be reviewed by the engineer and returned with a review code as described below. Upon receipt of such calculations or drawings bearing the review code and signature, the Contractor shall immediately take such action as demanded by the code. The review codes as referred to herein shall be defined as:

- **Status A** Information Submitted is of acceptable standard, work may proceed in accordance with the Contract and Specifications, no further review necessary.
- **Status B** Information Submitted is of standard acceptable in principle, work may proceed in accordance with the Contract and Specifications provided that comments incorporated. Incorporate comments and resubmit for further review.
- **Status C** Information Submitted not of acceptable standard, work may not proceed. Incorporate comments on calculation or drawing and resubmit.

5.1.8. The Building Services Consultant Supervising Engineers will comment upon the technical submission within 10 working days of receipt, if it is deemed that there is insufficient information submitted then the technical submission will be returned to the Mechanical Contractor for re-submission with appropriate level of detail. The 10-working day period will then recommence when the technical submittal is re-submitted.

5.1.9. The building services installations shall be designed and installed to achieve a design life in accordance with the CIBSE Guide to Ownership and Maintenance of Building Services and CIBSE Guide M. The building services shall all have a minimum 20-year design life.

5.1.10. Mechanical Contractor shall have full design responsibility for all and every aspect of the Mechanical services installation.

6. ENABLING, STRIP OUT AND BUILDERS' WORKS

6.1. General

- 6.1.1. The Contractor shall allow for all necessary enabling and isolation works required to make the existing site ready for the commencement of construction works.
- 6.1.2. The Contractor shall allow for all necessary builders works required for the scheme as detailed below.
- 6.1.3. The Contractor shall be responsible for the provision of, or re-instatement of, all fire stopping to services penetrations.

6.2. Existing Services Survey

- 6.2.1. Prior to commencement of works, the Contractor shall undertake detailed pre-construction survey / inspection and assessment of:
- 6.2.2. Historic inspection and testing certification.
- 6.2.3. Existing plant room & distribution pipework.
- 6.2.4. Existing mains cold water and tanked cold water systems
- 6.2.5. Existing above ground drainage systems
- 6.2.6. Existing gas pipework, routes and appliances throughout the whole complex.

- 6.2.7. Existing domestic hot water distribution pipework.
- 6.2.8. Existing fire alarm interfaces.

6.3. Making Good

- 6.3.1. The Contractor shall, in consultation with the main contractor, ensure that all necessary work to make good any areas where fabric is affected by the removal of services is fully covered in the main contractor's works.

6.4. Asbestos

- 6.4.1. The Contractor shall check the Asbestos Register for the existing property (if one has been produced or retained as part of the original building construction records) for any recorded instances of Asbestos or Asbestos Containing Materials (ACM).
- 6.4.2. Should the Contractor suspect the presence of asbestos, ACM's or any other hazardous materials in the vicinity of his workforce he must immediately cease work and clear that area of labour and inform the Main Contractor, Contract Administrator and the Client.
- 6.4.3. Under no circumstances whatsoever must the Contractor attempt to remove or take samples of the suspected material or materials.
- 6.4.4. In the event the presence of asbestos, ACM's or other hazardous material is confirmed or otherwise by a specialist services laboratory, the Contract Administrator will instruct the Contractor of actions to be taken.

6.5. General Builders Work

- 6.5.1. The Contractor shall ensure that detailing and coordination of all builder's work associated with the Mechanical services installation, including all holes, sleeves, trenches, etc. is provided. Such builders work shall be carried out by the Main Contractor, or as directed for the particular development.
- 6.5.2. Builders work details shall be indicated upon a dedicated drawing and shall be fully dimensioned and positioned to allow accurate fabrication and formation of the necessary openings by the Main Contractor. Care shall be taken to coordinate all Mechanical, Electrical and Public Health builders work requirements to avoid clashes and optimise the extent of openings and works required.
- 6.5.3. The Contractor shall be responsible for all builder's work holes for the Mechanical services installation that are below 100mm in diameter or 100mm x 100mm in size.
- 6.5.4. The builders work associated with the services installation to be carried out by the Main Contractor shall include, but not be limited to the following;
 - Forming of all holes, openings and the like, including necessary supports for such openings 100mm x 100mm or 100mm in diameter.
 - Forming of all walls, ceiling and floor chases.
 - Construction of all plant bases and supporting structures.
 - Trenching and backfilling.
 - Provision of and laying of all necessary underground ducts.
 - Forming enclosures.
 - Provision of any patresses' or lighting supports required for mounting in ceiling systems.
 - All making good.
- 6.5.5. The builders work by the Main Contractor shall not include primary or secondary supports for pipework, ductwork, cable trays, cables, etc. These shall be supplied and installed by the Mechanical Contractor.
- 6.5.6. Builders work details shall be indicated upon a dedicated or installation drawing and shall be dimensioned to allow accurate fabrication and formation by the Main Contractor. Care shall be taken to coordinate all Mechanical, Electrical, and Public Health builders work requirements to avoid clashes and optimise the extent of works.
- 6.5.7. It is the Contractor's responsibility to undertake/provide or request all builders work required to complete the Contract.

- 6.5.8. Where necessary, the Contractor shall liaise with the Main Contractor and structural engineer to ensure that builders work holes will not adversely affect the structure.

6.6. Fire Stopping

- 6.6.1. The Contractor shall ensure that fire stopping is installed or re-instated around every services penetration and to all ducts and risers where they pass through any type of fire-rated construction.
- 6.6.2. Provide and install firestop products that limit the spread of fire, heat, smoke, and gasses through otherwise unprotected openings in fire-rated assemblies, including walls, partitions, floors, roof/ceilings, and similar locations, restoring the integrity of the fire-rated construction to its original fire rating.
- 6.6.3. All through-penetration firestop systems shall be installed with approved methods using materials that have been tested and classified to produce an approved assembly.
- Products shall be manufactured in a facility that follows ISO 9001 best practices.
 - Products shall have undergone a formal life cycle assessment evaluating environmental impact.
- 6.6.4. Any recessed accessories installed within fire-rated construction are to have intumescent fire barriers installed to limit the spread of fire through the structure via the accessory and box.

7. DESIGN CRITERIA

7.1. General

- 7.1.1. This Section sets out the principal design parameters applicable to the Mechanical Services Installation.
- 7.1.2. The following Building Regulations Part L Approved Documents are relevant to this project:
- Approved Document L – Conservation of fuel and power Volume 2: Buildings other than dwellings
- 7.1.3. Upon request The Mechanical Services Installer shall be responsible for the production and issue of all appropriate calculations and information relevant for Part L Building Regulations Approval. The Mechanical Services Installer shall liaise with other Contractor design team members to ensure a fully co-ordinated calculation/information pack is issued to the Contractor to meet the programmed Building Control submission date.
- 7.1.4. The Mechanical Services Installer shall be responsible for the production and issue of all appropriate calculations and information relevant for Part L Building Regulations Approval and any other requirements set out in the above standards.
- 7.1.5. The Mechanical Services Installer shall liaise with other Contractor design team members to ensure a fully co-ordinated calculation/information pack is issued to the Contractor to meet the programmed Building Control submission date.
- 7.1.6. Any preliminary Building Regulations calculations, which have been carried out as part of the concept design will be issued to the Contractor design team for their information.

7.2. Spare Capacity

- 7.2.1. All capacity must allow a minimum of 10% spare for future use. This criteria relates to all aspects of the new mechanical services installation including but not limited to the following:
- BEMS
 - Heating Boilers
 - Heating Services Circulation Pumps
 - Heating Services Pipework
 - Electrical installation
 - Gas installation

- BEMS controls installation
- Electrical containment.

7.3. Pipework Systems

- 7.3.1. Water pipework systems shall be sized using the appropriate tables and correction factors from Section C. of the CIBSE Guides. Sizing shall be based on a maximum unit pressure drop from the index circuit of 250 Pa/m.
- 7.3.2. Unless otherwise specified, velocities throughout the system shall not exceed 1.5 m/s for steel pipes up to and including 50mm diameter and 3m/s for larger sized steel pipes. For copper pipes, these velocities shall be reduced to 1m/s and 1.5 m/s respectively. Where, exceptionally, local considerations require the above velocities to be exceeded the Engineer shall be advised of the situation. The above parameters shall only be exceeded with the Engineers and Contract Administrators written Approval.
- 7.3.3. Systems shall be designed to achieve good balancing characteristics. The distribution shall be divided into sub-circuits as necessary to limit or avoid short circuits. Equipment with high-pressure drops shall not be connected into the same sub-circuits as equipment with low-pressure drops.
- 7.3.4. Where the pressure drops are so great as to cause difficulty in commissioning even with separation of sub-circuits, then separate pumping of either, or both circuits shall be adopted, or the equipment re-selected to reduce the difference in pressure drops.
- 7.3.5. Closed circuits with variable flow shall be designed to be reverse return or shall incorporate differential pressure control valves to achieve acceptable flow characteristics under varying flow conditions.

7.4. Acoustics & Noise Ratings

- 7.4.1. Acoustic calculations shall be provided to confirm that the selection of equipment and attenuators meet the design requirement listed in this Section. Calculations shall include but not be limited to:
 - Boundary Noise Issues
 - Internal noise levels in plant rooms with confirmation whether ear protection is required.
 - Noise levels within all occupied spaces due to the mechanical services installation.
 - Structural borne noise and vibration from the mechanical services installation.
- 7.4.2. The systems shall be designed, and equipment selected to achieve the following noise levels within the building:

• Offices	NR 35
• Toilets	NR 40
• Plant areas Less than	65 dB(A)
• External Less than	52 dB(A) measured 3m from fresh air inlet and exhaust louvres
- 7.4.3. Structural vibration - The services installation shall be isolated from the structure to ensure that the frequency and amplitude of structural borne vibration falls within the 1.4 curve for continuous vibration and the 20 curve for intermittent vibration with up to 3 occurrences per day as shown of the CIBSE Guide A and CIBSE Guide B4
- 7.4.4. Plant including pumps / booster sets, etc. must be effectively isolated from the structure so that structure borne noise is minimized. Suggested noise limits and recommended mitigation measures for pumps should be < 35 dB(A) for pumps on a concrete base with the base supported on acoustic mounts providing at least 21 mm of static deflection. The mounts must incorporate a form of noise stop pad to attenuate any high frequency noise migrating down spring coils.

7.5. Public Health Services

- 7.5.1. The Contractor shall utilise Criteria laid down in the current Chartered Institute of Plumbing & Heating (CIPHE) Design Guide, CIBSE Guide G, BS 8558 and BS EN 806 Design, Installation, Testing and Maintenance of Services Supplying Water for Domestic Use within Buildings
- 7.5.2. Domestic Cold Water

- All water storage shall be provided in accordance with BS 6700.
- All internal domestic services pipework are to be light copper gauge tube BS 2871.

7.5.3. Domestic Hot Water

- All design shall be carried out in accordance with the Local Water Supply Authority requirements and the Water Supply (Water Fittings) Regulations.
- All distribution pipework will be sized with a minimum 10% spare capacity to ensure future flexibility.

7.5.4. Above Ground Sanitary Plumbing

- The Mechanical Contractor shall supply install, test and commission and set to work a complete new above ground drainage installation to the building and site as detailed on the drawings, to provide drainage to all water using appliances, condensing boilers/ pressurisation equipment etc, in accordance with Code of Practice, BS EN 12056:2000 and Part H of The Building Regulations.

8. LTHW HEATING

8.1. System Description

- 8.1.1. The Mechanical Contractor shall validate, modify, design, supply, install and commission the existing Low Temperature Hot Water (LTHW) heating and distribution pipework serving the building.
- 8.1.2. The main plant room will require reconfiguring and new pipework installed. To serve the proposed new layout.
- 8.1.3. The Mechanical Contractor shall validate the existing heat emitters within the building and replace them as necessary where repairs cannot made.
- 8.1.4. LTHW will be generated by the existing and new gas-fired heating plant with the following characteristics:
 - 2 x high efficiency condensing boilers
 - 1 x existing plate heat exchanger
 - Primary and Secondary LTHW Pumps
 - Motorised control valves
- 8.1.5. Existing LTHW Boilers shall circulate via individual primary pump sets, to a Vertical low loss / Reverse return header with a design primary flow temperature of 60°C and a return temperature of 55°C allowing for future conversion to ASHP. The system shall operate at 75°C flow and 55°C return temperature.
- 8.1.6. 2No. Secondary pump sets shall circulate LTHW circuits from the Vertical low loss / Reverse return header within the plant room to the building.
- 8.1.7. From the proposed new header dedicated secondary circuits will be serving the following areas
 - CT – Fan coil circuits
 - VT – Radiators heaters
- 8.1.8. CT circuits shall have a maintained flow temperature of 75°C
- 8.1.9. All emitters shall be fitted with thermostatic control valves to allow local occupancy adjustment. The level of adjustment will be restricted to an agreed range.
- 8.1.10. Motorised control valves linked to the building's BMS are to be installed on all circuits. Apart from local adjustment, all primary control will be carried out by the building operator via the BEMS.
- 8.1.11. Optimisation and compensation will be provided with Frost and night-time setback facilities.

8.2. Spare Capacity

- 8.2.1. All distribution pipework will be sized with a minimum 10% spare capacity to ensure future flexibility.
- 8.2.2. The low loss header will be complete with spare tap off points to accommodate future heating circuits where required.
- 8.2.3. All heating calculations have been carried out to include a margin of flexibility. This will allow increased heating demands to be met if required in the future.
- 8.2.4. Each area shall be divided into a number of circuits providing future flexibility of room layout through simple alteration of the BEMS control.

8.3. LTHW Pipework

- 8.3.1. All LTHW pipework services shall be thermally insulated. Thermal insulation is to be selected with reference to BRE Green Guide, to comply with BREEAM requirements.
- 8.3.2. All LTHW pipework shall be run in the floor void to serve perimeter radiators.
- 8.3.3. Steel pipework and joints shall be mild steel black medium weight or heavy weight manufactured in accordance with BS EN 10255: 2004. Joints shall be screwed or welded up to and including 50mm dia. Above this pipework shall be welded with flanged joints to be provided in accordance with BS EN 1092-1-2007. Bolting of steel flanges shall be in accordance with BS EN 1515-2-2001. All domestic services pipework and fittings visible in areas with applied finishes shall be painted to match the walls with suitable fixings as required. All exposed pipework within shall be chromium plated
- 8.3.4. Steel fittings shall be in accordance with BS 143 1255:2000 and 1256:2000 for malleable cast iron and copper alloy.
- 8.3.5. Steel welded fittings shall be in accordance with BS EN 10253-1:1999.
- 8.3.6. Threaded fittings shall also be in accordance with BS21.
- 8.3.7. Copper Pipework Joints and Fittings
- 8.3.8. Copper pipework shall be light gauge in accordance with BS EN 1057. The following fittings and jointing methods may be applied to suit the application.
 - Capillary soldered fittings to BS EN 1254 Part 1
 - Compression fittings to BS EN 1254 Part 2
- 8.3.9. Note: Compression fittings also suitable for stainless steel chrome-plated copper and polythene pipe may be used where required.
- 8.3.10. Push fittings on stainless steel chrome-plated copper pipes are not permitted.
- 8.3.11. The Installer shall supply and install valves to enable isolation, flushing, cleaning and balancing of the systems as required.
- 8.3.12. Valve shall be of the gate or ball type with hand wheel, lever or lock-shield to suit the application. For steel up to and including 50mmdia. Valves shall be screwed and have bronze bodies.
 - Gate valves shall be manufactured to BS EN 1982.
 - Ball valves shall be manufactured to BS EN 1982 with PTFE seating and packing.
- 8.3.13. For valves of sizes 50mm and above they shall be of the gate or butterfly type with flanged connections.
 - Gate valves shall be manufactured to BS EN 1171 with cast iron bodies.
 - Butterfly valves shall be manufactured be to BS EN 593 with ductile iron bodies.
- 8.3.14. Copper Installations (Isolating Valves)
- 8.3.15. Valves shall be of the gate or ball type with hand wheel, lever or lock shield to suit the application. The valves shall have compression ends in accordance with BS 1057 table 4 (15-54mm)
- 8.3.16. Balancing and commissioning valves shall be of the double regulating type with fixed orifice. Bronze valves shall be in accordance with BS EN 1254/2. Ductile Iron valves shall be in accordance with BS EN 1092
- 8.3.17. Check valves where required shall conform to BS 5154 (Bronze) or BS EN 12334 (Cast Iron).

- 8.3.18. Drain cocks shall be bronze conforming to BS 2879-2 and where required incorporate hose union outlet.
- 8.3.19. Expansion joints shall be selected specifically for the application. Each joint shall be anchored and guided in accordance with the manufacturer's instructions. Flexible connections where required shall be selected to suit the application. Connections to pumps and plant shall use the tied type connections.
- 8.3.20. Pipeline strainers shall be provided as specified and shall be Bronze to BS EN 1982 for sizes 15-50mm inclusive and Cast Iron to BS EN 1561 for sizes above 50mm dia. Strainers shall be fitted with 304 stainless steel 40 mesh screens.
- 8.3.21. All pipework passing through walls, ceiling, floors or boxing in shall be fitted with white plates. All pipework passing through walls and floors shall be fitted with sleeves made from similar material to the pipework.
- 8.3.22. Where new connections are made to pipework which is already insulated the contractor shall ensure that the joint is properly formed and sealed to provide a fully insulated pipe.
- 8.3.23. All pipework run within ceiling voids, storerooms, plantrooms and were boxed in shall be insulated using 25mm thick rigid phenolic foam sections. All pipework run behind plasterboard shall be insulated using Armaflex.
- 8.3.24. All insulation sections shall be fully sealed at all joints and shall be properly mitred at all bends. Aluminium end caps shall be applied to all sections of phenolic foam were terminated adjacent to valves or transient areas between ceiling void or boxing in and visible areas. All insulation shall be applied with identification bands to the relevant British Standard.

8.4. LTHW Water Quality

- 8.4.1. The contractor shall ensure the LTHW system is cleaned flushed and dosed with chemical treatment upon completion of works to inhibit corrosion and bacterial growth.
- 8.4.2. Water treatment chemicals shall be provided by:
 - Sentinel Performance Solutions Ltd
7650 Daresbury Park
Daresbury Warrington Cheshire
WA4 4BS
T: 01928 704 330
F: 01928 562 070
www.sentinelprotects.com/uk
- 8.4.3. Or technically equal and approved by the heating plant manufacturer.

9. DOMESTIC HOT AND COLD-WATER INSTALLATION

9.1. System Objective

- 9.1.1. The Contractor shall design, modify, supply, install, test and commission the domestic hot and cold water and distribution system to serve the building in full accordance with BS EN 806 and as detailed on the drawings and schematics.
- 9.1.2. The Contractor shall ensure that a high-quality installation is provided and that all items are supplied and installed so that the system is complete in its entirety.

9.2. System Description

- 9.2.1. The water services installation shall comply fully with the recommendations of the Code of Practice BS EN 806-2005, BS EN 806-3:2006 and the current Water Supply Regulations, taking into account, all amendments and any specific additional requirements of the Local Water Supply Company.
- 9.2.2. The installation shall be provided in its entirety and shall include all associated pipework, isolating valves, supports, insulation and all associated builders work, etc.
- 9.2.3. Pipework shall generally be run within ceiling voids, where exposed pipework drops shall be boxed in, and low-level pipework and final connections to be painted in accordance with the Architects' finishing

schedule. Thermostatic mixing valves shall be provided for wash hand basins accessible to vulnerable persons, delivering a maximum temperature of 43°C.

- 9.2.4. The pipework shall be to BS 2871: Part 1: Table X (EN 1057 half hard,) All pipework dropping within food preparation areas shall be in 316 stainless steels, and all bracketry and clips shall also be stainless steel.
- 9.2.5. All distribution pipework will be sized with a minimum 10% spare capacity to ensure future flexibility.

9.3. Domestic Cold Water

- 9.3.1. The contractor shall design, supply, modify & install, test and commission the Domestic Cold-Water installation.
- 9.3.2. Unusual flow rate patterns during periods of non-occupancy shall be logged by the BEMS and an alarm code shall be generated to assist with water leak detection and water wastage.
- 9.3.3. External hose union bib taps shall be isolated internally within the landlord's areas to prevent unauthorised use and will be located as required.

9.4. Domestic Hot Water

- 9.4.1. Hot water based upon per 10 l/s storage per wash hand basin. Guidelines to eliminate the risk of bacterial growth shall be strictly adhered to, i.e. hot water shall be stored at not less than 60°C and circulated at 55°C.

9.5. Pipework and fittings

- 9.5.1. The installation of the water services pipework shall be light gauge copper tube to EN 1057, (formerly BS 2871, Table X), with capillary or compression fittings to BS 864, all as manufactured by Yorkshire Imperial Metals Limited, or other equal and approved.
- 9.5.2. All pipework dropping within food preparation areas shall be in 316 stainless steel, and all bracketry and clips shall also be stainless steel.
- 9.5.3. Capillary fittings shall be used wherever possible; compression fittings shall be used at connections with equipment to act as service joints.
- 9.5.4. All joints shall be made in accordance with the manufacturers' recommendations using only their recommended fluxes, solders, jointing compounds, etc. and left clean after completion.
- 9.5.5. Self-cleaning fluxes shall not be used.
- 9.5.6. Only LEAD-FREE solders shall be used on water services, alternatively, Yorkshire Potable integral solder ring pattern fittings to BS864: Part 2 may be used. These shall be lead free and clearly marked with the YP motif indicating these characteristics.
- 9.5.7. All exposed pipework shall be installed neat and parallel to the wall or floor; all pipework drops shall be positioned in the corner of the room and boxed in. No exposed crossovers shall be allowed unless unavoidable.
- 9.5.8. All pipework supports shall be of the rubber lined BSA type. Distances between pipe supports shall be as detailed below;

Pipe nominal Bore	Horizontal spacing	Vertical spacing
Up to 15mm	1200mm	1500mm
22mm	1200mm	1500mm
28mm	1200mm	1500mm

9.5.9. All water services pipework shall be labelled with the following identification:

- Size
- Direction of flow
- Industry recognised banding BS 1710

9.5.10. Drain cocks shall be provided on all low points of the system.

9.6. Pipework Insulation

- 9.6.1. All Hot & Cold-water pipework services are to be thermally insulated. Thermal insulation is to be selected with reference to BRE Green Guide, to comply with BREEAM requirements.
- 9.6.2. Steel pipework and joints shall be mild steel black medium weight or heavy weight manufactured in accordance with BS EN 10255: 2004. Joints shall be screwed or welded up to and including 50mm dia. Above this pipework shall be welded with flanged joints to be provided in accordance with BS EN 1092-1-2007. Bolting of steel flanges shall be in accordance with BS EN 1515-2-2001. All domestic services pipework and fittings visible in areas with applied finishes shall be painted to match the walls with suitable fixings as required. All exposed pipework within shall be chromium plated.
- 9.6.3. There are several plastic pipe and fitting products currently on the market which have been tried, tested and approved for use with chilled water systems operating at temperatures of 20oC max.
- 9.6.4. It is important that products are not mixed in anyway and strict adherence to the All hot & cold-water pipework shall be insulated with slip on close cell elastomeric pipe insulation (as manufactured by Armaflex or equal and approved) with a fire performance class “0” of the 1985 building regulations.
- 9.6.5. The wall thickness of the insulation will be as follows according to a thermal conductivity of 0.037w/mK, Refrigerant pipe minimum recommended insulation thickness of 25mm.:
- 9.6.6. After installation of pipework, prior to sealing of insulation joints and starting of equipment, pipework should be pressure tested as follows:
- Strength Test = 1.1 x Ps
 - Tightness Test = 0.9 to 1.0 x Ps (Minimum 1 hour, preferable 24 hour) Where Ps = Maximum allowable system pressure.

10. Above Ground drainage

10.1. System Objective

- 10.1.1. An above ground drainage system shall be provided to collect foul drainage from the building in strategically located vertical stacks that shall rise through the building and terminate externally to provide a fully ventilated gravity system.
- 10.1.2. The system shall be designed in accordance with BS EN 12056 and Building Regulations Approved Document Part H for the installation of above ground drainage.
- 10.1.3. Where necessary, anti-siphon pipework and fittings shall be provided to maintain appliance trap seals and control pressure fluctuations, which may occur within the system.
- 10.1.4. All condensate pipework from mechanical plant shall be connected to the nearest available SVP via a HepVo valve arrangement. This is to prevent foul sewer gases from entering the building, where discharge from unvented systems are connected to the above ground drainage system.
- 10.1.5. The installation shall be complete with all soil and vent pipes, stub stacks, waste pipes and traps to form a complete drainage installation.

10.2. Pipework Materials

- 10.2.1. Materials for the branch waste and ventilating pipework shall be uPVC to BS 4514 and BS EN 1329 with solvent weld joints in accordance with the Workmanship Specification. The Contractor shall ensure that adequate provision for thermal expansion is provided in accordance with the manufacturer's recommendations.

- 10.2.2. Where high temperature water is to be discharged, wastes shall be in chrome plated copper to BS-EN 1057.

10.3. Waste Connections

- 10.3.1. All waste fittings shall be provided with 75mm deep seal two-piece tubular traps connected to the appliance and the branch discharge pipework. Traps shall be polypropylene and conform to BS EN 274.
- 10.3.2. Where wastes discharge over a floor gulley, the gulley shall be fully trapped and be complete with a back inlet.

10.4. Access

- 10.4.1. The Contractor shall provide adequate access fittings to allow the system to be maintained and for blockages to be removed in accordance with the requirements of BS EN 12056:2000. In general, access shall be provided on each stack at each floor level above the flood level of the highest connected appliances and on all branches and changes of direction. An access fitting shall be provided at the base of all discharge stacks prior to connection to the below ground drainage system.
- 10.4.2. Following the installation of the sanitary appliances, the Contractor shall take full responsibility for the protection of all sanitary fittings and shall replace, at his cost, any damaged items prior to handover.

11. SECONDARY STEELWORK AND PLANT / EQUIPMENT SUPPORTS

11.1. General

- 11.1.1. The Contractor shall provide all necessary secondary support steelwork required to install the mechanical, builder's work and electrical services installations.
- 11.1.2. The fixings to the structure, ceilings, bulkheads and walls etc. shall be suitable for the load imposed by the services installations and shall comply with the Structural Engineers and Architect's requirements.
- 11.1.3. Step overs shall be provided as required over pipework.
- 11.1.4. The Contractor shall ensure that the entire installation is installed in such a way that it is fully accessible for maintenance purposes and in line with the manufacturer's recommendations. Equipment in plantrooms shall be positioned in such a way that any item can be individually removed without the need for removal of any other items of plant or sections of pipe or ductwork distribution systems.
- 11.1.5. The Contractor shall ensure that where continuous plasterboard ceilings are specified by the Architect, the services installations are arranged such that no access panels are necessary (unless agreed in advance with the Engineer and Architect). The Contractor shall confirm that no additional access panels are required, and this item shall be recorded in their working drawing layouts.

12. THERMAL INSULATION

12.1. General

- 12.1.1. All thermal insulating materials and their installation shall be carried out in accordance with the relevant sections of BS 476, BS 3958, BS 5422, BS 5970 & BS 1710 and be in accordance with the accompanying workmanship specification Doc F.
- 12.1.2. The Contractor shall be responsible for the supply, delivery and installation of the insulation to pipework and equipment as detailed within this Specification. The Contractor shall include for sub-letting the insulation work to an approved specialist firm and shall include for all materials, labour and other incidentals necessary to complete the insulation as specified in the following sections.
- 12.1.3. For installations involving mineral wool, rock wool, or phenolic foam, the Contractor's operatives shall take general precautions against the exposure to these material(s) in accordance with the Health and Safety at Work Regulations, (see HSE Guidance Note EH 46 for Personnel protection) and the Control of Substances Hazardous to Health (COSHH) Regulations.
- 12.1.4. All thermal insulating materials shall comply with the relevant sections of BS 3958, BS 5422 and BS 5970 to satisfy water vapour permanence and current Building Regulations Class '0' definition and local requirements of statute applicable to the buildings.

- 12.1.5. Thermal insulation shall have a global warming potential (GWP) of less than 5 and an ozone depletion potential (ODP) of zero, such as Armaflex Class 'O' insulation.
- 12.1.6. The Contractor shall ensure that the pipework to be installed is clean and dry, and free from dust, dirt, oil, grease, and moisture.
- 12.1.7. All insulating materials and associated products shall be applied strictly in accordance with the manufacturer's recommendations and instructions. Any work failing to comply with these shall not be accepted. Adhesive shall be applied liberally and to the whole of the insulating surfaces wherever specified and in accordance with the manufacturers' instructions.
- 12.1.8. Denso paste shall be applied to copper pipework after cleaning and before application of phenolic foam as recommended by the pipework manufacturer.
- 12.1.9. Under no circumstances shall pipework be married together within insulating material in any of the contract works; pipes shall be insulated separately. No insulation will be accepted where it comes into contact with the building fabric.
- 12.1.10. The following items shall be insulated:
 - All heating, hot water and cold-water services located within plant rooms, tank rooms, ceiling voids, roof spaces, service ducts, chases, beneath floors, etc. or external to the building.
 - Any pipework carrying fluids above 50oC and on any pipework subject to freezing and the shedding of condensation.
 - All refrigerant pipework located within ceiling voids, service ducts or external to the building.
 - All ductwork carrying tempered air
 - All secondary ductwork from air conditioning / Comfort cooling Units.

13. COMMISSIONING

13.1. General

- 13.1.1. The entire mechanical, controls and public health services installation shall be balanced and commissioned by the Contractor in accordance with the general specification clauses, CIBSE Commissioning Codes or BSRIA Guidelines.
- 13.1.2. The Contractor shall submit in writing the balancing and commissioning test results to the Consulting Building Services Engineer before any witnessing will take place. The Engineer will only witness test results if the test sheets demonstrate that the balancing and commissioning has been completed and carried out satisfactorily in accordance with the specification requirement. If during witnessing the test results are found to be inaccurate, then the Contractor shall re-balance and re-commission the systems again. This procedure shall continue until the Consulting Building Services Engineer has witnessed satisfactory results.
- 13.1.3. The Contractor shall undertake the following responsibilities over a minimum of a 12-month period, once the building becomes occupied:
 - Testing of the Heating systems by the Contractor's specialist under full load conditions i.e. heating mode in mid-winter and under part load conditions spring / autumn.
 - Where applicable, testing should also be carried out during periods of extreme (high / low) occupancy.
 - Interviews with building occupants (where they are affected by the Heating systems) to identify problems or concerns regarding the effectiveness of the systems.
 - Re-commissioning of the heating systems (following any work needed to serve revised loads), and incorporating any revisions in the operating procedures into the O&M manual
- 13.1.4. The Contractor shall upon completion of the commissioning and setting to work of the entire systems monitor and report upon the condition achieved in respect of the specified criteria.
- 13.1.5. The Contractor shall provide a commissioning schedule within the first three weeks of the Contract completion which shall be submitted to the Engineer for comment. It is imperative that the Contractor allows in his overall programme for the commissioning of the systems and that it is not a last-minute item.

- 13.1.6. The Client will require to witness the satisfactory testing and commissioning of all the Contractor's installed works whether tested and commissioned in sections or otherwise.
- 13.1.7. The Contract Works, or sections thereof, should first be tested, commissioned and proved by the Contractor prior to offering to the Engineer for witness testing. A minimum five days' notice should be provided to all testing and commissioning requiring witness testing.
- 13.1.8. The Contractor shall carry out the testing and commissioning in accordance with all Contract Specifications, BSRIA GUIDES, CIBSE Codes of Practice and Guidance Notes for testing, proving and commissioning and shall demonstrate that the design criteria has been achieved.
- 13.1.9. The Contractor shall provide a method statement and programmes for testing and commissioning. Adequate notice must be given to allow the witness of such tests.
- 13.1.10. The Contractor shall provide at Contractor's own cost, all water, power, fuel, labour etc. necessary for the temporary operation of plant, including any temporary supplies for testing and commissioning, together with necessary labour etc.
- 13.1.11. The Contractor shall arrange for all manufacturer's guarantees to commence at the date of issue of the Certificate of Practical Completion and to be valid for a minimum period equivalent to the Defects Liability period.
- 13.1.12. All costs arising from the items above shall be included by the Contractor in his Tender. The Contractor is to provide all necessary equipment to satisfactorily test and commission the services installation.
- 13.1.13. The Contractor shall commission the entire system and then offer the completed system to the Engineer for witnessing.
- 13.1.14. The Contractor shall submit all calibration certificates for the commissioning equipment.
- 13.1.15. Pressure vessel and Safety valve test certificates shall be provided and be included as part of the O&M manuals.

14. OPERATING & MAINTENANCE MANUAL AND BUILDING USER GUIDE

14.1. General

- 14.1.1. The Contractor shall prepare an Operating & Maintenance manual and a Building User Guide following the requirements of BSRIA BG26 and BG79. The building logbook should be in accordance with the requirements of CIBSE TM31.
- 14.1.2. Where applicable the requirements of BREEAM standard of Very Good standard are to be achieved.
- 14.1.3. Draft O&M Manuals shall be made available for review by the Building Services Supervising Engineer four weeks prior to practical completion and shall be complete in all respects. Failure to do so will defer the practical completion date with associated late completion attributed to the Mechanical Contractor. The manuals shall be reviewed, and comments issued back to the Mechanical Contractor for incorporation into a final edition to again be reviewed by the Building Services Supervising Engineer prior to issue to the client.
- 14.1.4. The Mechanical Contractor shall include a cost within his tender for the preparation and issue of 3 No final copies of the Operation and Maintenance manuals, all record documentation, related documents, and drawings. Each copy of the O&M manual shall be complete with a CD / DVD containing the complete O&M manual in digital format and include the Record Drawings in both .pdf and .dwg (AutoCAD) format. Failure to provide this documentation will result in practical completion being denied.
- 14.1.5. The final version of the O&M's shall be issued at Practical Completion.
- 14.1.6. The Building User Guide shall be relevant to the non-technical building user, occupy a separate section in the O&M Manual and shall include the following content:
 - Building service and Emergency information
 - Energy and environmental strategy
 - Water use
 - Transport facilities (by others)
 - Materials and waste policy
 - Re-fit /arrangement considerations
 - Reporting provision
 - Training
 - Links and references

APPENDIX A – SCHEDULE OF MANUFACTURERS

Item	Manufacturer	Notes
Fire Stopping (proprietary)	Rockwool 3M	For accessory boxes in fire partitions
Water treatment	Sentinel Performance Solutions	
Boilers	Vaillant	
LTHW Boiler Flues	Sigram Flues Vaillant	
Plastic barrier pipe	Multipipe Ltd	
Pumps	Grundfos Wilo Lowara DAB	• VT Pump - 1.4l/s 47 kPa • CT Pump – 3.034l/s @ 55kPa • Primary Pump – 3.8l/s @ 14kPa
Pipework, Valves, and fittings	Pegler Yorkshire	
Automatic controls & actuators	Belimo Automation Ltd	
Main BEMS controls	Schneider Trend Ambiflex Vaillant	

APPENDIX B – BENCHMARK STANDARDS

Selected relevant standards (table not exhaustive or exclusive)		
Standard	Short Description	Application Guidance
Building Regulations Approved Document B Volume 2	Fire Safety	Guidance for fire safety in Buildings other than dwellings
Building Regulations Approved Document F	Ventilation	Guidance on building ventilation, including building air quality and preventing condensation in a domestic or non-domestic structure
Building Regulations Approved Document G	Sanitation, hot water safety and water efficiency	Guidance for compliance of cold and hot water services with Building Regulations
Building Regulations Approved Document H	Drainage and waste disposal: Approved Document H	Guidance for compliance of drainage systems with the Building Regulations
Building Regulations Approved Document L Volume 2	Conservation of fuel and power	Guidance for the conservation of fuel and power in buildings other than dwellings
Approved Document M Volume 2	Access to and use of buildings	Guide to the ease of access to, and use of, buildings, including facilities for disabled visitors or occupants
BESA DW143	Ductwork air leakage testing.	Requirements for air leakage of ductwork and pressure testing procedures
BESA RAC80	Design Specification for DX Packaged Air Conditioning Equipment in buildings	Guidance to sizing, selecting and installing DX packaged air conditioning systems
BESA TR11	Use of plastic pipework	Guidance for the use of plastic pipework
BESA TR20	Installation and testing of hot water services	Requirements for the installation and testing of pipework systems in commercial buildings
BESA TR30	Heat Pump installations	Guidance to the specification and design of heat pump systems for heating and cooling in buildings.
BESA TR6	Site pressure testing of pipework	Requirements for the procedures for site pressure testing of pipework systems
BS 12897	Water supply. Specification for indirectly heated unvented (closed) storage water heaters	Requirements for water heaters installation
BS EN 60898-1 (MCBs for household and similar installations) BS EN 60947-2 (MCCBs)	Miniature Circuit Breakers	Specification for miniature and moulded case circuit-breakers. Miniature air-break circuit-breakers for a.c. circuits
BS 4514	Unplasticized PVC soil and ventilating pipes of 82.4 mm minimum mean outside diameter	Requirements for PVC soil and ventilating pipes, fittings and accessories
BS 4533	Luminaires	Multi part document dealing with all requirements regarding luminaires

Selected relevant standards (table not exhaustive or exclusive)		
Standard	Short Description	Application Guidance
BS EN 60947-2IEC-9	Moulded Case Circuit Breakers	Specification for switchgear and control gear for voltages up to and including 1000 V a.c. and 1200 V d.c. Circuit-breakers.
BS 5266	Emergency lighting code of practice	Detailed guidance on the application and practice of emergency escape lighting, with a view to ensuring safety in the event that normal lighting is interrupted.
BS 5422	Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating	Requirements of thermal insulation
BS 5839	Fire detection and fire alarm systems for buildings.	Code of practice for design, installation, commissioning and maintenance of fire detection and fire alarm systems in non-domestic premises
BS 6004	PVC Insulated Cables. (non-armoured)	Electric cables. PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power and lighting
BS 6121-5	Mechanical Cable Glands.	Mechanical cable glands. Code of practice for selection, installation and inspection of cable glands and armour glands
BS 6724	LSF Thermosetting Insulated Cables. (armoured)	Electric cables. Thermosetting insulated, armoured cables for voltages of 600/1000 V and 1900/3300 V, having low emission of smoke and corrosive gases when affected by fire
BS 7211	LSF Thermosetting Insulated Cables. (non-armoured)	Specification for thermosetting insulated cables (non-armoured) for electric power and lighting with low emission of smoke and corrosive gases when affected by fire
BS 7346	Smoke control systems	Code of practice for planning, design, installation, commissioning and maintenance of smoke controls systems
BS 7671	IET Wiring Regulations	Requirements for Electrical Installations
BS 7942	Thermostatic mixing valves for use in care establishments.	Requirements and test methods of Thermostatic mixing valves
BS 8558	Complementary guidance to BS EN 806	Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings
BS 9999	Fire Safety	Code of practice for the fire safety design and management and use of buildings
BS EN 1057	Copper and copper alloys.	Requirements for copper pipework carrying hot water in sanitary and heating installations
BS EN 12056-2	Gravity drainage systems inside buildings. Sanitary pipework, layout and calculation	Design, calculations and layout of waste services

Selected relevant standards (table not exhaustive or exclusive)		
Standard	Short Description	Application Guidance
BS EN 12201-2	Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Pipes	Requirements for PE pipes carrying incoming water
BS EN 12449	Copper and copper alloys. Seamless, round tubes for general purposes	Material Specification for copper pipework carrying refrigerant
BS EN 1253	Gullies for buildings	Requirements for trapped floor gullies
BS EN 1254-4	Copper and copper alloys. Plumbing fittings.	Requirements for fittings combining other end connections with capillary or compression ends
BS EN 12845	Fixed firefighting systems	Design, installation and maintenance of Automatic sprinkler systems
BS EN 16005	Power operated pedestrian door sets.	Requirements and test methods of power operated pedestrian door sets
BS EN 274	Waste fittings for sanitary appliances.	Requirements for fittings, traps, overflows for waste systems
BS EN 60335-2-21	Household and similar electrical appliances. Safety. Particular requirements for storage water heaters	Safety requirements for hot water heaters
BS EN 60529	Classification of degrees of protection by enclosures.	Describes a method for classifying degrees of protection provided by enclosures, principally for electrical equipment.
BS EN 61534	Powertrack systems	Requirements and tests for powertrack systems
BS EN 62305-1	Protection against lightning.	General principles for the protection of structures against lightning, including their installations and contents, as well as persons
BS EN 806	Specifications for installations inside buildings conveying water for human consumption.	Requirements and recommendations for the design, pipe sizing, installation of potable water services
BS EN ISO 12241	Thermal insulation for building equipment and industrial Installations.	Calculation rules of thermal insulation for building equipment
BS EN 60947	Requirements for the interface level of equipment which may cause interference to radio reception.	Specification for radio interference limits and measurements for household appliances, portable tools and other electrical equipment causing similar types of interference
BSRIA BG Guide	Commissioning of air systems	Guidance to commissioning of ducted air distribution systems in buildings
CIBSE Code A	Air distribution systems	Guidance to the commissioning of air distribution systems
CIBSE Code C	Automatic controls	Guidance to the commissioning of automatic controls

Selected relevant standards (table not exhaustive or exclusive)		
Standard	Short Description	Application Guidance
CIBSE Code L	Commissioning Lighting	Guidance to the commissioning of lighting and associated controls
CIBSE Code M	Commissioning Management	Guidance to the management arrangements required to ensure that building services systems are commissioned to meet compliance with the objectives of Part L of the Building regulations
CIBSE Code R	Refrigeration systems	Guidance to the commissioning of refrigerating plant and systems used in air conditioning applications
CIBSE Guide A	Environmental design	Guidance on external conditions; Guidance on the comfort criteria of the Thermal, Visual, Acoustic environment
CIBSE Guide B1, B2, B3	Heating, Ventilation, Air Conditioning and Noise	Design guidance of HVAC systems including noise control
CIBSE Guide G	Public Health and Plumbing Engineering	Guidance for design and installation of PH services
CIBSE Guide H	Building control systems	Guidance for the design and installation of automatic building control systems
CIBSE Guide K	Electricity in Buildings	Guidance on load assessments, supplies, distribution, wiring systems, UPS, earthing, inspection and testing
CIBSE Guide TM13	Minimising the risk of Legionnaires disease.	Guidance on design, operation, maintenance and monitoring of water systems to minimise the risk of infection from Legionella Bacteria
CIBSE Guide TM31	Building logbook toolkit	Guidance to the development of the building logbook
CIBSE Guide TM39	Building energy metering	Good practice requirements for the provision of sub-metering
CIBSE Lighting Guides	CIBSE Lighting Guides	Good practice guidance to the design of lighting
DW 144	Specification for sheet metal ductwork	Specification for the manufacture and installation of sheet metal ductwork
DW 172	Specification for kitchen ventilation system	definitive guide to kitchen ventilation systems in non-domestic properties.
DW/TR19	Internal cleanliness of ventilation systems	Requirements for testing of cleanliness for both new and existing ventilation systems and cleaning procedures
HSE L8 ACOP	Legionellosis Approved Code of Practice	Guidance on managing risk from exposure to Legionella bacteria
IEC 60947	Low voltage switchgear and control gear	Regulations regarding selecting switch gear.
Institute of Plumbing Design Guide	Plumbing Engineering Services Design Guide	Guidance for design and installation of PH services

APPENDIX C – SCHEDULE OF DRAWINGS

P2-L5 3PE-ZZ-PL-M-001	LTHW Layout
P2-L5 3PE-ZZ-SC-M-002	LTHW Schematic
P2-L5 3PE-ZZ-SC-M-003	Strip out 1/2
P2-L5 3PE-ZZ-SC-M-004	Strip out 2/2
P2-L5 3PE-ZZ-PL-M-005	Domestic water services
L5 3PE-ZZ-SC-E-5001	Plant Room Electrical Strip Out
L5 3PE-ZZ-SC-E-5002	Plant Room Electrical Installation

APPENDIX D – MECHANICAL ENGINEERING SERVICES SUMMARY OF TENDER

MECHANICAL ENGINEERING SERVICES

SUMMARY OF TENDER (FIXED PRICE)

<u>Item</u>	<u>Description</u>	<u>Price</u>	
1	Preliminaries & General Conditions	£	
2	Stripping Out	£	
3	LTHW Pipework installation	£	
4	Additional Vaillant Boiler including flue	£	
5	Heat Meter installations	£	
6	BMS Installation	£	
7	Gas pipework, Valves and interlock system	£	
8	Pipework insulation	£	
9	Pump sets (Primary, CT, VT, DHW)	£	
10	Pressurisation units and expansion vessels	£	
11	DHW & MCWS installation	£	
12	Above ground drainage installation	£	
13	Testing and Inspection	£	
14	Operating and Maintenance Manuals and As Installed Drawings	£	
		£	
Sub Total		£	

	<u>Included Sums</u>	<u>Price</u>	
	Contingency Sum	£	
		£	
Grand Total		£	