

CBS THURLES SECONDARY SCHOOL

**CLASSROOM EXTENSIONS &
WOODWORK ROOM ALTERATIONS**

TENDER DOCUMENTS

**VOLUME A
WORKS DESCRIPTION - SERVICES ENGINEERS**

**SECTION 2
MECHANICAL SPECIFICATION**

June 2017



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1.0 GENERAL CONDITIONS & NON TECHNICAL PARTICULARS

This specification covers the standard requirements for the supply, assembly, installation, connecting up, testing and setting to work of the Mechanical installations for this project.

1.1 Project Particulars

Project Name CBS Thurles Secondary School –
Extensions & Woodwork Room Alterations

Site
Name: CBS Thurles Secondary School,
Address/Location: Rossa Street, Thurles, Co. Tipperary.

Employer
Name: Board of Management CBS Thurles Secondary School
Address: Rossa Street, Thurles, Co. Tipperary

Architect
Name: DH Ryan Architects
Address: 1 Liberty Square, Thurles County Tipperary
Contact: Hugh Ryan
Telephone: 0504 28850
Email: hugh@dhryan.ie

M&E Consulting Engineers
Name: Fahey O’Riordan Consulting Engineers
Address: Shanaclogh, Cappawhite, Co Tipperary
Contact: John Fahey
Telephone: 062 75929
Email: john@force.ie

Project Supervisor Design Process
Name: DH Ryan Architects
Address: 71 Liberty Square, Thurles County Tipperary
Contact: Hugh Ryan
Telephone: 0504 28850
Email: hugh@dhryan.ie

Quantity Surveyor
Name: N/A
Address:
Contact:
Telephone:
Email:

Civil / Structural Engineers
Name: PJ Brett & Associates
Address: Tirol House, Tyone, Nenagh Co. Tipperary
Contact: PJ Brett
Telephone: 067 37950
Email: pjbrett@pba.ie

The Contractor

Reference to "The Contractor" shall always indicate the contracting company to which the Particular Specification refers.

1.2 Contract

The Contract Form shall be as detailed in the Main Contract Document

Submission of a tender shall be taken as acceptance of the proposed contract form.

1.3 Assignment Or Transfer Of Contract

The contractor shall not assign all or any part of the work to another company, firm or individual without prior written consent of the Employer's Representative.

1.4 Drawings

Mechanical Services Drawings

The Mechanical services tender drawings are listed in the Drawing and Document schedule included as an appendix to this document.

Electrical Services Drawings

The Electrical services tender drawings are listed in the Drawing and Document schedule included as an appendix to this document.

Architectural Drawings

Architectural drawings are as scheduled in the as scheduled in the Main Contract Document, and are available from the Main Contractor.

Structural Engineering Drawings

Structural Engineering drawings are as scheduled in the Main Contract Document, and are available from the Main Contractor.

It is the sole responsibility of the Contractor to apprise himself of details or information contained on the above drawings or accompanying specifications, which may impact on the works.

1.5 Site Description & Access

The site for the proposed Classroom Extension & Woodwork Room Alterations is located on the existing CBS Thurles Main Building at Rossa Street Thurles Co Tipperary. The site is located on its own grounds within an enclosed site, in and adjacent to the existing school building with pedestrian and vehicular entrance gates. It is proposed to complete the Building works on an operational school campus which will require close co-ordination with the School Authority on operational matters.

The contractor's normal access to the Building works shall be via the main entrance from Rossa Street.

For full details refer to the Preliminary Health and Safety Plan accompanying this specification.

1.6 Management of the Works

The Contractor shall assign full time to the project a competent supervisor who shall have sole responsibility for, and make all decisions regarding site operations.

The Contractor shall prepare a programme, based on network analysis techniques, for the completion of the Works within the Contract period.

The Contractor, or his authorised representative, shall attend site progress meetings which will be held at regular intervals (minimum fortnightly). The Contractor shall be responsible for informing sub-contractors and suppliers as are necessary that their attendance at progress meetings will be required.

Where a contract will be carried on at the same time as one or more independent contracts on the same site, the Contractor shall liaise as necessary with other Contractors. The client's representative's decision regarding inter-contractor issues (use of available work areas, programming of related work, etc.) shall be final.

This Contractor shall liaise with all relevant authorities, e.g. Employer, etc. regarding access to and availability of the site.

No work of any kind, payment for which is to be made in accordance with a record of time and material, shall be executed unless complete arrangements for such are specially authorised by the Client's representative **in writing** beforehand.

Daywork Sheets, specifying the time and materials employed on each Daywork item, shall be submitted to and signed by the Client's representative or his authorised Agent on or before the expiration of the week following that in which such work shall have been done. One unpriced copy of such Daywork Sheets shall be forwarded to the Engineer/Client's representative followed within 14 days by priced copies in duplicate.

The Client's representative must be advised, in advance or within seven days, of any works considered by the Contractor to constitute a variation to the contract. This will apply whether the works are caused by circumstances within the Contractor's control or not. Costs incurred by such variations will only be considered for payment if they comply with this procedure. Variations to the Contract shall only be carried out when clearly instructed in writing by the Client's representative.

The Contractor shall give the Client's representative each week a return of the number and descriptions of tradesmen and general labourers employed on the Works including those employed by specialist sub-contractors listed separately.

1.7 Quality

Contractors, sub-contractors and suppliers shall be ISO 9000 certified. Where such certification is not achieved, the contractor shall, on request, provide satisfactory evidence of quality control systems that meet with the Client's representative's approval.

The Contractor shall guarantee the performance of the entire installation and all items forming part of the installation. The defects liability period shall be as set out in the Form of Tender and shall extend from the Date of Practical Completion for that period. The Contractor shall make good any defects which occur during this period. Failures of consumable items (e.g. lamps etc) during the defects liability period shall be rectified by the contractor at his expense.

The contractor shall ensure that all materials and equipment are new unless otherwise specified and shall handle store and fix materials and equipment with care to ensure that they are in perfect condition when incorporated into the works.

The contractor shall handle, store and fix each material and item of equipment in accordance with the manufacturer's recommendations and submit copies of manufacturer's recommendations to the Building Services Engineer when requested.

The Employer may appoint an Inspector. Neither the appointment nor the action of the Inspector will invalidate the responsibilities of the Contractor. The Inspector will have no power to authorise variations to the work.

Assessment of the quality of materials and workmanship shall be made in the presence of the Engineer or his representative, unless otherwise instructed.

The Contractor shall conform to all Local Authority requirements with regard to regulations, inspections, permissions to erect hoardings, demolitions, clearance, etc., as applicable.

The Client's representative shall be notified in writing, a minimum of five working days in advance, of the performance of any tests or commissioning procedures being undertaken by the Contractor and any of his sub-contractors, suppliers, etc. in order to allow for witnessing of such tests by the ER. Where notice is not given in accordance with these requirements the tests shall be repeated at the ER's request.

1.8 Security

All personnel working on or attending the site will be required to have valid photo identification (Safepass). The names of all contractor personnel shall be submitted to the employer on a weekly basis.

Personnel and materials entering and leaving the site may be searched.

Photographs of any part of the site may not be taken without the written permission of the employer.

Documents shall be restricted to the use of the Contractors staff and must not be issued to third parties, other than members of the Project Team, unless authorised in writing by the Client's representatives.

The Contractor shall not impede or interfere with the Security Systems and procedures in use by the Employer.

1.9 Project Timescale and Restrictions

The project will commence on appointment and will progress strictly in accordance with the programme as set out in the main contract documents / Preliminary Health and Safety Plan. The contractor shall comply with the requirements and restrictions as set in the preliminary plan.

1.10 Working Drawings

The Engineers are not obliged to produce any working drawings and the tenderer shall note that the drawings accompanying this enquiry will not be detailed further.

It is the sole responsibility of the successful tenderer to produce working drawings, which are to be detailed sufficiently to allow site operatives to install the services without the necessity for site design.

The contractor shall prepare and submit for the approval of the Engineer, working drawings for all systems to be installed under this Contract, together with such schedules of data, calculations and other information called for by the Engineer **within 14 days of contract award**. These works shall include the following:

- Equipment schedules and technical specifications
- Equipment installation co-ordination and equipment layouts.
- Ducting and Piping Routes for all services
- Control drawings and schedules
- Builders works setting out drawings and details

The tendered figure shall include for the design development and production of all of the above. Allow a minimum of 5 working days response time from the Client's representatives.

1.11 Site Meetings

The following information must be presented in writing to the Engineers at least 1 full working day prior to the site meeting:

- Updated programme and progress report
- Cost report, including notification of all actual or potential variations
- Costs associated with any agreed variations
- Site manpower for previous period
- Listing of information required
- Equipment and material status

1.12 Commissioning

The Contractor shall provide the Client's representative with a schedule of all commissioning and testing procedures and dates giving at least 5 working days notice of same. Facilities shall be provided for the Employer's Representative to witness all testing and commissioning.

1.13 As-Installed Drawings and O & M Manuals

Two full sets of hardcopy drawings and manuals in strict compliance with the Specifications, shall be required for this project and in addition two soft copy sets shall be provided on disk or memory stick.

Record drawings shall be required as hard copies and on disc in AutoCAD Release 2008 (or later) format.

The Contractor shall be supplied with a full set of tender drawings, which shall be retained on site and marked up as the project progresses. The marked-up drawings shall be made available at site meetings for inspection.

Reservation of copyright will not be permitted. All technical submissions and drawings including electronic and printed material shall become the property of the client.

1.14 Site Access and Delivery of Materials

The Contractor will arrange site access for materials and plant.

The Contractor shall check the dimensions of all materials and plant prior to delivery to site and ensure adequate turning circles and access is available.

1.15 Health, Safety and Welfare at Work

The project design and construction shall be executed in accordance with the Health, Safety and Welfare at Work (Construction) Regulations 2006-2013. In this regard, the Contractor shall be aware of the Regulations, and the specific details that are contained in the accompanying Preliminary Health and Safety Plan. The format for all agreements under this act shall be in accordance with the format set down by the IEI (Institution of Engineers of Ireland/ACEI Association of Consulting Engineers of Ireland)/of copies of which can be obtained on request.

Comply with all safety, health and welfare regulations, whether statutory or deriving from the Employer or other bodies having powers, regarding all work done, including work done by sub-contractors.

The Contractor shall appoint a Safety Officer to visit the site as often as necessary, but no greater than monthly intervals, to ensure that safety requirements are being observed. The Safety Officer shall prepare a written report of each visit which highlights the safety procedures and practices being observed and any deviations from them. A signed copy of the written report shall be submitted to the Client's representative.

The Safety Officer shall notify the Main Contractor, in writing, of all breaches of safety regulations or dangerous practices which are observed and are the responsibility of the Main Contractor, the Employer, other contractors, companies or individuals on the site.

1.15.1 Project Supervisors

The Project supervisors are as indicated in section 1.1 above.

1.15.2 Contractors with Design Input - General Duties of Designers -

Where a contractor designs any element of the works (or engages someone else to design it on his behalf) as part of his contract, the contractor has a statutory obligation to perform the duties set out in Section 16 of the regulations in relation to those parts of the works. These are:

- a) Take account of the general principles of prevention as specified in the Third Schedule of the Principal Regulations (S.I.10 of 2005) and any relevant Safety and Health Plan or Safety File prepared in accordance with the Health Safety and Welfare at Work (Construction) Regulations 2006-2013.
- b) Co-operate with the Project Supervisor appointed for the Design Process or the Project Supervisor appointed for the Construction Stage, as appropriate, to enable that project supervisor to comply with these regulations.

- c) Promptly provide the Project Supervisor appointed for the Design Process or the Project Supervisor appointed for the Construction Stage, as appropriate, with such information as is known to that person regarding particular risks to the safety and health of persons at work as referred to in the First Schedule which may be associated with the project and also with such information regarding the nature and scope of the project to the extent necessary to enable the project supervisor to comply with these Regulations.
- d) Take into account any directions from the Project Supervisor appointed for the Design Process or the Project Supervisor appointed for the Construction Stage, as appropriate.

1.15.3 Safety File

Under Section 15 of the Regulations, each Designer is required to provide the Project Supervisor (Construction Stage) with relevant health and safety information to be taken into account during any subsequent construction work (which would include for instance maintenance, upkeep etc.). This might include such information as:

- a) Drawings showing the part of the works for which the Designer is responsible.
- b) The general design criteria adopted.
- c) Details of the construction or installation including manufacturer's instructions for the installation of proprietary elements, pipe layouts, wiring routes and diagrams.
- d) Information considered relevant to the maintenance of the construction or installation.

1.15.4 Co-ordination of Persons Engaged in the Design of the Project

In accordance with Section 11 of the Regulations it is the duty of the Project Supervisor for Design Process to co-ordinate the activities of persons engaged in the design of the project.

1.15.5 Preliminary Health and Safety Plan

To enable the Project Supervisor for Design Process to prepare the preliminary Health and Safety Plan for the project and where the timing permits it is necessary for the contractor to give the information which is relevant to the requirements of the Regulations in relation to that part of the works for which they are tendering:

- A general description of the works.
- The time in which it is intended that the works will be completed.
- Work which will involve Particular Risks as defined in Schedule 1 & 2 of the Regulations.

1.15.6 Health and Safety Plan for Project

To enable the Project Supervisor for Construction Stage to develop or amend the Health and Safety Plan for the project where a contractor with design input is appointed after the Preliminary Health and Safety Plan has been prepared by the Project Supervisor for Design Process it is necessary for the sub-contractor to give the Project Supervisor for Construction Stage information which is relevant to the requirements of the Regulations in relation to that part of the works for which they are tendering:

- A general description of the works
The time in which it is intended that the works will be completed
- Work which will involve Particular Risks as designed in Schedule 1 & 2 of the Regulations

1.15.7 Contractor to Check All Matters

The contractor is to examine the site and the information supplied regarding the nature and extent of the proposed works so as to be satisfied as to what is required to be done to fulfil the duties in relation to the design and preparation for the works and also what measures are required to be taken to meet the requirements of the Regulations in the execution of the works including

complying with the Health and Safety Plan. All costs arising in respect of these obligations are to be included in the tender figure and the Client will not be liable for any such costs which are reasonably foreseeable and which are not so included.

1.16 Patent Rights

The contractor shall ensure costs of all materials and equipment supplied includes for costs associated with patent rights and royalties arising from use of any such materials and equipment.

1.17 Verify Existing Conditions

The contractor shall before commencing work examine all adjoining work on which this work is in any way dependent for perfect workmanship according to the intent of this specification and report to the Employer's Representative any condition which prevents performance of first-class work. NO "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed before submittal of a proposal.

1.18 Co-Ordination

Certain materials may be furnished, installed, or furnished and installed, by others. Examine the Contract Documents to ascertain these requirements.

In relation to such works this contractor shall:-

- A. Carefully check space requirements with other trades to ensure that all material can be installed in the spaces allotted thereto. Finished suspended ceiling elevations are indicated on the general construction drawings.
- B. Caution workers both verbally and in writing as to the dangers involved in doing work within or adjacent to electric closets, plant rooms and Switchboard Rooms, due to the dangers caused by presence of high voltage and currents in these spaces and operate a permit to work system as necessary.
- C. Provide required supports and hangers for the distributed services and equipment, so that loading will not exceed allowable loadings of structure while retaining the frequency of supports as dictated by this Specification. Submittal of a bid shall be deemed a representation that submitting such bid has ascertained allowable loadings and has included in estimates the costs associated in furnishing required supports.
- D. Be responsible for scheduling this work with other trades in accordance with the construction sequence.
- E. Coordinate with others field drilling, cutting and/or reinforcing of holes in structural slab required for work under this specification and obtain approval from Structural Engineer. Allow for all costs for all such drilling, cutting and reinforcing costs.
- F. Install the engineering services in accordance with the requirements for ceiling heights and fully co-ordinate with all other trades.
- G. Take responsibility to co-ordinate the supply, installation, commissioning, testing and programming of all the works described in the contract documents, whether it is supplied or modified under these Works or is a free issue for installation.
- H. Accept responsibility for co-ordination and liaison with others to ensure that the installation as detailed does not conflict with other services or the building fabric, either during the construction or within the finished building.
- I. Ensure that co-ordination with all related elements of work has been fully coordinated and planned prior to submitting information for acceptance or commencing the installation. No instructions will be issued in respect to additional cost due to modifications not being so co-ordinated.

- J. Allow for the positioning, routing and/or locating of any service run or equipment to be adjusted from the positions shown on the Tender drawings, during the production of co-ordinated Installation (Shop) Drawings.
- K. Take site dimensions during the preparation of the Installation (Shop) Drawings and be responsible for their accuracy.

1.19 Technical Submittals

The requirements in relation to technical submittals shall be as follows:-

- A. Submit to the Building Services Engineer for acceptance detailed Builders work Drawings, Installation Drawings, Co-ordinated Shop Drawings, technical literature and samples for the installation and equipment described herein.
- B. Produce Builders work Drawings showing all bases, holes, openings, chases and other builders work requirements associated with the package of works specified herein.
- C. Confirm any preliminary builders work and structural information, already provided by the Building Services Engineer, and incorporate into Builders work Drawings.
- D. Fully detail and dimension Builders work Drawings and be solely responsible for their accuracy.
- E. Fully co-ordinate the drawings with all other services and the structure. Work in conjunction with other trades to ensure that the drawings are fully co-ordinated.
- F. Submit detailed Installation (Shop) Drawings and Builders Work Drawings for all areas and elements of the installation including plant rooms, showing equipment layouts, cores and risers. Provide the drawings at a scale sufficient to fully inform the Building Services Engineer of all installation details with general arrangement layout drawings at a scale not less than 1:50 with plant rooms, risers, details and sections at 1:20 scale.
- G. Show in layout and detail pads, foundations, anchorages, supports and attachments to the building structure where required for the installation of the work with dimensions, materials and method of construction noted.
- H. Check Shop Drawings and samples for accuracy, completeness of required information and conformance with the contract documents. Be responsible for Shop Drawings found to be inaccurate, incomplete or not in conformance with the contract documents before submitting for review.
- I. Ensure shop drawings for manufactured material and equipment includes model numbers, dimensioned drawings, operating weights, material specifications, operating features and controls, wiring diagrams, performance characteristics, service procedures, including clearance requirements for maintenance work, and conformance to specified codes and standards. Note that in addition to these requirements, other specific submittal data, and forms of data submission, are required by the Contract Documents for particular items of equipment and material.
- J. Submit names, sizes, catalogue numbers and samples of equipment for acceptance as detailed elsewhere in this document.
- K. Ensure that for each submittal there is clearly indicated the Contract Drawing Number or Specification Section used as reference.
- L. Ensure samples are identical in all respects to the material which is to be installed or applied in the execution of the work, and of sufficient size or quantity to permit proper evaluation and review. Furnish with the material, manufacturer's descriptive labels and printed application

instructions which are normally attached to the material or its packaging. Submit samples for acceptance when requested by the Building Services Engineers.

- M. All drawings and technical literature submitted for acceptance shall receive a Building Services Engineers review stamp indicating A, B or C action as defined below:

“A - Accepted”

Action means that fabrication, manufacture or construction MAY proceed providing the submittal complies with the Contract Documents.

“B1 - Accepted”

Action means that fabrication, manufacture or construction MAY proceed providing the submittal complies with the Building Services Engineer notations, comments, changes or alterations made and the Contract Documents. The submittal shall be resubmitted incorporating all comments made by the Building Services Engineer.

“B2 - Resubmit”

Action means fabrication, manufacture or construction MAY proceed with only the portion of the drawings not affected by the Building Services Engineer comments. The remainder of the drawing shall be revised incorporating the comments and resubmitted prior to fabrication, manufacture or construction.

“C - Rejected”

Action means that the submittal DOES NOT comply with the Contract Documents and that fabrication, manufacture or construction SHALL NOT proceed. Submittals stamped in this manner are not permitted on the job site.

Works fabricated/installed prior to completion of this process is performed at contractors own risk.

- N. Ensure that all drawings used by site personnel for the installation of equipment bear the Building Services Engineers' review stamp indicating the acceptance status.
- O. Be responsible for materials installed or work performed without acceptance of material samples and/or shop drawings. Accept the cost of removal of such material or work which is judged unsatisfactory for any reason.
- P. Acceptance by the Building Services Engineer of drawings, technical literature and other submittals relates to conformance with the design intent only and is not a release of responsibility for detailed compliance with the specification, design drawings and Contract Documents.
- Q. Upon appointment issue a detailed programme for submittals agreed with the Building Services Engineer.

10 working days shall be allowed for the review and acceptance of each submittal.

- R. Properly reference each submittal with the project name, submittal contents and a unique number.
- S. Submit for review a list of the special tools, lubricants, and recommended spare parts to be supplied in the service kits.

1.20 Factory Acceptance Testing

The Building Services Engineer requires that all plant be factory tested and precommissioned prior to delivery to site. The contractor shall give five working days notice of proposed factory testing and pre commissioning and shall afford the Engineer the opportunity to witness such tests at the factory.

The contractor shall submit factory test method statements for approval prior to factory acceptance testing visits.

1.21 Operation of Plant Prior To Practical Completion

The contractor shall ensure systems are not, without the prior written approval of the Building Services Engineer used or set into operation before Practical Completion.

Systems to be used before practical completion for the benefit of these works must have all defective consumable elements (including lamps and tubes) replaced by new not more than seven days prior to Practical Completion.

No system shall be put into use prior to handover to the Client, except for testing and commissioning, unless in accordance with the following procedure:

- 1) Following the receipt of written instructions, operate designated parts of these works, provided that such operation is practicable and does not prejudice your responsibilities and obligations as specified herein.
- 2) Additionally and with adjustment to the works sum, if instructed, provide:
 - a) Comprehensive insurance including indirect loss for any plant being operated
 - b) Maintenance of the installation
 - c) Re-instatement of the installation to “as new” condition prior to handover to the Client
 - d) Allow the defects liability to commence at handover

1.22 Cleaning Upon Completion

At completion the contractor shall carry out a thorough clean-down of all the installations using a specialist contract cleaning company. Such cleaning shall only commence when all works are completed and when authorised by the employers representative.

1.23 Operating and Maintenance Manuals

The contractor shall provide two hardcopy copies and two disks of all operating and maintenance manuals and as installed drawings for the works. Drawings shall be provided in the latest revision of AutoCAD and also in PDF format.

The contractor shall agree the format and contents of the handover manual with the Building Services Engineer. The operating and maintenance manuals shall include, but are not limited to the following:

1. Index of Contents
2. Contact details for the contractor and all equipment suppliers and involved parties.
3. A full description of each of the systems installed, written to ensure that the Client's staff fully understand the scope and facilities provided. Description to include data on general design parameters, normal associated operating conditions and manufacturer's information concerning correct operation, etc, based on commissioning results.
4. A description of the mode of operation of all systems.
5. Diagrammatic drawings to each system indicating principal items of plant, equipment, valves, etc.
6. A photo-reduction of all record drawings, together with an index. In A4 / A3
7. Legend for all colour-coded services.
8. Schedules (system by system) of plant, equipment, valves, etc, stating their locations within the building, duties and performance figures. Ensure each item has a unique code number cross-referenced to the record and diagrammatic drawings and schedules.

9. The name, address and telephone number of the manufacturer of every item of plant and equipment together with catalogue list and order acknowledgement numbers.
10. Manufacturer's technical literature for all items of plant and equipment, assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions.
11. A copy of all Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records (including, but not limited to, electrical circuit tests, corrosion tests, type tests, start and commissioning tests) for the installations and plant, equipment, valves, etc, used in the installations.
12. A copy of all manufacturers' guarantees or warranties.
13. Copies of Insurance and Inspecting Authority Certificates and Reports.
14. Starting up, operating and shutting down instructions for all equipment and systems installed.
15. Details of procedures to maintain plant in safe working conditions.
16. Control sequences for all systems installed.
17. Schedule of all fixed and variable equipment settings established during commissioning.
18. Back-up copies of any system software.
19. Documentation of the procedures for updating and/or modifying software operating systems and control programs.
20. Instructions for the creation of control procedure routines and graphic diagrams.
21. Details of the software revision for all programs provided.
22. Two back-up copies of all software items, as commissioned.
23. Details of regular tests to be carried out (e.g., water cooling towers, etc).
24. Copies of relevant HSE/CIBSE/IEE/ETCI etc Guidance notes, etc.
25. Procedures for seasonal change-over and/or precautions necessary for the care of apparatus subject to seasonal disuse.
26. Recommendations for the preventative maintenance frequency and procedures which should be adopted by the Client to ensure the most efficient operation of the systems.
27. Details of lubrication systems and lubrication schedules for all lubricated items.
28. A list of normal consumable items.
29. A list of recommended spares to be kept in stock by the Client, being those items subject to wear or deterioration and which may involve the Client in extended deliveries when replacements are required at some future date.
30. A list of any special tools needed for maintenance cross referenced to the particular item for which required.
31. Procedures for fault finding.
32. Emergency procedures, including telephone numbers for emergency services.
33. Copies of all items incorporated in the plant room and switch room schedules and schematics.

The contractor shall provide the Manuals in A4 size, plastic-covered, loose leaf, four ring binders with hard covers, each indexed, divided and appropriately cover-titled. Fold drawings larger than A4 and include in the binder so that they may be unfolded without being detached from the rings.

The contractor shall provide record drawings and include for the provision of relevant framed plasticized drawings in all electrical rooms.

Two copies of all record drawings, in print form, are required to be handed to the PSDP before completion of the project. They shall have been previously submitted to the Building Services Engineer for comment. The PSDP also requires 2 copies of all record drawings to be made available on disk. All record drawings are to be prepared on AutoCAD and shall also be provided in PDF format.

1.24 Site Modifications

The contractor shall not make site modifications to assemblies without authorisation from the Building Services Engineer.

Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with any type test certificate obtained for arrangement of components.

1.25 Operational Demonstrations

The contractor shall provide a written statement to the Building Services Engineer confirming that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.

The contractor shall demonstrate to the Building Services Engineer that all system components are operating correctly, and the completely integrated installation will function in accordance with the specified performance requirements. Allow for a 1 week environmental test period for this demonstration.

1. Run each plant for 1 week.
2. Provide a log book and record all hours run.
3. Where required provide equipment to simulate loads on-site.
4. Where required, allow for "Doomsday" testing of Mechanical, Electrical and Systems to observe correct operation of building under failure of the normal power.
5. Where required, allow for the full testing of the air conditioning system(s).

Any items, which have failed their acceptance tests shall not be accepted by the employer and shall be replaced by the contractor at contractor expense.

1.26 Loose Tools and Lubricants

The contractor shall provide special loose tools recommended by plant and equipment manufacturers for the satisfactory maintenance of their machinery to the Client at the completion of the works.

The contractor shall identify and all such tools and provide a suitable galvanised/lockable steel box for storage

The contractor shall provide lubricants for all moving plant and equipment as recommended by the manufacturers.

1.27 Defects Liability Period

The contractor shall be responsible for making good any defect in or damage to any portion of the works which may develop during a period of twelve months after practical completion and which arise either from defective materials or workmanship or from any act or omission.

During the defects liability period the contractor shall be responsible for all routine and preventative maintenance as required / recommended by the equipment manufacturers.

1.28 Site Survey

The tenderer shall have visited and checked the site relative to all aspects of the work and include for same in his tender. No claims whatsoever will be entertained by the engineer due to the lack of knowledge of site conditions or existing installations.

2.0 SUMMARY DESCRIPTION OF THE WORKS

The following is a summary of the works proposed. Refer to the relevant sections of this specification, and the associated drawings for full details. **The contractor shall price for ALL items of plant and materials to provide a complete fully functional installation whether specifically mentioned or not.**

2.1 General

The scope of work for the mechanical sub-contract on this project involves the Cextension and alteration of mechanical services for the Classroom Extensions and Woodwork Room Alteration at CBS Thurles Secondary School, Rossa Street, Thurles, Co. Tipperary as specified herein and as detailed on the drawings.

2.2 Standards

The Mechanical services shall be installed in accordance with current editions of the Building Regulations, relevant Irish Standard Specifications, EU Standards and Directives and the recommendations of the Chartered Institution of Building Services Engineers, which are, in the Engineer's opinion, applicable. Installations shall in particular conform to the latest edition of the following standards, and codes of practice in effect at time of tendering:

- i. Department of Education Technical Guidance Documents TGD 003, TGD 005, TGD 031, TGD 032 and TGD 033, Building Regulations
- ii. Chartered Institute of Building Services Engineer (C.I.B.S.E)
- iii. American Society of Heating, Refrigeration and Air Conditioning Engineers (A.S.H.R.A.E)
- iv. Relevant BSI and ASME Codes and Standards
- v. LPC Codes and Practices
- vi. Health & Safety at Work Act, 2006 - 2013
- vii. Heating and Ventilation Contractors Association (HVCA) specifications and standards DW/144 1998-2016.

2.3 Scope of Work

The scope of the works includes the following:

- (i) Heating Services to the extensions and alteration of existing services
- (ii) Water and wastes services and alteration of existing services
- (iii) Air filtration services to the woodwork room and
- (iv) Heat recovery ventilation services to the science 3 preparation room
- (v) Testing & commissioning / re-commissioning of the new and altered mechanical services installations.
- (vi) Maintenance of the newly installed services for the defects period.

The Mechanical Contractor shall supply all labour, materials, equipment and engineering services, and perform all works necessary to install the complete, tested, commissioned, and operational mechanical systems in accordance with the Specification and Drawings.

3.0 ELEMENT (51) : HEATING CENTRE SERVICES

3.1 Heat Source & Controls

The existing heating centre boilers and burners and BMS System are being retained. Connections for the new extensions shall be made locally from the existing heating distribution pipework as detailed on the drawings. Local room temperature controls shall operate independently of the BMS.

4.0 ELEMENT (52) : DRAINAGE AND REFUSE DISPOSAL

4.1 Extent and Programme of Works

This section shall include for the disconnection and removal of the existing Woodwork Room sink unit and for installation of a new sink and associated soils and wastes installation above ground to connect to the underground drainage systems which shall be installed by the main contractor. This installation shall be carried in PVC connected into the existing underground system at ground. The main contractor / specialist fitted furniture sub-contractor shall supply and install the new benches in the woodwork room including the new sink unit.

4.2 Woodwork Room & Science Room 3 Preparation Room Sinks

The contractor shall include for isolation, disconnection, removal and disposal of the existing Woodwork room sink and cutting back of water services to the header in the ceiling void and for blank capping the wastes below ground.

Contractor to supply, install new water services pipework and modify existing pipework to serve the new sinks in the Woodwork room and Science Preparation Room. New sinks will be supplied and fitted by the fitted furniture contractor. Wastes shall connect to underground drainage upstands to be provided by the builder.

4.3 The Soils and Waste Pipework

Soils and waste pipes generally shall be run in PVC pipe complying with BS 4514 with fittings generally in PVC complying with BS 5255. Other plastics such as polypropylene and high-density polyethylene may be used for particular fittings and applications. Joints shall be solvent welded on PVC pipe, but special sockets with synthetic O-rings may be used in some cases, particularly with polypropylene. On no account shall solvents be used for jointing on polypropylene.

Pipe ends shall be cut square using a fine tooth saw and all swarf shall be removed with glass paper. The cut end of the pipe and the socket into which it shall be inserted shall be cleaned with a patent cleaner recommended by the pipe manufacturer. In the case of PVC pipe and approved solvent welding cement shall then be applied to both cleaned surfaces in accordance with the manufacturing instructions.

The pipe shall then be fully inserted into the socket with a slight twisting motion and any excess solvent removed with a clean cloth. The joint should then be held firm in position for at least 20 seconds to allow it to set and should not be handled for about 2 minutes.

4.4 Soils and Waste Pipe Connections

The Contractor shall allow for connecting the outlets of all sanitary and other fittings with waste outlets to the soil or waste pipework as appropriate. Traps generally shall be in polypropylene unless otherwise stated, mounted immediately below the fitting, and complying with BS 5572. All traps shall be accessible and provided with adequate facilities for cleaning, and where necessary shall be capable of being easily dismantled or removed. Traps from kitchen sinks and equipment, and from bowl type urinals should be in brass chromium plated, where required.

Traps with outlets for pipes up to and including 50 mm size should have minimum water seal of 75 mm and where over 50 mm outlet the seal should not be less than 50 mm unless otherwise indicated.

Bottle traps shall be used on wash hand basins where the trap is exposed. Where siphonage may occur due to the arrangement of small discharge pipework, resealing traps may be used provided the Engineers approval is obtained for each location.

4.5 Soils and Waste Pipe Supports

Plastic pipe used for soil and waste installations shall be supported generally as outlined in the Guide published by the Institute of Plumbing. Supports shall be spaced at not more than 12 times

the diameter of PVC pipe 32 mm and above whilst vertical pipes should be supported at intervals not greater than 24 times the pipe diameter. UPVC pipe should be supported at intervals not greater than 8 times the diameter of the pipe.

Pipe supports should be by a suitably designed galvanised metal collar or intermediate bracket and suspension for fixing to wall or underside of floor. Collars on vertical pipes should be located so that the support is at the boss branch. Metal pipe clips can be adapted to suit the outside of a vertical pipe by the addition of a barrel clop collar. UPVC pipe clips should be used between anchor points on vertical pipes when is necessary to accommodate some movement due to thermal expansion.

4.6 Blank Caps and Cleaning Doors

Blank caps and cleaning doors shall be provided at all branches and other locations where rodding access it necessary for cleaning or removal of blockages. Generally their position shall be at branches s indicated on the drawings but the contractor shall review the proposed runs before installation and shall consult with the Engineer before installation commences to see whether any additional cleaning doors are necessary.

4.7 Vent Pipes

All vent pipes shall be taken to roof level s indicated on the drawing and shall terminate in a patent roof vent cowl, which shall be supplied and installed by the main contractor in accordance with the manufacturers details.

4.8 Connections to Existing Drainage

The Contractor shall make off all soil and waste connections to the existing sockets provided in the building, and which generally are to finish flush or close to the floor. Where this is of PVC a joint ring socket should be located at floor level to allow for some differential movement without damaging the vertical stack.

Where connections are to cast iron, a ring seal collar shall be fitted and caulked with lead and gaskin. Where the connection is to a clay drainpipe a 2 : 1 sand and cement adapter and gaskin shall be used around the ring seal.

4.9 Fire Stopping of Soils and Wastes Pipes

Soils and wastes pipes of 49mm diameter and over, where passing through fire compartments (i.e. floor to floor) or between compartments on the same level shall be fitted with fire sleeves. The fire sleeves shall be of galvanised steel with an intumescent liner which shall enclose the PVC pipe where it passes through the wall, floor or ceiling and which shall then reach a temperature of approximately 150oC expand inwards to close the PVC pipe and seal the aperture completely against the passage of flame and flumes. The fire sleeves shall be as manufactured by Messrs Dufaylite Developments Ltd., Types VR or VF, where passing through floors and HR or HF where passing through wall, or similar approved.

5.0 ELEMENT (53) : PIPED WATER SERVICES INSTALLATION

5.1 Scope of Work

This section covers alterations to the domestic cold and hot water services serving the school extensions.

5.2 Water Heaters

The Contractor shall supply and install ATC undersink water heaters as particularly scheduled on the drawings or equal and pre-approved. The units shall be positioned as close as possible to the outlets to minimise heat loss and delivery time.

Water heaters for sinks in class rooms shall be thermostatically controlled to limit the outlet water temperature to 43°C. The cold water supply shall be taken off the nearest available cold water pipework and with an isolation valve installed on the cold water supply side of the water heater.

The electrical contractor will provide new 13 Amp electrical spur outlets at the sinks in Classrooms to serve the new undersink heaters under the electrical sub-contract.

5.3 Science Room 3

The science room 3 is being redeveloped as a full science room and additional water services shall be provided to cater for sinks in the student benches as detailed on the drawings. The fit out of science room 3 furniture shall be completed under a separate furniture fit out contract. The mechanical contractor shall provide tap off points only for future connection by the fitted furniture contractor.,

5.4 Pipework

All pipe work will be installed using copper pipework using brazed joints. Bends, springs and sets in Table X tube may be site made where standard fittings cannot be used, or where this method will give a neater appearance. Table Z schedules shall be used in straight length only. Tables X and Z are as per ASMI Codes.

Pulled bends or offsets, which show fattening, ripples or constriction of bore will be rejected.

Fittings for brazing shall have socket ends for brazing with copper/silver/phosphorous rod to BS 1845. Pressure rating and service conditions for fittings shall be equal to the specified tube.

Fittings incorporating screwed threads to BS 21 shall be jointed using compounds to BS 5292 and hemp or PTFE tape as listed in the Water Research Centre 'Water Fittings and Materials Directory'.

All solder used in making capillary joints shall be lead free.

Care must be exercised at any points of junction between copper tube and steel to avoid direct contact.

A suitable fitting of dielectric material shall be used to prevent electrolytic action taking place.

Where pipework is indicated on the drawings as chromium plated such pipework shall be sent to a specialist for plating after all pulled bends and soldered joints are complete. Where completed sections are to be site jointed in exposed locations unions shall be used.

5.5 Pipe Supports

Pipework where run on the surface shall be supported by means of bronze school board type brackets built-in or screwed on according to location. In certain positions single or multiple brackets may be used. Supports in floor ducts shall consist of steel channel and rollers except that copper pipe shall be used as roller instead of mild steel tube.

Pipework in roof space shall be supported on unistrut sections supported from the underside of the roof structure with drop rods. Pipework shall rest on copper roller sections provided in the unistrut channel.

The Engineers approval for the type of support proposed in any location shall be obtained before fitting.

5.6 Control Valves and Stop Cocks

Stopcocks of the 'Ballofix' type or similar approved, shall be provided where indicated or required to allow isolation of supply for renewal of washers or other maintenance. Where possible they shall be so arranged as to control fittings or groups of fittings in individual locations, and shall be mounted in such positions as to be screened by the fittings. No stopcocks shall be fitted in an exposed position except with the Engineers approval. All valves shall have gunmetal or bronze bodies and shall comply with B.S 21 shall be jointed using compounds to B.S 5292 and hemp or PTFE tape as listed in the Water Research Centre 'Water Fittings and Materials Directory'.

5.7 Pipe Sleeves

In all places where pipes pass through solid walls or floors suitable sleeves shall be provided and fitted at such points. Sleeves shall be in one length and to be fixed flush with the surface of the finished wall or floor.

5.8 Wall and Ceiling Plates

The Contractor shall supply and install wall, floor and ceiling plates on all pipes, which are installed through floors, walls or ceilings. These shall be of set screw pattern zinc alloy die castings type with chromium plated finish, all to the approval of the Engineers. They should be heavy quality Halls Thimble type or equal approved.

5.9 Branches and Connections to Fittings

All branches from the mains to fittings shall be located in the position shown on the drawings and shall generally be run on the surface except where otherwise indicated, or where concealed by wall fitments. They shall be secured by bronze pipe saddles multiple or single according to location, and securely fixed to the wall. Connections to fitting shall be made with a copper to iron adaptor, Instantor Fig. 312, or similar approved.

5.10 Insulation

All concealed pipework or pipework at high level or anywhere there is a risk of causing condensation shall be insulated.

Insulation shall be 'rigid foil back insulation with Class O fire rating, or equal and pre-approved.

Such insulation shall be applied in the unslit condition and provision must be made against the future shrinkage of the material by compressing the various lengths by up to 10% of their initial length. Insulation must cover very part of the piping including bends, elbows, tees etc. The joints between the various sections shall be made with approved adhesive and shall also have approval quality waterproof tape, opanol or similar wound around the joint.

The insulation shall be in accordance with the following sizes:

Internal Pipe diameter	Insulation Thickness
Up to 19 mm	19 mm
Over 19 mm and up to 32 mm	25 mm
Over 32 mm and up to 50 mm	32 mm

5.11 Labelling

All valves etc. shall be carefully labelled to indicate their purpose, size and duty. Labels shall be manufactured from 3 mm thick brass plate chromium plated and having the wording engraved in 6 mm high block lettering. They shall be secured to the apparatus concerned by 3 mm diameter chromium plated screws.

5.12 Painting

Any rust marks on any of the equipment shall cause the equipment to be rejected and will be replaced by the contractor. Any rust marks on pipe work shall be well rubbed down and cleaned and shall be primed and painted. All-purpose made brackets or supports shall be primed and painted on all surfaces. A finishing coat will be required on all exposed pipework.

5.13 Water Services Testing and Commissioning

General

The Contractor shall in relation to the Engineer's entitlement offer all plant for witness testing and inspection. If the tests are beyond the resources of the manufacturer he shall make arrangements for these to be carried out elsewhere. Any variation of this requirement shall be agreed in writing with the Engineer.

Testing of Motors

Witness testing will normally be waived on standard types of small motors made by approved manufacturers and small components used in the manufacture of units of plant.

Contractor's Obligations.

No inspection or passing by the Engineer or any other duly authorised person or group of the works, plant or materials shall release the Contractor from due obligations under the contract.

Testing

All pipework shall be tested as soon as practicable after installation and before completion of shaft walls, access panels, suspended ceilings and applications of any insulation.

In the event of the failure of any test and defect shall be located and repaired, and the test repeated.

Test Certificate.

A test certificate shall be submitted following successful testing of the complete system.

The Test Certificate shall include:

- Project Name:
- Name of Sub-contractor:
- Service:
- Section Under Test:
- Nature of Test:
- Water
- Pressure
- Duration
- System Flushed: Yes/No
- Record Drawings Submitted: Yes/No
- Signatures of Sub-contractor:
- Witness:
- Date of Test:

Commissioning of Pipe Services

The Contractor shall include for instructing the personnel responsible for the operation of the system in the correct operation and maintenance of the entire system. During the commissioning period he shall go over with them the commissioning and servicing manuals and shall ensure that they understand fully and are properly instructed in planned maintenance of all aspects of the plant. A signed statement from the employer stating that such instructions have been given will be required.

Testing of Pipe Services

After the installation is complete but before the insulation is applied the pipe work and valves shall be hydraulically tested to 4bar and shall remain drop tight at the pressure for a period of eight hours. All fittings shall be disconnected during the hydraulic test, and open ends capped.

All joints shall be lightly hamper tested and pulled by hand while under pressure. Should any leakage occur the Contractor is to make good at his own expense, notwithstanding that previous tests may have been satisfactory.

If necessary the Contractor may be required to test the system in sections and not extra will be allowed on this account unless previously agreed.

After a satisfactory test under cold water pressure and once the insulation has been applied, the valves connecting the circulating mains shall be opened up and the system shall be operated to ascertain that circulation is satisfactory. The Contractor shall be held responsible for the efficient working of the system (faulty design excluded) and for defects arising from faulty materials and workmanship.

Outlets shall then be opened one at a time to demonstrate that they can deliver the requisite flow of water, after which about 1/5th of those installed shall be opened simultaneously to demonstrate that the system can meet normal load in a satisfactory manner.

The Engineer is to be duly notified before each test is made.

5.14 Sterilisation of Domestic Water Systems.

After satisfactory completion of final testing the following sterilisation procedure shall be carried out:

All hot and cold domestic water services, tanks and calorifiers/cylinders shall be sterilised in accordance with BS 6700. The Sub-contractor shall supply all necessary fittings to enable the chlorination to be carried out.

Sterilising water shall be disposed of in compliance with the requirements of the Water Authority. Protective clothing and goggles shall be provided for the operatives carrying out this work in accordance with the health and safety requirements.

Detailed records shall be maintained for all sterilisation procedures carried out. A copy of Sterilisation Certificates for all parts of the system shall be submitted containing the following information:

- Name of Sub-contractor:
- Service:
- Section Sterilised:
- Project Name:
- Method of Sterilisation:
- Contact Time:
- Minimum Chlorine Level at Outlets:
- Signatures for Sub-contractor:
- Witness:
- Date of Sterilisation

6.0 ELEMENT (56) : SPACE HEATING INSTALLATION

6.1 Extent of Works in This Section

The upgrade works of the Classroom Extensions and Woodwork Room Alterations will comprise of the following:

- Supply, delivery, installation, testing and commissioning of new radiators as shown on the drawing for the extension areas
- Removal, relocation, testing and re-commissioning of certain existing radiators which are to be retained / relocated as shown on the drawing

Localised zone controls shall be provided using two port valves with spring loaded actuators and anti-tamper local thermostats in each room

The scope of work involves both the supply, installation and connection of heating distribution pipework in the 2 classroom extension and the isolation, disconnection and modification of the existing heating distribution pipework as required to facilitate the proposed alterations to the Technology, Woodwork and Science Classrooms.

The heating distribution installations shall be as specified herein and as detailed on the drawings and as specified herein. It shall be the responsibility of the Mechanical Services Contractor to co-ordinate his services with those of other trades to avoid clashes. Any abortive work, which occurs as a result of a clash due to lack of co-ordination shall be resolved without cost to the client or his representatives.

The clauses outlining the standards of workmanship and materials within the General Specification shall apply as well as those outlined below.

Existing Radiators shall be retained in the Woodwork Room as shown on the drawing. The Contractor shall make allowance for replacement of any defective radiator and or fittings of the existing system where necessary. Replacement of such items shall be confirmed with the Building Services Engineer.

6.2 Pipework and Fittings

LTHW heating pipework shall be fabricated from black MS tubing medium grade to BS 1387. Cold feed and open vent pipework shall be fabricated from galvanised MS medium grade tubing to BS 1387 with screwed and socketed ends. Drain pipes from automatic air pipes, pumps, safety valves etc shall be fabricated from copper piping to BS 2871 Table X.

Pipes shall be new, clean, and free from defects, of even bore throughout, shall be delivered with the manufacturer's protective coating undamaged and shall have plain chamfered ends for welded joints or screwed and socketed ends as detailed in the Particular Specification.

All mains shall be graded to ensure that no air locking occurs.

The cold feed and the open vent pipes shall be fabricated from galvanised MS medium grade tube to BS 1387 with screwed and socketed ends.

Drain pipes from automatic air vents, pumps, safety valves etc. shall be fabricated from light gauge copper piping to BS 2871 Table X.

Piping to valves and equipment shall be connected with either flanges or unions to facilitate the removal of the equipment.

- | | | |
|---|--|-------------------------------|
| a | Pipework within ceiling voids and exposed to view up to and including 50 mm ID 65 mm dia and above | Screwed BSP
Welded |
| b | Pipework within ducts | Welded |

All joints on concealed pipework shall be formed using proprietary fittings be of the seamless steel 'medium' butt welding type to BS 1965 Part 1. All branches shall be arranged to sweep in the direction of flow. Stab-in branch welds or swagged reducers and or branches shall not be accepted. All branches shall be by a tee piece. All reducers shall be eccentric where the pipework is on the horizontal and concentric on the vertical. The flat side of eccentric reducers shall be positioned to allow venting to the high point in the run or system. Pulled bends may be used on all exposed pipework up to 25 mm bore and up to 40 mm bore for concealed pipes. For pipes over 25 mm bore on exposed pipework and over 40 mm bore on concealed pipework long radius welding bends shall be used. If the cross-sectional area of any pulled bend is altered or if the throat of any bend is rippled it will be rejected.

To provide for drain points on welded pipework an internally screwed MS socket shall be welded into the main with the base of the socket shaped to the contour of the main pipe. Air venting points on pipes 32 mm bore and above shall be provided by welding a plain pipe 150 mm long x 32 mm dia. to the top of the main with the end of the branch swaged down and fitted with a MA screwed socket to connect to the automatic air eliminator. For pipes below 32 mm dia the bore of the air collecting branch shall be equal to the bore of the pipe being vented.

Flanges used on welded pipelines shall be in steel of the slip-on welding type to BS 4504 and shall be drilled and faced for a nominal working pressure of 10 bar.

Fittings for use with screwed pipework shall be in black malleable iron to BS 1256 with connections to heating surface made with sweep type fittings. Where two mains connect or divide sweep or twin elbow branch fittings as may be appropriate shall be used.

If a tee piece has to reduce on the run and a reducing fitting is not available the reduction shall be made by using a hexagon nipple and an eccentric reducing socket. The use of bushings will not be permitted.

Pulled bends may be used as described for welded pipework otherwise long radius screwed bends must be fitted. Short radius elbows may only be used with the permission of the Engineer.

Drain or air venting branches shall be provided as described for welded pipework only screwed pipe fittings with square branches shall be used.

Flanges used on screwed pipelines shall be of steel to BS 4504 threaded to BS 21 and drilled and faced for a nominal pressure of 10 bar.

Malleable iron unions shall have gun-metal ground seats and the use of connectors and backnuts will not be permitted. During the progress of the work any surplus flux and jointing paste visible at joints shall be carefully removed. The amount of jointing materials used shall be the minimum required to complete the joint. Care shall be taken that fittings are not excessively tool-marked and when pipes are cut they shall be carefully reamed out to restore the bore.

Sufficient flanges or unions shall be used to ensure that any part of the installation can be easily removed.

Fittings for use on cold feed and open vent lines shall be in galvanised malleable iron to BS 1256. Square tees can be used on this pipework.

All pipework shown in floor ducts shall be fully welded, painted with two coats of corrosion resistant paint and insulated in accordance with the specification. All new pipework in floor ducts shall be inspected by the Consulting Engineer prior to back filling. There shall be no joints on underground pipework.

6.3 Pipework Supports and Brackets

The complete heating installation shall be supported from the building structure other than the roof purlins generally in accordance with the General Specification.

The contractor shall be responsible for the overall design and installation of all supports and brackets necessary for the installation as contained within this specification and on the associated drawings.

Pipework shall be supported in a manner which will allow for free movement due to expansion and contraction with supports arranged as near as possible to joints and changes in direction.

In the boiler room pipework shall be supported from the walls or floors on purpose made MS brackets and in overhead ducts, MS wall brackets shall be attached to the walls using rawl-bolts, hilti-bolts or similar. The erection of these brackets shall be the responsibility of this contractor.

All pipework shall be set on cast iron or bronze rollers and chairs fixed to the angle framework, or alternatively adjustable suspension type rods and pipe rollers may be used. Pipework in floor ducts shall also be set on rollers and chairs fixed to angle framework, bolted to the sides of the duct. Alternatively, rollers placed in MS channel attached to the duct floor may be used.

The erection and fitting of the angle iron framework or mild steel channel is the responsibility of this contractor. Care will be taken to ensure that the correct support is applied to MS and copper piping and that dissimilar metals are not in contact. Provision shall be made to ensure that pipework does not leave the roller by providing inverted 'U' guides fabricated from 9 mm Dia. round iron at 12.0 m centres. All brackets and supports shall be thoroughly cleaned and painted one coat of red oxide of lead paint.

Before manufacture the design of brackets and supports must be agreed in writing with the Engineer and where necessary this contractor shall submit drawings to the Engineer for approval.

Exposed pipework in rooms shall be supported on malleable iron or brass split pattern screw-to-wall school board brackets depending on the pipe service. This contractor shall include for lining up the brackets, drilling and plugging the walls and fixing the brackets. Screws shall have a minimum length of 50 mm with brass screws being used with brass brackets. Plastic type wall plugs to suit the screw size shall be used.

Where floor level pipes are subject to abuse additional floor type brackets comprising a split pipe ring, pipe nipple and back-plate secured to the floor shall be fitted in locations decided by the Engineer. Brackets which have to be secured to structural steelwork shall be fixed with special girder clips; welding or drilling the steelwork may not be carried out without special permission.

Supports shall be spaced in metres according to the following table.

STEEL PIPE			LG COPPER PIPE		
BORE	HORIZONTAL	VERTICAL	BORE	HORIZONTAL	VERTICAL
15 mm	1.5	1.8	15 mm	0.9	1.2
20 mm	1.5	2.1	22 mm	1.2	1.5
25 mm	1.8	3.0	28 mm	1.5	1.5
32 mm	1.8	3.0	35 mm	1.5	2.0
40 mm	2.4	3.0	42 mm	1.8	2.4
50 mm	2.4	3.5	54 mm	1.8	3.0
65 mm	2.7	4.0	65 mm	2.4	3.7
80 mm	3.0	4.0	76 mm	2.4	3.7
100 mm	3.0	4.6	108 mm	2.4	3.7
125 mm	3.7	5.5	133 mm	3.0	3.7
150 mm	4.5	5.5	159 mm	3.7	3.7

6.4 LTHW Valves

In the boilerhouse and plant rooms all valves 65 mm bore and above shall be cast iron flanged gate valves with a bronze trim disc wedge, rising stem and outside screw and yoke. They shall comply with BS 5150 with flanges drilled and faced to BS 4504 for a nominal pressure of 10 bar and shall be similar to Crane Fig. FM 82 or equal to approval.

Boilerhouse and plant room valves fitted in pipes with a bore from 25 mm up and including 50 mm shall be bronze flanged full way gate valves with a solid gun-metal wedge and non-rising stem. They shall comply with BS 5154/B drilled and faced to BS 4504 for a nominal pressure of 10 bar and shall be similar to Pegler Fig. 1071 PN 16 or equal to approval.

Valves 20 mm bore and below shall be in bronze of the full way gate type with internally screwed ends to BS 5154/B SIMILAR TO Pegler Fig. 1070 M-PM 25 or equal to approval.

Outside the boilerhouse isolating or circuit valves up to 100 mm bore shall be in bronze of the full way gate type with internally screwed ends and shall comply with BS 5154/B similar to Pegler Fig. 1070 PN 32 or equal to approval. Valves fitted to pipework over 100 mm bore shall be of the cast iron flanged type similar to Crane FM 82 or equal to approval.

Flanged valves shall be provided with suitable steel mating flanges and where the mating flange and the flanged valve are of dissimilar materials the joint shall be made with a suitable rubber composition insertion joint which shall be the full free diameter of the flange. Flanged valves in the boilerhouse and plant rooms shall be fitted with an 'open and shut' indicator.

Union type valves shall be fitted to the flow and return connections to each radiator, natural or fan assisted convector unit heater or pipe coil. These valves shall conform in all respects to BS 2767-10 manufactured in forged brass with a chromium plated finish similar to Pegler Fig. 2063 or Fig. 2076 or equal to approval. A wheel valve shall be fitted to the flow inlet to the appliance with a lock shield valve on the return outlet the valves being of the angle or straight pattern as necessary.

On single or two pipe circuits up to and including 32 mm bore the circuit isolating valves shall be of the union type in forged brass to BS 2767-10 similar to Pegler Fig 2076 WH on the flow and Pegler Fig. 2076 LS on the return or equal to approval.

Valve Type	Gun-Metal Hattersley Crane	Cast Iron Hattersley Crane
Gate	Fig 33X D151/9	Fig 549 F52/F51
Lockshield	Fig 33XLS D235/7	
Valve Type	Manufacturer	Reference
Globe	Crane	F366 73/E or
	Hattersley	Flanges to BS4504
Double Regulating	Bailey	2707/2705/2504 -
	Crane	DM 900/910/920/930
	Hattersley	CV2432/4733DR/CV2733/4733DR
Automatic Air Vents	Winns	Type 1680
3-Way Vent Cocks	Winns	Type 1680
	NABIC	Fig 503
Drain Cocks	Hattersley	To comply with BS2789
	Crane	Type 2
Check Valves	Crane	FM 492
Needle Valves	Crane	D71

Any valves necessary for isolation and/or regulating the system shall be provided and installed so that they are accessible for operation and maintenance.

6.5 Heat Emitters – Convactor Radiators

The Contractor shall supply and install steel panel type radiators as manufactured and supplied by Merriott or equal and approved, of the type and size as shown in the Radiator Schedule and locations shown on the drawings. Panel radiators shall be rigidly supported on steel brackets supplied by the radiator manufacturers. These shall be fitted at the back of the radiator and shall be generally concealed from view. Radiators shall have a clear space of 40 mm between the back of the radiator and the wall, and 150 mm between the bottom of the radiator and the finished floor. The case height shall be as per schedule of radiators.

In no case is any radiator to stand above the bottom of any window board, and the Contractor is to arrange to check the Schedule of Heaters with the Engineer before ordering to ensure that this is so.

All wall radiators supplied should comply with the following:

- All radiators must be EN442 certified
- All radiators must be suitable for low H2O water content
- All radiators must be pressure tested to 20 bar and suitable for working pressure of 10 bar
- Low water content - .98 litres per metre or less
- Heat exchanger must be corrugated
- Flat panel radiators to have a one-piece cover
- All radiators to come with 30 year warranty
- All heaters to be securely fixed to manufacturer's specification.
- All mounting location and details to be agreed on site prior to installation
- Radiators to be factory painted in white glass washable enamel finish and shall be repainted if damaged during installation.
- Final dimensions of all radiators to be confirmed on site prior to ordering
- Sample of all radiators to be approved prior to ordering
- This schedule must be read in conjunction with the relevant part of the specification and drawings
- Radiators shall be provided with a key operated chromium plated air vent. All keys shall be interchangeable.
- The radiator shall be finished in anti-static paint with white glass washable enamel finish.

The Contractor shall also allow in his tender for disconnection and temporary removal of all radiators for wall finishing and for re-decoration.

6.6 Radiator Valves

Control valves shall be fitted on the flow and return connections to all radiators. The valves on the flow shall be of the hand wheel pattern with mushroom composition hand wheels, while those on the return shall be of the lock shield pattern. Where exposed valves shall be of the easy clean chromium plated finish, Pegler type.

Control valves shall be gunmetal throughout and shall be of angle or straight pattern to suit connections. Valves generally shall be complete with gunmetal unions fitted on the heater side so as to allow disconnection of heaters without emptying down the system

6.7 Automatic Air Vents

Automatic air vents shall be provided on all high points in the system and they shall be as Spirax Sarco Fig No AE 31 CV. Each air vent shall be fitted with a Lockshield isolating valve and 10 mm table x copper pipe to BS 2871, to drain outside.

6.8 Balancing / Commissioning Valves

Balancing/commissioning valves shall be provided as a minimum as indicated on the drawings or more as necessary to complete the balancing of the heating installation.

The water flow rate through each circuit, sub-circuit and heater battery shall be declared and

proved to the Engineer's satisfaction.

If additional valves are found to be necessary in the estimation of the Mechanical Contractor, then he shall make due allowance for any difference in pressure loss in the final selection of pump duties. Any difference in cost shall be borne by the contractor and any claim to the Employer in this respect shall not be entertained.

6.9 Painting

The manufacturers finish coat on radiators and other equipment shall be accepted as being a suitable finish provided it is undamaged and clean.

Any rust marks on any of the equipment shall cause the equipment to be rejected and will be replaced by the contractor. Any rust marks on pipe work shall be well rubbed down and cleaned and shall be primed and painted. All-purpose made brackets or supports shall be primed and painted on all surfaces. A finishing coat will be required on all exposed pipework.

7.0 ELEMENT (57) : MECHANICAL VENTILATION

7.1 Scope of Work

The Contractor shall supply, install and commission mechanical heat recovery ventilation installation as detailed on the drawings. The contractor shall supply, commission and install all necessary items of plant such as HRV units, ductwork, volume control dampers, supply grilles, extract grilles, fire dampers etc as required for a complete system.

Supply air unit, supply grilles, fire dampers and duct work shall be as scheduled and detailed on the ventilation drawings or equal and pre-approved.

All internal ductwork is to be insulated using foil back insulation.

7.2 Woodwork Room Air Filtration Ventilation

Two stage air filtration units shall be supplied as scheduled and shall comply with HSA and TGD 33 guidelines in regards to air quality. Air Filter units shall be as scheduled or equal and approved.

The Contractor shall allow for all necessary ceiling anchoring connections for the complete installation of the air filtration units.

The Contractor to allow for installation of new 13 Amp electrical spur outlets at each unit to serve the new air filtration units – refer also to the electrical section. The Contractor shall include for commissioning of all units. Air Filtration units will be operated by two circuits each with local isolator.

The Contractor shall supply 10% of each filter type rounded up to nearest standard pack, as spares on the date that Practical Completion for the project is attained.

7.3 Ventilation

The Mechanical Contractor shall supply, install and commission heat recovery ventilation units as scheduled on the Drawings. Units shall be VAM type as manufactured by Daikin or equal and pre-approved.

The Mechanical Contractor shall supply and install the complete duct work system including supply diffusers, extract grilles, external louvers etc as detailed and scheduled on the drawings. All duct work is to be in accordance with DW 144 and C.I.B.S.E. guidelines.

7.4 Duct Ancillaries – Dampers, Fire Dampers & Insulation

7.4.1 Ductwork

This clause covers the materials of construction to be used in the design, fabrication and erection of medium pressure ductwork for use in HVAC air distribution systems. The ductwork shall be installed and commissioned in accordance with DW144.

All supply and return ductwork to be standard rectangular or spiral duct. The final connections to plenum boxes shall be made via use of maximum of 1 m of flexible aluminium.

Ductwork Insulation shall be securely fixed within all air handling equipment. Where required a vapour barrier shall be provided.

All internal supply air ductwork shall be insulated and thermal insulation shall have a thickness not less than 25mm and a thermal conductivity not greater than 0.04 W/m°C.

7.4.2 Ductwork Materials

All ductwork for ventilation and exhaust ductwork within the building shall be manufactured from galvanised steel and all materials used shall be provided. All ductwork shall be manufactured to the sizes shown on the drawings and gauges as recommended by the current edition of the Heating and Ventilation Contractor's Association (HVCA) Specification No. DW/142 Part 2 and 3.

7.4.3 Ductwork Construction

All ductwork shall be fabricated and constructed in accordance with HVCA Specification No. DW/142. The thickness of sheet metal and type of stiffening for ductwork shall, in all cases, be determined by the larger duct dimension.

7.4.4 Ductwork Bends and Fittings

Rectangular bends for ductwork shall be in accordance with Fig. No's 54 to 72 of the HVCA Specification No. W/142 Part 3. Where stiffening is required on the flat side of bends, they shall be attached in a radial pattern. The spacings for these stiffeners shall be measured along the centre line of the bend.

Circular fittings shall be constructed in accordance with HVCA Specification No. DW/142 Part 4, Fig. No's 87 to 110.

All ductwork branch connection shall be at 45° angle entry to trunk ducting in accordance with HVCA DW/142 Specification Fig. No.95.

7.4.5 Ductwork Joints

All rectangular ductwork joints shall be slide-on flanged joints. Flanged joints on rectangular ductwork shall be in accordance with HVCA Specification No. DW/142 Part 3 and Fig. No's 41 and 42 and circular ductwork shall be jointed in accordance with DW/142 Part 4, Fig. No's 74, 75, 75, 82 and 83.

7.4.6 Sealant Gaskets

All ductwork joints shall incorporate neoprene or silicone sealant gaskets. Certification of sealant used shall be provided.

7.4.7 Ductwork Supports

Ductwork support hangers for horizontal ducts shall be in accordance with Table No. 24 and No. 25 of the HVAC Specification No. DW/142 Part 6 and as shown on the detail drawings.

7.4.8 Ductwork Finishes

A protective finish shall be applied to all mild steel sections, e.g. flanges, stiffeners, hangers, supports, before fixing. Suitable protection for normal conditions shall be two coats of red oxide or zinc chromate paint.

7.4.9 Deflectrols

The Mechanical Contractor shall supply deflectrol turning vanes at all branch connections off main ducts.

Deflectrol turning vanes shall be installed at an angle of 12 degrees to the horizontal in the direction of air flow. All deflectrol turning vanes shall be finished with No. 2 grey primer.

Where swept duct turns are not feasible square duct bends with tuning vanes shall be employed. Turning vanes shall be factory manufactured multiple radius type and shall be rigid fixed diagonally across the duct bend in the direction of the air flow. Turning vanes and deflectrols shall be AS manufactured by Barber and Colman Limited, or approved equal.

7.4.10 Control Dampers

Damper for the control of air volumes in rectangular ductwork shall be inserted in the supply and exhaust ductwork in the positions shown on the drawings. Damper blades shall be of rigid construction without sharp edges and shall be air tight when closed.

They shall be mounted on a robust spindle and be so constructed as to prevent distortion or jamming in operation. All hand controlled dampers shall be provided with a locking device on the outside of the duct, located parallel to the blade.

Spindles shall be extended to the outside of the duct and be provided with a groove in line with the blade.

Spindles shall be carried on non-ferrous nylon or ball bearings. Dampers for circular ductwork shall be butterfly type with spindle housed in airtight bearing. Damper shall have perimeter blade landing around inside of casing. Spindle shall have external quadrant locking device.

7.4.11 Fire Dampers

Fire dampers shall be provided in the ductwork system, in the positions shown on the drawings. All fire dampers shall be constructed to BS 476 Part 8 : 1972 and have a rating of 2 hours. Fire dampers shall be constructed in such a manner as to close automatically and to remain tightly closed upon operation of approved fusible link, or other approved heat actuated device located where readily affected by an abnormal rise of temperature in the duct.

Fusible links shall have a temperature rating approximately 10 degrees celsius above the maximum temperature that would normally be encountered with the system in operation or shut down, but not less than 74 degrees celsius. Fire dampers shall be as manufactured by Action Air Equipment Ltd. or similar to approval.

7.4.12 Access Openings

All access openings shall be rigidly formed and fitted with airtight covers, so designed as to be simply and speedily removed and re-fixed. Multiple set screws or self-tapping screws are not permitted as a method of fixing. Access doors shall be provided for the purposes given below as indicated on the drawings:

- a) Access for personnel for maintenance operations
- b) Access for routine maintenance lubrication of items not requiring full man access.
- c) Access for cleaning.
- d) Access for items concealed in ducts (e.g. dampers, fusible links, etc.).
- e) Test holes to permit entry of pitot tubes and other equipment

7.4.13 Test Holes

Test holes for instruments shall be provided where indicated on the drawings and in all locations where fan duties are to be tested, and performance of regulating dampers is to be assessed. All test holes shall be 25mm diameter and provided with an effective seal.

7.4.14 Connection to Builder's Work

All air intake and exhaust outlets where protruding through the roof shall be provided with weathering aprons and flashing plates.

Where metal ducts and fan inlets and outlets connect, connection shall be by metal frame or built-in companion flange or ring.

Companion rings shall be provided with an adequate number of suitably sized rag bolts or fixing devices. In all cases the duct end must finish with a mating flange.

The material of the duct shall be extended in the form of a spigot, beyond the flanged connection and into the builder's work. Joints between mating flanged and companion rings or frames shall be fitted with a sealing gasket as described in Section 7 of the HVCA Specification No DW/142. All sealants shall be silicon type.

7.4.15 Measurements

The Mechanical Contractor shall be responsible for taking all measurements as necessary for the fabrication and erection of all ductwork.

7.4.16 Noise and Vibration

All equipment and ductwork shall be such that all noise is eliminated and that no drumming, windage, vibration or other noises are audible.

7.4.17 Diffusers Grilles & Louvres

The Contractor shall supply and install the supply diffusers and grilles as scheduled on the drawing which shall be as Gilberts or equal and pre-approved.

Each supply and extract grille shall have two sets of separately adjustable blades, one set horizontal and one set vertical. Each supply air register shall, in addition, be provided with an air flow control/damper which shall be the opposed blade type, blades shall be adjustable from the front of the grille. The style and finish of all louvers to be approved by the Project Manager. The grilles will be manufactured by Gilberts or equal and approved.

Diffusers shall be of steel or aluminium construction. Steel diffusers shall be protected against corrosion and shall be stove enamelled. Each diffuser shall be provided with an air flow rate control/damper. Where a diffuser is directly connected to a stud which has a straight length of less than two diameters or equivalent diameters, then an equalising deflector shall be used. The diffusers will be manufactured by Gilberts or equal and approved.

External louvers shall be as specified. Each louver shall be complete with a galvanised steel bird mesh screen. The louvers shall be fixed in a weatherproof manner to the Architects requirements and shall be to an approved colour to architect selection. The external louvers will be manufactured by Gilberts or equal and approved.

8.0 ELEMENT (58) : OTHER SERVICES

8.1 Testing and Commissioning

8.1.1 General

The Contractor shall in relation to the Engineer's entitlement offer all plant for witness testing and inspection. If the tests are beyond the resources of the manufacturer he shall make arrangements for these to be carried out elsewhere. Any variation of this requirement shall be agreed in writing with the Engineer.

8.1.2 Testing of Motors

Witness testing will normally be waived on standard types of small motors made by approved manufacturers and small components used in the manufacture of units of plant.

8.1.3 Contractor's Obligations.

No inspection or passing by the Engineer or any other duly authorised person or group of the works, plant or materials shall release the Contractor from due obligations under the contract.

8.1.4 Testing

All pipework shall be tested as soon as practicable after installation and before completion of shaft walls, access panels, suspended ceilings and applications of any insulation.

In the event of the failure of any test and defect shall be located and repaired, and the test repeated.

8.1.5 Test Certificate.

A test certificate shall be submitted following successful testing of the complete system.

The Test Certificate shall include:

- Project Name:
- Name of Sub-contractor:
- Service:
- Section Under Test:
- Nature of Test:
- Water
- Pressure
- Duration
- System Flushed: Yes/No
- Record Drawings Submitted: Yes/No
- Signatures of Sub-contractor:
- Witness:
- Date of Test:

8.1.6 Heating Services

8.1.7 Preliminary checks

Prior to carrying out cleaning or chemical treatment process, ensure that:

- All foreign matter is removed.
- Certified pressure tests have been carried out in the parts of the system to be cleaned. Carry out further pressure tests on the isolated sections of the system independently.
- All water used for pressure testing is inhibited. Leave remaining pipework sections full after testing.
- Where there is a risk of freezing inhibited mono-ethyleneglycol is used.

- Circulation has been demonstrated and approval obtained on all parts of the system. Manipulate and leave fully open all valves other than those used to isolate sections. Carry out balancing and certification after the flushing, cleaning and passivation operations.
- No damage can occur to any item of plant or equipment due to cleaning and chemical processes.
- Chemicals used are compatible with system materials.
- All items of plant and equipment subject to damage or blockage due to cleaning and chemical treatment processes are isolated or removed.
- Dirt pockets are installed at low points to facilitate solids removal. Supply dirt pockets with drain valves sized to pipework size.
- All drains provided have been tested and approved and that any pumping equipment associated with the drainage system is fully commissioned.
- Dead legs that are more than 3 pipe diameters in length are looped to allow effective cleaning.
- Strainer baskets and filter media, incorporated within systems, are removed; and where necessary spool or stool pieces are installed.
- Temporary strainers and filters are installed as required for removal of solids during cleaning and chemical treatment processes.
- Strainers are clean prior to the start of the cleaning process, throughout the cleaning and on completion.
- Suitable supply and drainage points are provided with 50mm minimum connections, properly sited and installed, either valved or plugged.
- All automatic/manual air vents are fully commissioned.
- All requirements of COSHH regulations are complied with during the chemical cleaning and chemical treatment of the system.
- Where required by local water authority, provide effluent tanks for storage of all waste products of cleaning and chemical treatment processes.
- Following local water authority approval, either neutralize and dispose to drain of all waste products; or ensure authorised disposal at registered sites.
- Comply with Waste Management Duty of Care: A Code of Practice and Control of Pollution (Special Waste) Regulations 1980 where appropriate.

8.1.8 Testing

- Pressure test all services pipework
- Operating gauge pressure less than 3.5 bar, test gauge one and a half times operating pressure.
- Operating gauge pressure 3.5 - 7.0 bar, test gauge pressure twice operating pressure.
- For below ground pipework test to 7 bar or twice the working pressure (whichever is the greater) for 4 hours.
- Comply with procedures given in HVCA Guide to Good Practice for Site Pressure Testing of Pipework. Ensure safety precautions detailed in HSE Guidance Note GS4 Safety in Pressure Testing are adopted.
- Test concealed or buried pipework before any permanent covering is applied.
- Advise engineer, in advance, of the time pressure tests may be witnessed.
- Carry out Hydraulic Pressure Testing as described in HVCA Guide to good Practice for Site Pressure Testing of Pipework. Test section by section for one hour, as the work proceeds and prior to application of thermal insulation.
- Keep record of pressure tests and issue them to the consultant engineer, and include them within the handover documentation.

8.1.9 Commissioning

Commissioning codes

Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems and air systems to achieve the standards set in the CIBSE Commissioning Codes.

Preliminary checks

Carry out checks and procedures as detailed in CIBSE Commissioning Code W, Section W1. Ensure system is statically complete as defined in section B4 of BSRIA Application Guide 2/89 Commissioning of water systems in buildings.
Use pre-commissioning checklist from BSRIA Application guide 2/89.

Setting to work and regulation

Set to work and regulate water distribution systems in accordance with CIBSE Commissioning Code W, Sections W2 and W3, and sections C3 and C4 in BSRIA Application Guide 2/89.

Measurement

Use instruments for measurement detailed in BSRIA Application Guide 2/89.

Test all outlets in groups to determine that appropriate flow rates and temperatures are achieved.

Advise engineer, in advance, of the time commissioning may be witnessed.

8.1.10 Instruments and Gauges

Ensure instruments are correctly calibrated. Record details of instruments on record sheets. Submit evidence of correct calibration of instruments to be used in connection with commissioning and testing.

8.1.11 Thermostats and Temperature Sensors

Test all thermostat and temperature sensor readings against calibration equipment that is provided with a calibration cert that is dated within six months of the test period.

8.1.12 Performance Testing

Test the full system, under various conditions. Check the operation of run and standby plant, and check all controls settings, and the operation of every function of the controls system before requesting that the consultant engineer to witness the correct operation of the system.

APPENDIX A
DRAWING SCHEDULE

DRAWING & DOCUMENT SCHEDULE



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