



Galileo Energy Services

Unit A6, M4 Business Park,
Celbridge, Co. Kildare.
Tel: 01-6274103
www.galileoenergy.ie

**KILMACANOGUE NATIONAL SCHOOL
KILMACANOGUE,
BRAY,
CO. WICKLOW.
A98 N602**

ROLL NUMBER: 18365Q

MECHANICAL SERVICES SPECIFICATION

VOLUME 1

PARTICULAR SPECIFICATION FOR THE MECHANICAL INSTALLATION

TENDER ISSUE (T1)

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GENERAL ITEMS

Introduction

The intention of this specification and the drawings issued is to describe and provide for a complete installation. The Contractor is advised that the work to be executed as described in these documents shall be complete in every detail, notwithstanding that every item involved may not be specifically mentioned or described. The Contractor shall be held to allow for all materials and labour necessary for an entire and complete installation and shall not avail of any unmentioned error or omission should such exist.

The works entails the construction of a new extension building to Kilmacanogue National School, Kilmacanogue, Bray, Co. Wicklow. The works includes for the supply and installation of new mechanical services in the new extension and various works in the existing main school building. Refer to the drawings for further information, layout of the building and services/works required. All works shall be in compliance with all relevant Building Regulations, Irish Standards, British Standards, CIBSE Guidelines and Good Engineering Practices.

The Contractor shall be required to ensure all necessary flexibilities & resources are available to the project to meet the deadlines and programmes. The Contractor shall liaise with the Main Contractor regarding the programme and order of works and any concerns he may have over the completion date should be raised prior to the awarding of the contract.

The Contractor shall take all reasonable care to ensure all site workers and visitors are not endangered by any element of their works. The Contractor must ensure that the works are completed as soon as possible and/or within the agreed program time frame.

The Contractor shall also review all Architects and Structural Engineers drawings to familiarise themselves with the proposed development and scope of works involved. It is the Contractor's responsibility to raise any concerns over the proposed works with the Engineer prior to commencement of works. Failure to inform the Engineer of any such concerns will be deemed that the contractor has accepted the design and scope of works to be fault free.

This specification will set out in general terms the design drawings and data to be used by the Contractor in order to submit a tender bid for the mechanical services installation and the works associated with the installation. The procurement, delivery, supply, handling, erection, installation and commissioning of the services as there under described as may be seen or



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inferred from the enclosed drawings and documents from the Consulting Engineer.

The Contractor shall satisfy himself that the installation is in accordance with all codes and standards. All works described shall comply with:

- i) The Safety, Health and Welfare Act, 1989.
- ii) Requirements of the Health and Safety Authority / SI 138.
- iii) Requirements of the Fire Officer.
- iv) All Irish Building Regulations including Building Control (Amendment) Regulations (BC(A)R), S.I. 9 of 2014.
- v) Factories Act / Statutory Instruments.
- vi) Client Safety Protocol.
- vii) Client Specifications.
- viii) Chartered Institute of Building Services Engineers.
- ix) The Tender Drawings.
- x) The Contract Preliminaries.
- xi) All relevant Irish, British and European Standards and Codes of Practice.

Please note that 'The Contractor' in this specification refers to the Mechanical Contractor.

The Contractor shall familiarise himself with the above and the obligations therein.

For any queries relating to this specification or related drawings, the Contractor shall contact the following:

*Mr. Johnny O'Sullivan,
Galileo Energy Services,
Unit A6,
M4 Business Park,
Celbridge,
Co. Kildare.
Tel: 01-6274103
E-mail: johnny@galileoenergy.ie
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Site visit prior to tender submission

The Contractor shall be deemed to have carried out a site visit of the site prior to the completion of his tender to ascertain for themselves the full extent and nature of the works.



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The Contractor shall ensure that all factors, site conditions, and items are taken account and what items are necessary in order to complete the installation and to leave same in a complete working condition to the satisfaction of the Employer's Representative.

No extras or variations shall be allowed for additional work that could have been ascertained by visiting the site. The Contractor shall contact the Main Contractor to arrange an appropriate appointment to visit the site during the tender period.

Tendering contractors MUST NOT arrive to site without prior appointment.

Tenderers shall note that no claim in respect of lack of knowledge of prevailing site conditions, builders work or existing services can be considered.

The tender drawings are based on the best information available at the time of preparation and by visiting the site the contractor shall satisfy himself of the exact extent and nature of works involved.

Standard and code of practice

Unless specifically stated otherwise, or approved by the Engineer, installation, materials and equipment shall be in accordance with the relevant Irish, European International and British Standards and Codes of Practice and CIBSE Guidelines, whether indicated in this Specification or not.

Where stated in this document the British Standard Reference numbers shall be compatible with the I.E.C. reference numbers or vice versa.

Acts and regulations

The installation(s) shall comply with all Acts, relevant Statutory Instruments and Regulations including any special Regulations issued by the electricity, gas and/or water authorities. The tender shall be based on the Acts and Regulations current on the date for return of tenders. If these Acts and/or Regulations are amended or new Acts and/or Regulations are enacted after that date the Electrical Contractor shall inform the Engineer immediately.

Specified equipment

The Contractor shall refer to the rear of this document for a schedule of the specified equipment on which The Company's price is based. The Tenderer may offer an alternative manufacturer, providing the equipment offered is equal in all aspects, i.e. aesthetic appearance, classification and performance.

Alternative equipment proposed to that specified shall only be accepted/installed with the expressed approval of the Engineers in writing prior to the completion of the tender documents.



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Plant warranties

Where a manufacturer's warranty applies, the warranties on plant and equipment shall commence from the date of commissioning and acceptance of plant by the Engineers.

Form of tender

The Contractor will pay particular attention to the proper completion of the Form of Tender. Completion of the Form of Tender must be as per the item numbers listed and should note that any section heading may apply to one or more of the items listed in the Summary of Prices.

The Contractor shall include in his tender under additional headings if necessary, and irrespective of the items indicated for all work specified or implied by the drawings or specification.

The tenderer shall be deemed to have full knowledge of the Specification and Drawings supplied to him and to have made himself fully acquainted with all requirements and to have obtained clarification on any matter or detail, which may be obscure to him.

Should any matter arise which in the opinion of the tenderer is obscure, he shall submit the details for clarification in writing to the Employer's Representative Engineer within 7 days of expiration of the tender period. The Employer's Representative shall circulate a reply to all Tenderers before the tender period expires.

The tender price is to be based on the works being carried out at rates of pay during working hours and under conditions of labour not less favourable than those established for the trade or industry in the district where the works are to be carried out. Any non-productive time associated with the recruitment of additional staff by the Contractor during the execution of the contract shall be deemed to be included in the tender price.

Installation and setting out of works

The Contractor shall set out the whole of the works and be responsible for the correctness of the positions, levels and dimensions of the several works. All openings, plinths, bases and holes to be cut in the structure shall be positioned and marked by the Contractor.



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The tender drawings are diagrammatic only and the Contractor shall allow for a practical installation allowing for the setting around obstructions and other minor modifications which may or may not be apparent from the Architectural, Engineering, Structural, or services drawings.

The exact courses and positions of all pipes, ducts, flues, cabling, conduit, trunking etc. and other items of equipment shall be duly laid out and marked on the job by the Contractor and approved before execution as the best possible course and position, having regard to all considerations including temperature and the proximity to other services plant.

The Contractor shall make good any incorrectly set out works and shall be liable for costs of making good any work incorrectly carried out. The Contractor shall furnish all materials, labour and instruments necessary to enable the setting out to be checked.

Conflict between drawings and specifications

In the event of there being a conflict between drawings and specification, the tenderer shall obtain clarification before submitting his tender. Failure to do so will be deemed to imply that the most onerous requirements have been included for.

In the event that an apparent contradiction exists between any of the specification or between any of the specification and the drawings, this shall be addressed in writing to the Engineer during the tender period for clarification. If an apparent contradiction is not identified during the tender process, then it shall be at the discretion of the engineer to identify which document or clause takes precedence. Claims raised post-tender in relation to apparent contradictions shall not be entertained and the onus shall remain with the contractor to highlight any such issues during the tendering period. This in no way over rides the order of precedence of information as defined within the contract.

Contract drawings and specifications

Refer to the 'Document Issue' sheet issued with this pack as this document highlights all the contract drawings and specifications.

Details of the complete installation are indicated on the contract drawings and described within this specification. The exact locations of all equipment shall be agreed on site with the Consulting Engineers prior to installation where any doubt or potential conflict with other installations is perceived. Plant and equipment which is installed and which conflicts with existing work or installations will be removed and reinstalled without expense to the client by the Contractor.



Materials and workmanship

All materials used in the works shall be fit for the use for which they are intended and for the conditions in which they are to be used in and includes materials which:

- a) Bear a CE mark in accordance with the provisions of the Construction Products Directive (89/106/EEC)
- b) Comply with an appropriate harmonized standard, European technical approval or national technical specification as defined in article 4(2) of the Construction Products Directive (89/106/EEC)
- c) Comply with an appropriate Irish Standard or Irish Agreement Board Certificate or with an alternative national technical specification of any member state of the European community, which provides in use an equivalent level of safety and suitability.

The installation shall be carried out and maintained in the best and most substantial and workmanlike manner. Workmanship shall comply with British or Irish Standards and the relevant codes of practice.

Only fully qualified and competent tradesman and helpers shall be employed on the works. Work shall not be sub-let or done by any other Contractors without the Employer's Representative permission.

No work shall be covered up prior to inspection by the Employer's Representative.

Wherever a proprietary name is used to specify a material or process it shall be deemed to have the term '**or equivalent**' appended to it.

Where a material or process is described by reference to its propriety name the name is used to indicate the standard of construction, appearance, ease of maintenance and durability acceptable to the Employer's Representative. The Employer's Representative will approve the use of alternatives where such alternatives are shown to equal or surpass the qualities of the product or process specified. Accordingly, proprietary names wherever mentioned in the Specification, schedule of Rates or on the drawings shall be deemed to mean the provision of the named product or process or an approved alternative.

Notwithstanding the above no items shall be used for the works except those as specified in the contract documents except with the permission of the Employer's Representative. Any points, which differ in the contract documents to the Contractors normal practice, may receive consideration at tender stage if referred to the Employer's Representative. If no reference is made at tender



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stage it will be assumed that the Contractor will proceed exactly according to this specification.

Improper materials

The Employer's Representative shall have the power to order during the progress of the works the removal from site of any material, which in his opinion is not in accordance with this contract, the substitution of proper materials, and the removal and proper re-execution of any work, which in respect of materials and workmanship is not in accordance with the contract. This condition is not withstanding any previous tests or interim payments.

Liability for defects

Works showing defects or damage, whether caused by or as a consequence of negligence on behalf of the Contractor or not and regardless of whether the defects are discovered during the progress of the works or upon completion of the works, and regardless of whether the works have been approved or fully certified, the Contractor shall make good, at his own expense, such damage or defects discovered. On refusal to do so the Employer shall be entitled to carry out the work necessary and recover the expenses associated with such work.

Allow for maintaining the works in perfect condition for 12 months after the issue of the Employer's Representative's Certificate of Substantial Completion in accordance with the Conditions of Contract.

Conditions of building and site

The Contractor shall be responsible for making good any damage caused to the fabric or decor of the building or site by, or as a result of, his negligence or the negligence of his employees or contractors or others unnamed or otherwise. All rubble and waste shall be removed as it arises. Upon completion of the works, the site and building shall be thoroughly cleaned to the satisfaction of the Employer.

The Contractor shall pad ladders or similar equipment so that the building structure or finishes are not damaged in anyway. He shall also ensure that oil, grease or similar goods do not cause damage to the structure during the execution of the works.

Local authorities

The Contractor shall observe and comply with the requirements of all Statutes and Byelaws and serve notice on the Authorities or Owners of water, gas, electricity or any other items, which may be affected in any way by the execution of the works.



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Plant

The Contractor shall supply all necessary slings, tackles, scaffolding, haulage, instruments, materials, apparatus, tools and labour for delivery and erection of the works, and for the completion and testing of the works to the entire satisfaction of the Employer's Representative.

Loss, theft, damage and injury

The Employer or Employer's Representative shall not bear any responsibility for the loss, theft or damage of equipment or materials associated with the works either during delivery or at any time during the execution of the works. All plant, equipment, tools, workmanship and materials shall comply with the relevant safety standards. The Contractor shall bear responsibility for the safety of his employees and agents throughout the execution of the works.

Copyright

Copyright is reserved on the Consulting Engineers' documents, which include all drawings, specifications, sketches, and the like. These documents may only be used in relation to the works as outlined in this contract. Photocopying of documents is not permitted without prior permission of the Consultant Engineer. Any copies of documents made during the execution of the works shall be returned to the Consulting Engineer prior to final payment.

Contractors drawings

The Contractor shall prepare if requested by the Employer's Representative any working drawings necessary for proper completion of the Contract. Two copies of each drawing shall initially be submitted to the Employer's Representative and upon approval the Contractor shall provide 6 no. copies of said drawings for distribution.

Working drawings shall show the final arrangement of all items of plant and their associated connections, all control assemblies, and panels, as well as the routing of all pipework and ductwork. The Contractor shall consult with all relevant parties and in the preparation of his working drawings to ensure there is no conflict between the Mechanical, Electrical and other services, Architectural or structural elements.

Variations, extras and omissions

No variation shall vitiate this Contract or save as hereinafter provided or give rise to any claim for compensation.



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Where an extra, variation, omission is required the Contractor shall submit a price for such variation, omission or extra to the Employer's Representative in writing within seven days of the request for such a price.

He shall not proceed with such alteration, variation or extra until such a time as he has received a Variation Order in writing from the Employer's Representative.

No payment shall be made whatsoever to the Contractor for any variation, alteration, addition or extra unless a Variation Order is produced. Variations shall be priced at the rates submitted by the Contractor with his tender where such are applicable.

Pricing

Un-priced items

Any item left un-priced shall be deemed to be included for in the tender and the cost of the item shall be deemed to be spread across and included in the rates generally.

Currency

All prices and rates shall be deemed to be denominated in Euros (€).

Electricity supply, electric wiring and equipment

All electrical equipment is to be suitable for the standard ESB supply of 400/230V @ 50hz AC.

Where starters or controls are provided with any equipment included under the mechanical services contract, they shall be handed over to the Electrical Contractor together with their wiring diagrams, for erection and commissioning by him.

Electrical sub-systems certification

All electrical subsystems shall be certified as having been carried out in compliance with the requirements of the ETCI Wiring Regulations.

Copies of the ETCI Subsystems certificates, accompanied by the relevant test results, shall be included with the ETCI Completion Certificate in the Health and Safety File for the project.

In the event of the Contractor failing to secure subsystem certificates for all items of equipment then the Contractor shall be liable for the cost of having the system tested, remedied as necessary and certified.



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The tender figure shall be deemed to include for all costs incurred by the Contractor in providing the appropriate documentation.

Proprietary names

Wherever a proprietary name is used to specify a material or process it shall be deemed to have the term '**or equivalent**' appended to it. If applicable, if the Contractor proposes an alternative material or equipment, this material or equipment shall be approved by the Employer's Representative prior the end of the tendering period.

Where a material or process is described by reference to its proprietary name, the name is used to indicate the standard of construction, appearance, ease of maintenance and durability acceptable to the Client / Employer's Representative. The Client / Employer's Representative will approve the use of alternatives where such alternatives are shown to equal or surpass the qualities of the product or process specified. Accordingly proprietary names wherever mentioned in the Specification, Schedule of Rates or on the drawings shall be deemed to mean the provision of the named product or process or an approved alternative

'Safepass' accreditation

The Contractor shall comply with the requirements of the construction industry's safety accreditation scheme, known as the 'Safepass' scheme.

Decision of the Employers Representative

The decision of the Employer's Representative on all questions relating to the execution of the works, the meaning of the Drawings and Specification, the manner of the execution of the works or the quality of the materials, the nature, quality of the works executed or what amount was included in the Contract shall be final, conclusive and binding.

Works outside the contract

The contractor should note that claims for additional works will not be entertained unless specifically requested in writing by the Employer's Representative.

Waste management

The site shall at all times be kept as clean and tidy as possible and the contractor shall be responsible for removing debris and rubbish on a regular basis. Removal of waste from site shall comply with the statutory waste management requirements



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Damage

External:

The Contractor shall note that any damage to the existing yards, main entrance, grassed areas, access roads or paved areas that may arise during construction stage of the project and caused by the construction works or by the Contractor's vehicles or staff, is to be made good by him at no extra cost to the Client.

The Contractor should provide all necessary protection to existing paved, grassed and landscaped areas around the site and shall make good any damage caused by lack of such protection at no extra cost to the Client.

The work is not to interfere in any way with the public roads. In particular, the Contractor is to ensure that these areas are to be left free of all dirt and debris and builder's materials and parking of construction vehicles, etc and the roadways are to be thoroughly cleaned as and when required. Any damage caused to the surrounding public roadways shall be made good to the satisfaction of the Local Authority at the Contractor's expense. Any damage caused to the surrounding barracks roadways shall be made good to the satisfaction of the Client at the Contractor's expense.

Internal:

The Contractor shall note that any damage to the existing walls, windows, floor coverings, ceilings, doors, etc. that may arise during construction stage of the project and caused by the construction works or by the Contractor's plant or staff, is to be made good by him at no extra cost to the Client. Any damage caused to the internal building as listed above shall be made good to the satisfaction of the Client at the Contractor's expense.

Interpretation of this specification and drawings

This specification has been written using simple, direct language wherever possible. Imperative terms such as 'provide' and 'submit' mean that the Electrical Contractor shall 'provide' or 'submit' the relevant samples, documentation or information.

If any discrepancies exist or there is any doubt about the interpretation of the Documents, obtain clarification from the Project Manager.



Declaration of Performance/CE markings

General:

The Contractor shall be aware of the Construction Products Regulation (CPR), which entered into force on 1 July 2013 and requires mandatory CE MARKING of construction products covered by Harmonised European Standards (HENS), when products are placed on the EU market. The purpose of the CPR and CE Marking of construction products is to facilitate the free circulation of construction products across the EU market. In doing so, the CPR has established a common technical language for declaring, specifying and setting requirements for construction products.

All CE MARKED construction products must have a Declaration of Performance (DoP), drawn up by the manufacturer. The DoP provides information on the performance of the construction product in relation to technical essential characteristics e.g. compressive strength, durability etc.

It is important that the electrical contractor uses only CE MARKED construction products within this installation and obtains a DoP for each product to ensure the product is fit for the use for which it is intended and for the conditions in which it is to be used. Furthermore, it is the Contractor's responsibility to ensure all works should be carried out using "proper materials...which are fit for the use for which they are intended and for the conditions in which they are to be used" in order to demonstrate compliance with the requirements under Building Regulations.

All materials, equipment and plant used in the works shall be fit for the use for which they are intended and for the conditions in which they are to be used in.

All materials, equipment and plant shall adhere to the following:

- Shall bear a CE mark in accordance with the provisions of the Construction Products Directive (89/106/EEC)
- Shall comply with an appropriate harmonized standard, European technical approval or national technical specification as defined in article 4(2) of the Construction Products Directive (89/106/EEC)
- Shall comply with an appropriate Irish Standard or Irish Agreement Board Certificate or with an alternative national technical specification of any member state of the European community, which provides in use an equivalent level of safety and suitability.

The Contractor shall provide a Declaration of Performances (DOP's) cert for all materials, equipment and plant used in the works.



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Evidence:

The Contractor shall provide evidence of Declaration of Performances(DOP's) and CE markings for all equipment, plant and material used in this project upon request by the Employers Representative. This is also mandatory for B(C)ar compliance sign off.

BREXIT implications for CE Marking and deployment of products for contracts with the EU member states including the Republic of Ireland:

As the UK has recently left the EU on the 31st January 2020. Contractors shall be aware of the implications and non-compliance risks for them or any of their sub specialists to install products which are CE marked under UK notified bodies. Post Brexit, UK notified bodies used for certification of conformity for 'CE' marking proposes will lose their status as EU Notified bodies and will be removed from the EU Nando website. In such instances the manufacturer of the product will need to obtain alternatives for certification of conformity for 'CE' marking.

Trade union rates and agreements

The Contractor must be in compliance with all Trade Agreements and the Contractor shall pay all employee's connected with the project to current trade union rates. If the Contractor appoints Sub-Contractor's to complete work then they too shall be compliant with current trade union agreements.

This will be monitored on site to ensure that all the Contractors employees and subsequent Sub-Contractors are in compliance with all Trade Agreements and that all are paid current union rates.

All employee's and Sub-Contractors employed by the Contractor for the duration of the works shall have their union cards on them at all times.

NZEB/BER Compliance

This building needs to be NZEB compliant.

An NZEB compliance report and calculation has been carried out for this project and the building is NZEB compliant based on all the plant, equipment, materials, etc. as specified below in the specification document.

The Contractor shall ensure that all items specified within this specification is installed as a preliminary NZEB/BER calculation has been carried out based on this specification.



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If the Contractor is to deviate from the specified items within this specification and propose alternatives, the Contractor must ensure that these items match the specified criteria within this specification.

If in any case the Contractor takes the onus to install any item that isn't an equivalent to the specified items or isn't formally approved by the Engineer, then the Contractor shall be asked to carry out an individual NZEB/BER assessment to ensure it meets the desired NZEB/BER criteria. This shall be carried out at the Contractors expense and any cost implications for this shall be at the expense of the Contractor.

Timescale, working hours, payment, etc.

Refer to the Main Contractor for specific details on these requirements.



BUILDING CONTROL REGULATIONS

General:

All works shall be carried out to the new Building Control (Amendment) Regulations (BC(A)R), S.I. 9 of 2014.

Therefore, the Contractor shall allow for the following over the following stages of the contract:

Commencement Stage:

- Familiarise themselves with the drawings, specifications and documents lodged with the Commencement Notice.
- Ensure a competent person is assigned to oversee the Construction works.

During Construction:

- Install the services and construct the building in accordance with the plans and specifications.
- Ensure that the workmanship complies with the requirements of the Building Regulations.
- Ensure that materials which they select and for which they are responsible comply with the requirements of the Building Regulations.
- Co-operate with the design team, the Assigned Certifier and other certifiers.
- Co-operate with the Assigned Certifier for the implementation of the site inspection plan.

Upon Completion:

- Sign the Certificate of Compliance (completion).
- Provide to the Assigned Certifier, such documents for which they are responsible, as may assist the Assigned Certifier to collate particulars for the purposes of handover and certification, and/or for further submissions to the Building Control Authority.
- We will require Certificate of Compliance with the Building Regulations and relevant standards and manufacturers requirements at this stage.
- Ensure the coordination and provision of all test certificates and confirmations to the satisfaction of the Assigned Certifier or other designated inspectors or certifiers providing Ancillary Certificates;
- Maintain records.



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Inspections during the Construction Process:

The Contractor shall allow the following for inspections during the Construction Phase:

- Contractor to give the Engineer at least 5 days notice to carry out a necessary inspection.
- All services that are to be hidden or concealed shall be left exposed until inspected.
- Prior to closing up services in walls, ground, attics, etc., all tests shall be completed and sign off sheets shall be signed and witness signed. Test sheet to contain the name of the tested, name of the witness, type of test, duration of test and results recorded.
- No cost variations will be accepted for time delays or opening up for inspections if these procedures are not followed.

BUILDERS WORK

General:

All Builders work associated with the execution of this Contract shall be carried out under the main contract by the Main Contractor. The Contractor shall liaise with the Main Contractor on all builders work requirements relating to their installations and shall prepare detailed builders work drawings for the Main Contractor.

The Contractor shall prepare any working drawings if necessary, agree all details with the Employer's Representative, mark out and be responsible for correctness, and the cost of any unnecessary work due to the Contractor failing to comply with this condition shall be the Contractors responsibility. The Contractor shall ensure that cutting away and general attendance is reduced to a minimum and must not impede or delay the carrying out or completion of this work. The permission of the Employer's Representative shall be secured before cutting or chasing is commenced.

The Contractor shall be responsible for the preparation of the following:

- Builders work drawings, including all necessary opes for installation.
- Technical submittals, for all items of plant and equipment that vary from the specified equipment herein.
- Ensuring that all services/installation details are completely integrated with all aspects of the building elements, to the satisfaction of the Client.



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Opes through Fire Barrier Membrane:

All services through fire barriers, fire walls or floor slabs shall be sleeved either side of the fire barrier/wall/slab. All opes shall be filled in and fire proofed by the Main Contractor after services is installed and commissioned. Allow for all necessary works. Liaise with Main Contractor in ensure that all opes for services are fire-proofed.

CO-ORDINATION

The Mechanical Contractor shall allow for liaising with all other trades in relation to coordination. Before any works are started on site, the Mechanical Contractor shall hold a meeting with the Electrical Contractor to co-ordinate the M&E installations in the building. The co-ordination of the electrical installations shall be the responsibility of the Electrical Contractor but the Mechanical Contractor shall allow for co-ordinating the mechanical installation with the Electrical Contractor.

The Mechanical Contractor shall provide all information necessary and on time to the Main Contractor for the proper discharge of this responsibility. The Mechanical Contractor shall agree all methods, sequences timing and all relevant details of the works within his contract with the Main Contractor in advance and shall not deviate from this agreement unless otherwise agreed in writing with the Contractor. No adjustments will be made to the mechanical contract sum where additional work is required due to poor co-ordination or where the Employer's Representative has not been informed in good time of a co-ordination difficulty that could have been resolved by a design decision had the issue and its full implications been advised to the Employer's Representative in good time. The Mechanical Contractor shall liaise with all other trades when co-ordinating their works.

The Mechanical Contractor shall mark out opes and holes on all floor and wall surfaces as required to the satisfaction of Services Engineer, Structural Engineer and Main Contractor in sufficient time to allow the Main Contractor complete his works to programme.



(5-) MECHANICAL WORKS

General

The Contractor shall be responsible for all mechanical works and shall ensure that the full price for this work is included in the tender price. This section of the Specification outlines the mechanical services installation and describes the particular requirements of the mechanical services to be installed. This section is intended to be read in conjunction with all other technical and non-technical sections of the specification and with the tender drawings. Where this section is at variance with any other sections of the tender documents, the tenderer shall obtain clarification from the Employers Representative before tendering. Failure to do so will be deemed to imply that the most onerous requirements have been included for.

50.0 MECHANICAL SITE SERVICES

The Contractor shall be responsible for co-ordinating the builders work and trenching required for all site services. The Contractor shall be responsible for the final connections from the site services to the final equipment within the Building.

50.01 Liquified Petroleum Gas (LPG) Installation

General:

The existing heating centre is heated via an underground oil supply from an external oil tank. However, the new heating centre shall be fed from a new underground LPG gas supply from an external LPG gas tank located as indicated on the drawings.

Trenching, piping and all builders attendances shall be carried out by the Contractor as part of this contract.

LPG gas storage tank:

The new heating centre shall be supplied from a new one tonne LPG gas tank, which shall be procured directly by the Client. The Contractor shall liaise with the School and ensure adequate lead in times are adhered to. Technical data and specifications shall be made available to the School when required to ensure all information is issued to the gas supplier as required.

The LPG tank shall be located as indicated on the drawings. The LPG tank shall be located within a dedicated compound as indicated on the drawings.



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The Contractor shall allow for all attendances in providing this compound which includes the concrete foundation base and security fencing as per details on drawings. Fencing shall be as indicated on the drawings.

The Contractor shall be responsible for arranging for the supply of the LPG tank to site, which shall include the following tasks:

- a) On appointment to liaise with the gas tank supplier on when the gas tank will be required.
- b) To liaise with the tank supplier in order to ensure any capital contributions due are paid in good time and so as not to delay the completion of the project.
- c) Sign any paperwork required and forward all of same to the gas supplier.
- d) Provide for all necessary liaisons and attendances to the gas supplier.
- e) Comply with follow regulations: I.S. 820:2000 Non Domestic Gas Installations, I.S.813, Domestic Gas installations and I.S. 265, Code of Practice for the Bulk Storage of Liquified Petroleum Gas Part 1.

Installation of LPG Tank:

The LPG tank shall be installed 3000mm from all buildings, boundaries property lines and fixed sources of ignition. Tank must be 3000mm from bund walls around oil tanks and 6000mm from petrol bunds.

Toxic or hazardous substances must be 15metres from the tank.

See detail on drawing for information on the installation of the tank.

Builders attendances to LPG tank installation:

The LPG tank shall be installed in a dedicated tank compound to the tank suppliers recommendations. There shall be a number of builders attendances in order to complete this.

All associated builders work for the gas tank installation shall be carried out under this contract by the Contractor. The appointed Contractor shall be completely responsible for all builders work. A suitably qualified Building Contractor shall be employed by the Contractor to carry out the associated works. Due allowance for this item must be allowed for in the tender price. See 'Builders Work Schedule' in 'Volume C1' of this document for further information.

See detail on drawing for information on the installation of the tank.



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The following is a list of the works required:

Base for LPG tank:

Install a concrete base for the tank. Size as indicated on the drawings which is 3600mm by 1600mm. Base shall be a minimum of 100mm depth on firm subsoil with well compacted hardcore on top. Finished surface of concrete must not be below surrounding ground level.

Base for tank compound:

As highlighted above, a 100mm high concrete base shall be installed for the LPG tank. In addition to this, for ease of maintenance all the areas inside the tank compound shall be concreted. This is the distance between the tank base and the fencing. Finished surface of concrete must not be below surrounding ground level. Size as indicated on the drawings which is 4200mm by 3200mm.

Fencing:

The tank compound must be surrounded by a fence. Size as indicated on the drawings. Fencing shall be 1800mm high and shall be located 1000mm from the LPG tank. The minimum specification for the fencing shall be 12 gauge 52mm x 52mm x 52mm weld-mesh or chain link steel fence. The tank compound dimensions is as indicated on the drawings which is 5000mm by 3000mm.

The Contractor shall allow for the installation of an access gate/door into the compound. The gate shall open outward and shall not be self-locking.

50.02 Underground gas pipework

General:

There shall be a new gas supply installed in an underground trench from the new LPG gas tank and the boilerhouse. Refer to drawing 50(S00) for further information and the route of the underground trench.

The size and type of the existing underground gas supply pipework to the boilerhouse from the LPG gas tank is 63mm MDPE (Medium density Polyethylene) pipe.

The Mechanical Contractor shall supply, install and test this new underground natural gas supply pipework. Size and route of pipework is as indicated on the drawings.

The gas installation in the building shall comply with I.S. 820:2019.



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New underground gas pipework:

New underground natural gas shall be carried in Gas Medium density Polyethylene to B.S. 5750, or equivalent. All gas pipework shall be installed to suppliers requirements as Non-Domestic Gas installations I.S.820:2019. Size and route of pipework is as indicated on the drawings.



The underground gas pipework shall adhere to the following specifications:

- Pipework shall be medium density polyethylene (MDPE).
- Shall be suitable for natural gas and LPG gas.
- Shall be yellow in colour.
- Internal abrasion resistant.
- Stress cracking resistant.
- Not notch sensitive.
- Complies with I.S. 820:2019
- Certificated by British Gas Transco Ltd, DVGW, and others.
- Complies with GBE/PL2 Part 1-1995.
- Manufactured by a BS EN ISO 9001:2008 company.

Allow for all necessary fittings and valves etc.

Pressure testing of underground pipework:

General:

The Mechanical Contractor shall allow for carrying out a strength and soundness test on all the new underground gas pipework installed.

A pressure test shall be carried out on the new underground gas pipework before the external trench is filled in. The Mechanical Contractor shall confirm that the pipework has passed the test and all is satisfactory with the underground gas pipework before the trench is filled back in.

In the event of a failure of a test, the defect shall be repaired, defective part replaced, and the pipe replaced. After rectification works have been completed, the test shall be completed.



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The test shall be carried out using air, nitrogen or another inert gas. Water shall not be used as a test fluid. Oxygen or distribution fuel gas shall also not be used

Test equipment:

The test equipment used for the test shall be capable of being read in graduations of at least 1% of the required test pressure.

- For pressures $\leq 100\text{mbar}$, a water gauge (manometer) with a millimetre scale should be used.
- For pressures $\leq 300\text{mbar}$, a mercury or High Specific Gravity manometer should be used.
- For pressures $\geq 300\text{mbar}$, a verified gauge should also be used

Test pressure:

The test pressure chosen for a strength and soundness test to be carried out on any pipework shall be a function of its intended maximum operating pressure (MOP) as indicated below. The applied test pressure shall not exceed the pressure that any component of the pipework is capable of withstanding. Test pressure and stabilisation periods for gas pipework shall be as follows:

Maximum operating pressure (MOP)	Test pressure (for NG)	Test pressure (for LPG)	Temperature stabilisation min
greater than 2 bar and less than or equal to 5 bar	$1,40 \times \text{MOP}$	$1,40 \times \text{MOP}$	15 ^a
greater than 100 mbar and less than or equal to 2 bar	$1,75 \times \text{MOP}$	$1,75 \times \text{MOP}$	10
greater than 40 mbar and less than or equal to 100 mbar	$2,5 \times \text{MOP}$	$2,5 \times \text{MOP}$ (minimum 150 mbar)	5
less than or equal to 40 mbar	100 mbar	150 mbar	5

^a For test pressures greater than 2 bar it is necessary to condition the pipework before the test commences to allow for the elastic qualities of PE (creep).

Maintain this pressure without pumping for at least 1 hour without any drop in pressure. Repeat test as directed until system is proven gas tight.

Comply with all supplier's requirements. Upon completion of pressure testing, each system shall be purged with its own gas. The entire installation shall comply with I.S. 820:2019 Non-Domestic Gas Installations.



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Testing and commissioning:

Once the strength and soundness test has been successfully completed, the Mechanical Contractor shall provide a declaration commissioning cert of successful completion of the test. This shall be completed by the person responsible for the test and shall include the following information:

- Date and time of test
- Description of 'Strength and Soundness Test'
- The diameter of pipework tested
- The duration of the test
- The pressure of the test
- Type and sensitivity of the gauge used
- Result of test
- Confirmation that the gas pipework installation is installed in compliance with I.S. 820:2019
- Name and signature of the competent person that completed the test

Trenching:

All trenching required for the new gas pipework shall be completed by the Main Contractor. The Mechanical Contractor shall liaise with the Main Contractor on all required trenching required for the new underground gas pipework.

50.03 External overground gas pipework

General:

As highlighted in section 50.02 above, a new 63mm underground MDPE gas pipe shall be supplied and installed by the Mechanical Contractor to the existing boilerhouse of the building. Refer to the site services drawing 50(S001) for further information.

No plastic MDPE gas pipework shall enter the building so the new 63mm MDPE underground gas pipework shall exit and pop-up out of the ground at low level at the building in the location as indicated.

At this point, the pipework shall transition from plastic polyethylene pipework to steel metal pipework to enter the building. As a result, some external overground gas pipework shall be required and this pipework shall be installed in steel.

All above ground and exposed gas pipework within the building shall be installed in mild steel. No plastic polyethylene pipe shall be installed in the building.

Size and route of pipework is as indicated on the drawings.



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Isolation valve:

The steel gas pipework shall then enter the new building at low level in the location as indicated on the drawings. An isolation valve shall be installed on the gas pipework as it enters the building. Refer to section 54.04 for details on the gas isolation valves.

External overground gas pipework:

The Mechanical Contractor shall supply, install, test and commission all the overground natural gas pipework as indicated on the drawings. Size and route of all overground external gas pipework is as indicated on the drawings.

All gas pipework shall be installed to suppliers requirements as Non-Domestic Gas installations I.S. 820:2019. Allow for all necessary fittings and valves etc.

Over ground natural gas shall be carried in Black steel Pipe Class B seamless medium gauge, Blue Band to B.S. 1387 with flanged joints where necessary. Fitting material shall be Steel Butt welding B.S. 1965 to match pipe or steel welding to B.S. 10 table E. Allow for all necessary fittings and valves etc. All gas pipework shall be installed to comply with ICP 3&4 with appropriate colour labelling to comply with it.

All gas pipework within the plantroom/boilerhouse and building shall be installed in mild steel. No plastic polyethylene pipe shall enter the building. Size and route of pipework is as indicated on the drawings.

Painting of gas pipework:

All gas pipe work above ground shall be painted with two coats of yellow paint by the Mechanical Contractor.

The Mechanical Contractor shall allow to make good all surfaces before painting the gas pipework.

The Mechanical Contractor shall allow for the following to paint the gas pipework.

- **Step 1:** Thoroughly clean the pipework and prepare for painting.
- **Step 2:** Apply a good exterior primer to the external pipework.
- **Step 3:** Paint the external gas pipework with two coats of Yellow Gas Paint (Ochre paint) to highlight that it is gas pipework.



Pressure testing of pipework:

General:

The Mechanical Contractor shall allow for carrying out a strength and soundness test on all the external gas pipework installed.

In the event of a failure of a test, the defect shall be repaired, defective part replaced, and the pipe replaced. After rectification works have been completed, the test shall be completed.

The test shall be carried out using air, nitrogen or another inert gas. Water shall not be used as a test fluid. Oxygen or distribution fuel gas shall also not be used.

Test equipment:

The test equipment used for the test shall be capable of being read in graduations of at least 1% of the required test pressure.

- For pressures $\leq 100\text{mbar}$, a water gauge (manometer) with a millimetre scale should be used.
- For pressures $\leq 300\text{mbar}$, a mercury or High Specific Gravity manometer should be used.
- For pressures $\geq 300\text{mbar}$, a verified gauge should also be used.

Test pressure:

The test pressure chosen for a strength and soundness test to be carried out on any pipework shall be a function of its intended maximum operating pressure (MOP) as indicated below. The applied test pressure shall not exceed the pressure that any component of the pipework is capable of withstanding.

Test pressure and stabilisation periods for gas pipework shall be as follows:

Maximum operating pressure (MOP)	Test pressure (for NG)	Test pressure (for LPG)	Temperature stabilisation min
greater than 2 bar and less than or equal to 5 bar	$1,40 \times \text{MOP}$	$1,40 \times \text{MOP}$	15 ^a
greater than 100 mbar and less than or equal to 2 bar	$1,75 \times \text{MOP}$	$1,75 \times \text{MOP}$	10
greater than 40 mbar and less than or equal to 100 mbar	$2,5 \times \text{MOP}$	$2,5 \times \text{MOP}$ (minimum 150 mbar)	5
less than or equal to 40 mbar	100 mbar	150 mbar	5

^a For test pressures greater than 2 bar it is necessary to condition the pipework before the test commences to allow for the elastic qualities of PE (creep).



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Maintain this pressure without pumping for at least 1 hour without any drop in pressure.

Repeat test as directed until system is proven gas tight. Comply with all supplier's requirements.

Upon completion of pressure testing, each system shall be purged with its own gas. The entire installation shall comply with I.S. 820:2019 Non-Domestic Gas Installations.

Testing and commissioning:

Once the strength and soundness test has been successfully completed, the Mechanical Contractor shall provide a declaration commissioning cert of successful completion of the test.

This shall be completed by the person responsible for the test and shall include the following information:

- Date and time of test
- Description of 'Strength and Soundness Test'
- The diameter of pipework tested
- The duration of the test
- The pressure of the test
- Type and sensitivity of the gauge used
- Result of test
- Confirmation that the gas pipework installation is installed in compliance with I.S. 820:2019
- Name and signature of the competent person that completed the test.

50.04 Existing oil tank and oil line

Existing oil tank:

The Contractor shall allow for decommissioning and removing the existing external steel oil tank and associated oil line that is currently in place for the building. The oil tank is located within a concrete structure with a roof installed on it. The new boiler shall be a gas boiler that shall be fed directly from a LPG gas tank. The approximate dimensions of the existing oil tank are 3000mm long by 2000mm wide by 1500mm high. The tank is manufactured from 10mm steel plate. The Contractor shall allow for the following works in decommissioning and removing the existing oil tank and oil line:

- Drain and remove any oil within the existing tank. Drain and flush out oil tank prior to dismantling. Collect oil and dispose of in accordance with



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current waste disposal legislation. This shall be completed by a registered oil collection company as Rilta Environmental Ltd., or equivalent.

- Allow for the cutting and dismantling of the existing steel oil tank in order to remove. Use non sparking tools for dismantling and hot work-permit.
- Cap the existing oil line from the oil tank to the boilerhouse.
- See below photo indicating the structure where the existing oil tank to be decommissioned.

Existing oil line:

The existing oil supply to the boilerhouse shall be decommissioned and removed. Allow for valving and capping the existing 25mm oil supply as it enters the boilerhouse. Allow for decommissioning and removing all oil pipework in the boilerhouse and all pipework to the existing boiler from where it is proposed to blank the incoming supply. The existing oil pipework in the boilerhouse is black mild steel tube pipe.



51.0 HEATING CENTRE FOR EXISTING BOILERHOUSE

GENERAL

The Contractor shall be responsible for all works as identified on the drawings including all mechanical works, builders' works, building finishing works and electrical works. The Contractor shall employ suitably qualified personnel to carry out all necessary mechanical works, builders' works and electrical works for this project. The Contractor shall ensure that the full price for this work is included in the tender price.

This section of the specification outlines the services installation and describes the particular requirements of the services to be installed and the works carried out. This section is intended to be read in conjunction with all other technical and non-technical sections of the specification and with the tender drawings. Where this section is at variance with any other sections of the tender documents, the tenderer shall obtain clarification from the Employers Representative before tendering. Failure to do so will be deemed to imply that the most onerous requirements have been included for.

51.01 Survey of the existing mechanical installation

Once appointed, the Contractor shall carry out a detailed survey of the existing mechanical installation in the existing boilerhouse for the building to determine the exact scope of works associated with the mechanical installation.

The Contractor shall allow in his costs for a plumber to spend a half a day surveying the existing mechanical installation in the building and providing a report on his findings.

51.02 Existing oil burner and oil boiler

The existing cast-iron sectional oil boiler and oil burner that is currently in place in the boilerhouse shall be decommissioned and removed from site. The existing boiler may contain asbestos containing material and this asbestos containing material shall be decommissioned and removed by a registered Asbestos Removal Contractor. Refer to 'Removal of Asbestos Items' section in this specification for further information.

The Contractor shall allow for the decommissioning and removal from site of the existing oil-fired cast iron section boiler and associated oil burner in the boilerhouse.

Allow for all works involved in decommissioning and removing the existing boilers and associated burners in the existing boilerhouse.



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51.03 Existing Oil line

The Mechanical Contractor shall allow for decommissioning and removing from site the existing oil line and associated oil services within the existing boilerhouse. This shall include the weight, valve etc in the location as indicated on the photo attached.





51.04 New gas boiler

General:

As described above in item 51.02, the existing oil boiler and oil burner shall be decommissioned and replaced with a new gas condensing boiler as indicated on the drawings.

The Contractor shall allow for the supply and installation of a gas fired condensing boiler with a rated output of 285.7kW.

The boiler shall be mounted on a formed concrete plinth to manufacturers recommendations. The contractor shall measure the existing plinth and shall include in the tender documents if the plinth needs to be extended to cater for the new gas condensing boiler.

The Contractor shall be responsible for carrying out the necessary refractory lining, if required, to the boiler combustion chamber all to manufacturers instructions.

The Contractor shall allow for the supply and installation of the following gas condensing boiler:

Boiler specification & Construction:

<u>Specification:</u>	Gas fire condensing boiler
<u>Duty:</u>	285.7kW
<u>Quantity:</u>	1no
<u>Proposed Model:</u>	'Rendamax R604 EVO with a rated output of 285.7kW (or equal and approved and approved)
<u>Burner Type:</u>	The burner for the gas boiler is incorporated into the boiler.
<u>Type:</u>	Pre-mix modulating
<u>Sections:</u>	6no
<u>Fuel:</u>	LPG Gas
<u>Accessories:</u>	

- Speed controlled pump



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- Safety valve, manometer and deaerator.
- 2x max. water pressure switch and 1 external high limit thermostat.
- Gas filter incl. connection kit.
- Max. gas pressure switch.
- External high limit thermostat.
- 2nd return connection for split system use.
- Bypass (incl. pump)
- Plate heat exchanger.
- Low velocity header, suitable for dt=10K/15K or dT=20K).
- Duo header for connecting 2 boilers in cascade.

Label on boilers:

The Contractor shall provide a 200mm x 200mm steel plate label screwed to the casing of the boiler with the following wording "*Important Notice: Do not reduce the boiler operating flow temperature below 82° Celsius.*"

Dimensions (approximate) of boiler with burner:

Length:	1348mm
Width:	748mm
Height:	1466mm
Weight (empty):	434kg

Fitting of boiler:

The Contractor shall ensure that prior to ordering the boiler, that the proposed boiler model will fit adequately into the space where the existing boiler is currently located.

51.05 Flue for the new boiler

Existing flue:

There are existing 250mm flue stack from the existing boiler connecting to an existing flue in the boilerhouse exiting the boilerhouse at high level through the existing chimney. The existing flue arrangement shall be retained in the location as currently installed on-site. The existing flue connection from the existing oil boilers to the existing flue stack shall be decommissioned and removed.

New flue:

There will be a new 200mm flue connections to the new gas boiler once they are in place. The Contractor shall allow for connecting the flue connection for the



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new boiler to the existing 250mm flue arrangement in the boilerhouse at high level before exiting the boilerhouse. The existing flue connection from the existing oil boiler to the existing flue arrangement shall be decommissioned and removed.

The Contractor shall allow for the decommissioning and removal of the existing flue and installation of new flue arrangement for the new boiler.

The Contractor shall allow for connecting new 200mm diameter flue for the new boiler to the existing 250mm steel flue arrangement in the boilerhouse.

The new flue for the new boiler shall be a 200mm diameter twin walled stainless steel flue. This shall be connected to the existing 250mm diameter steel flue arrangement that is currently in place for the existing boiler before exiting the boilerhouse at high level through the existing chimney. Allow for all attendances and necessary lengths, bends, angles, offsets, etc. of flues in order to connect to the existing flue in the boilerhouse.

Allow for all necessary accessories. The flue supplied shall be suitable to the boiler above so consult the equipment suppliers before ordering.

Allow for all changes of direction and offsets in order for the flues to rise to high level in the boilerhouse to connect to the existing flue arrangement. All changes of direction in flues must be limited to a maximum angle of 45°.

Flue shall be manufactured to BS4543. Material shall be 0.5mm 304 grade stainless steel.

Steel chimney and flue installations must be a proprietary system to BS EN 1859:2000 and BSEN 1856-1: 2003, complete with boiler adaptor, wall support, intermediate supports, roof supports, roof flashing, storm collar, locking bands and rain cap. On larger installations, site engineered flues must be in accordance with BS 4076:1989.

The chimney flue system shall be an integrated flue system consisting of stainless steel inner lining, 25 mm insulation and stainless steel outer casing, complete with all necessary fittings, clips, mountings etc. typically as manufactured by Dinak (Dinak Twin Wall Flue System) or equal & approved. It shall be installed in positions as indicated on the drawings and shall include all components necessary to provide a complete and satisfactory installation. The components shall be manufactured generally in accordance with BS 4543 under quality controlled conditions certificated to BS 5750 Part II. The chimney system thermal performance shall have been tested in accordance with DIN 18160 and copies of the relevant test reports shall be submitted to the Engineer on request.



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New flue liner down the existing chimney:

The Contractor shall allow for supplying and installing a 250mm diameter flexible insulated stainless steel flue liner in the existing flue to the roof of the building for the existing flue arrangement. The height of the existing flue arrangement is approximately 6 metres.

51.06 LPHW Pipework, fittings, valves and accessories in the boilerhouse

Pipework:

All new LPHW (Low Pressure Hot Water) flow and return heating services pipework in the plantroom/boilerhouse shall be installed in black mild steel tube piping.

All new LPHW (Low Pressure Hot Water) heating flow and return pipework to be installed in the boilerhouse shall be black steel pipe Class B seamless medium gauge, Blue band to BS EN 10255.

All mild steel pipe and tube shall be dual certified to BS EN 10217-1:2002, fully traceable back to the manufacturer and shall be supplied with 3.1 mill test certification. All of our BS EN 10255:2004 steel pipe shall be compliant with the European Pressure Equipment Directive (PED) 2014/68/EU.

All mild steel pipework in the boilerhouse shall have all joints welded. Butt steel welding to B.S. 1965 to match pipe.

Pipework arrangements as per the attached drawings. Pipework must be capable of being connected to for adjustment at a later date without the need for the Client to employ a specialist Contractor with specialist tools to perform the works.

Welding:

All LPHW (Low Pressure Hot Water) flow and return heating services pipeline welding shall be in accordance with the relevant BS specification or where BS does not apply shall be of the highest standard of workmanship and shall be subjected successfully to any test required by the Engineer.

All LPHW (Low Pressure Hot Water) flow and return heating services pipework shall be welded in accordance with the requirements of BS 2640 and 2971, copies of which shall be retained on site during course of installation.



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The Mechanical Contractor shall ensure that all operatives engaged on welding are familiar with the requirements of this BS Specification and are normally capable of welding to the standards therein laid down.

Threading Fittings:

Where threaded fittings are specified they shall be in black malleable iron, banded type, individually tested to BS 143 and 1256: 1986 and screwed to BS 21: 1985. All bends used shall be of the long radius type, elbows will not be allowed.

Jointing of threaded fittings for water carrying pipework shall be by means of carefully stranded flax evenly covered in jointing compound and wound on to the male thread so as to bind around the thread during the screwing of the fitting. Care should be taken to clean off all loose strands of flax after the joint is completed.

Painting of Heating Services Pipework:

All new LPHW (Low Pressure Hot Water) flow and return heating services heating distribution pipework throughout the plantroom/boilerhouse shall be provided with one coat of red oxide paintwork prior to fitting insulation. Failure to provide this paintwork prior to insulation will result in the removal of insulation for painting.

The Mechanical Contractor shall allow to make good all surfaces before painting the heating services flow and heating services return pipework.

The Mechanical Contractor shall allow for the following to paint the LPHW heating services pipework in the boilerhouse:

- **Step 1:** Thoroughly clean the pipework and prepare for painting.
- **Step 2:** Prior to installing the insulation, paint the heating services pipework with one coat of red oxide paint.

Commissioning:

The Mechanical Contractor shall allow for commissioning the entire system throughout the boilerhouse once installed.

The Mechanical Contractor shall employ a suitable commissioning company carry out the commissioning of the heating system.

Automatic Air Vents

Fit automatic air vents at all high points on all heating pipes at high level in the boilerhouse as indicated on the drawings. Fit automatic air-vents on the highest



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point of the flow and return pipework in the boilerhouse as indicated on the drawings.

The Mechanical Contractor shall ensure that pipes are laid with the correct gradient to eliminate air locks and to allow for adequate venting. Automatic air-vent shall be as Honeywell Vent EA122, or equivalent.



The valve shall have the following features:

- Integral stop valve. Enables seat to be cleaned without draining the system
- Vacuum break ensures air collection
- 3/8" BSP connections
- Expanding disc under cap.
- 1/8" to 1/2" adaptor

Circuit Valves:

Fit control valves on flow and return LPHW pipework to allow isolation of the heating flow and return pipework. Valves shall be full-way pattern with gland surfacing boxes complete with iron hand wheels screwed or flanged as necessary with cast iron bodies, gunmetal wearing parts and bronze seatings.

Valves shall be as Crane D151 isolation valves for gate valves or Crane F611 for butterfly valves, or equivalent.





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Regulating Valves:

The Mechanical Contractor shall allow for the supply and installation of Flow measuring/Double Regulating Valves on all pipework and circuits as indicated on the drawings.

Commissioning Valves:

The Mechanical Contractor shall include in his price for the supply and installation of fixed orifice double regulating valve commissioning sets on the heating circuits in the boilerhouse as indicated on the schematic.

The number and size of valves shall be as indicated on the drawings and where required for satisfactory commissioning, operation and maintenance.

Valves shall not be mounted with the test plugs pointing in a downward direction; otherwise they may act as dirt pockets. Measuring devices must provide flow measurement accuracy to within $\pm 5\%$ under the design service conditions and must be suitable for the application such that the differential pressure produced is consistent with achieving measurement accuracy.

Valves shall be as Crane D931 fixed orifice double regulating valves, or equivalent.

Fixed orifice double regulating valves shall be as Crane D931/D933/D934 and shall adhere to the following:

- Fixed orifice performance.
- Hand wheel and pressure tappings oriented for maximum convenience.
- Insertion test points for quick connection.
- PN25 pressure rating.
- Adaptor kit for use with copper tube.



Strainers:

The Mechanical Contractor shall allow for the supply and installation of all strainers as indicated on the drawings.



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Strainers must be installed to protect to the heating circuits and heating equipment in the boilerhouse as indicated. Strainers shall be cast iron or bronze body, self cleaning 'Y' pattern full size, of connecting pipe, designed for 10 bars of water services and heating.

Strainers shall be 1/16" perforated SS on water services and 1/32" perforated SS on heating. Strainers 50mm and smaller shall be screwed; strainers larger than 50mm shall be flanged, with blow-down cocks. Strainers must be suitable for the pressures and service of the piping system in which they are to be installed. Strainer bodies for line sizes up to 50 mm must be of bronze to IS EN 1982: 1999. Strainer pressure ratings must be at least 150% of maximum service pressure in the application. See drawings for quantities required.

Size of strainers shall match the pipe size of the circuit where the strainer is to be installed.

Strainers shall be as Crane D297, Crane FM276, or equivalent.



Non-return valves:

The Mechanical Contractor shall allow for the supply and installation of the non-return valves on the pipework as indicated on the drawings. The number and size of these valves shall be as indicated on the drawings.

The non-return valves shall be bronze swing check valve with resilient disc. The valve shall permit flow in one direction only and close automatically if flow reverses. The valve shall be entirely automatic in action, depending upon pressure and velocity of flow within the line to perform their functions of opening and closing. Valves shall be as Crane D140, or equivalent.



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Pressure Gauges:

The Mechanical Contractor shall allow for the supply and installation of pressure gauges on the pipework as indicated on the drawings. In order to install the gauges on the pipework, the Mechanical Contractor shall allow for the supply and installation of a 15mm socket for the installation of the gauges.

- 100mm face diameter
- 0 to 6 bar range.
- Bottom entry
- Bourdon tube copper alloy
- Black steel case
- Acrylic window
- Chrome plated bezel
- 3/8" BSP bottom entry male connection
- Direct mounting
- Dual scale bar and psi
- Accuracy class 1.6 to BS EN 837-1:1998



Temperature Gauges:

The Mechanical Contractor shall allow for the supply and installation of temperature gauges on the pipework as indicated on the drawings. In order to install the gauges on the pipework, the Mechanical Contractor shall allow for the supply and installation of a 15mm socket for the installation of the gauges. The temperature gauges shall have the following features:

- 100mm face diameter
- 0° to 120° degree range.



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- Bottom entry
- Black steel case
- Acrylic window
- Chrome plated bezel
- 50mm immersion length c/w BSP 1/2" pocket
- Pocket for 100mm dial - push fit
- Dual scale °C and °F
- Accuracy class 1 to BS EN 13190:2001



Systematic Valve Charts:

All valves supplied and fitted by the Mechanical Contractor in the plantroom/boilerhouse, excluding radiator valves, shall be fitted with circular plastic labels with black lettering on a white background, which shall be fixed between the wheel and the nut securing the wheel to the valve spindle.

Each valve shall be numbered in accordance with a corresponding valve chart schedule. The valve chart shall indicate clearly the function of each valve so numbered. A valve chart shall be completed for the boilerhouse and which shall be laminated and displayed in a suitable location within the boilerhouse.

Labelling:

All new LPHW (Low Pressure Hot Water) flow and return heating services pipework installed in the plantroom/boilerhouse shall be labelled with appropriate colour identification bands, flow indication arrows and zone numbers.

All labels must be neat, lined up with other labels, oriented for easy view, and securely fixed. Any labelling installed which does not fit this description shall be removed and replaced.

Labels on new LPHW (Low Pressure Hot Water) flow and return heating services pipework shall be provided at least once within the building compartment and every 10m on long runs within a single compartment such as a corridor.

All labels must be neat, lined up with other labels, oriented for easy view, and securely fixed. Any labelling installed which does not fit this description shall be removed and replaced.



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Labels on new pipework shall be provided at least once within the building compartment and every 10m on long runs within a single compartment such as a corridor.

Bracketing and supports

All new LPHW flow and return pipework in the boilerhouse shall be adequately bracketed and supported.

Pipework shall be run on suitable unistrut brackets that are either supported off the floor or the wall.

Exceptional care shall be exercised when supporting and bracing pipework to ensure that no hammering or vibration takes place and that the complete system operates in a quiet manner even when valves are closed off quickly against full pressure. Brackets shall allow for thermal expansion and ample clearance to be allowed when setting out brackets for large pipes. Supports shall be arranged to be as near as possible to changes in direction and joints.

All adjacent pipework following the same route shall be bracketed at the intervals specified for the smallest pipe in the run.

The following are the bracket intervals depending on the material of pipework:

BORE (mm)	HORIZONTAL (m)	VERTICAL (m)
15	1.5	1.8
20	1.5	2.1
25	1.8	3.0
32	1.8	3.0
40	2.4	3.0
50	2.4	3.5
65	2.7	4.0
80	3.0	4.0
100	3.0	4.6
125	3.7	5.5

Insulation:

All new LPHW (Low Pressure Hot Water) flow and return heating services pipework installed in the plantroom/boilerhouse shall be thoroughly insulated. Refer to section 51.05 below for further information.



51.07 Insulation in the boilerhouse

Existing pipework:

All existing heating services pipework in the boilerhouse shall be retained and all the existing thermal insulation on this existing pipework shall be retained.

New pipework:

All new heating pipework throughout the building and in the existing boilerhouse shall be insulated.

All LPHW heating flow and LPHW heating return pipework installed in the building and in the boilerhouse shall be insulated as follows:

- Pipes from 15mm to 20mm: 30mm thick insulation
- Pipes from 25mm to 80mm: 40mm thick insulation
- Pipes from 100mm to 300mm: 50mm thick insulation
- Pipes from 80mm: 50mm thick insulation

Where pipe work is to be laid in floor ducts, it shall be insulated as above and then wrapped in Oppanol (or equivalent).

Pipe work at high level in corridors or any other location where the insulation will be visible to the general public shall be insulated as described above.

All new pipework within the plantroom/existing boilerhouse or concealed within the building shall be insulated with foil backed insulation. Valve jackets provided with Velcro fixings shall be provided on all valves within the plantroom.

New pipe work within suspended ceilings, attic spaces or anywhere concealed from view shall be insulated as described above and clad in aluminium foil. All pipe work within the plantroom shall be insulated as described below and clad in aluminium foil.

Insulation:

All new LPHW heating flow and LPHW heating return pipework installed in the building and in the boilerhouse shall be insulated using Isover Climpipe, Rocklap H&V, (or equivalent) foiled back mineral wool insulation, or equivalent. All insulation shall adhere to standards B.S. 5422:2009 and B.S. 5970:2012. The Contractor shall allow for the supply and installation of all insulation for the heating services pipework.



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The insulation shall be of preformed sections of rigid mineral wool incorporating an aluminium foil laminate cover and fitted in accordance with the manufacturer's instructions.

The insulation shall also be applied to all connections, bends, tees and valves.



Insulation shall adhere to the following specifications:

- Type:

Reinforced foiled back mineral wool insulation with a self-adhesive overlap to ensure a strong vapour barrier as Isover Climpipe, Rocklap H&V, or equivalent.

- Thickness:

As highlighted above.

- Thermal conductivity:

- 0.033 W/mk at mean temperature of 10°C.
- 0.036 W/mk at mean temperature of 50°C.
- 0.043 W/mk at mean temperature of 100°C.

- Thermal performance:

To comply with B.S. 5422:2009.

- Fire performance:

To comply with Euroclass A2L, S1, d0 fire rating when classified with BS EN 13501-1

Class O compliance. The factory applied aluminium foil facing shall meet the highest standards required by BS476: Part 6 'Fire propagation' and B.S. 476: Part 7 'Surface spread of flame'.



- Service temperature:

The temperature on the aluminium facing should not exceed 80°C.

- Smoke and toxicity:

Shall achieve the criteria for smoke generation and toxicity as given in the IMO Resolution MSC 61 (67). (Smoke and Toxicity Test to Part 2, Annex 1 and 2 of the Fire Test Procedures Code)

- Certification:

CE Marked.
B.S. 5422:2009.
B.S. 476: Part 7
B.S. 5970:2012
CE 0402-CPD-SC0408-10.

Painting of Pipework prior to insulating:

Refer to section 51.01.

51.08 Commissioning

The Contractor shall allow for commissioning the entire new flow and return pipework throughout the boilerhouse once all works are completed within the boilerhouse. The Contractor shall employ a suitably qualified company to carry out the commissioning in the boilerhouse.

The Contractor shall allow for commissioning the existing heating system in the boilerhouse once all works are completed.

51.09 Pressure test

The Contractor shall hydraulic pressure test all new pipework in the boilerhouse to 7 bar and shall remain drop tight for a period of at least 12 hours. If pressure has dropped at all from noted mark, the installation cannot be regarded as sound and shall not be commissioned until the escape is repaired and the installation re-tested. If pressure remains stable, then installation can be deemed sound.

Comply with procedures given in the 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.

Advise appropriate personnel, in advance, of the time pressure tests may be witnessed. Keep record of pressure tests and issue them to the Employer's Representative and include them within the handover documentation.



51.10 Flush out, pressure test and corrosion inhibitor

Flush out of new pipework:

Upon completion of the installation but before fitting any pumps; all pipework shall be thoroughly flushed out with clean water until water flows clear from the system. Once that is completed, all new pipework shall then be pressure tested as highlighted below.

Pressure testing of new pipework:

The Contractor shall hydraulic pressure test all new flow and return LPHW pipework in the unit to 7 bar and shall remain drop tight for a period of at least 12 hours.

If pressure has dropped at all from noted mark, the installation cannot be regarded as sound and shall not be commissioned until the escape is repaired and the installation re-tested. If pressure remains stable, then installation can be deemed sound.

Comply with procedures given in the 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.

Advise appropriate personnel, in advance, of the time pressure tests may be witnessed. Keep record of pressure tests and issue them to the Employer's Representative, and include them within the handover documentation.

Corrosion Inhibitor:

Once all new pipework has been adequately pressure tested, all new pipework and the new heating system shall be dosed with Fernox (or equivalent) corrosion inhibitor on commissioning. Exact dosage rates to be advised by the Employer's Representative prior to commissioning.

Allow for installing corrosion inhibitor in the heating system once all works have been completed. Allow for 50litres for tendering purposes.

A commissioning cert confirming that the correct treatment has been applied will be required prior to handover.

51.11 BMS Controls in existing boilerhouse

51.02.01 General

The existing BSM controls panel in the existing boilerhouse shall be retained but shall be extended to cater for the additional items as indicated on the drawings.



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A new boiler shall be installed in the boilerhouse which shall be gas fired. There shall also be a new gas detection system installed in the boilerhouse that shall be incorporated into existing MCC controls panel located in the boilerhouse. The Contractor shall contact the panel supplier to see if there is capacity on the existing panel to install the new devices or whether the existing panel needs to be extended to cater for the new devices. All costs for connecting the and controlling the new devices to the panel shall be included in the tender costs.

Please ensure that the existing controls panel is in working order on completion of the project. Please liaise with the existing MCC controls panel supplier to ensure the panel can be extended to cater for the items as indicated on the drawings. The BMS supplier is ACE Controls (021-4873005)

Labelling

Upon completion, the panel shall be labelled with rigid engraved plastic labels for each and every separate item controlled. All labels must be neat, lined up with other labels, oriented for easy view, and securely fixed. Any labelling installed that does not fit this description shall be removed and replaced as required.

The panel shall include a label stating, "All switches must normally be placed in the "Auto position", Proposed labelling schemes, in addition to the full layout of any panel switches and lamps must be submitted to the Employer's Representative prior to order as incorrectly labelled or arranged displays shall be replaced if layouts have not been agreed, the panel may be rejected on arrival at site.

Equipment Connections

The controls schematic is given for indication purposes only. Prior to producing wiring diagrams for the controls system, the Contractor shall obtain full control and power wiring details for all equipment from the equipment suppliers and provide these to the controls specialist. Details of all mechanical equipment shall be supplied to the controls supplier to ensure that overloads specified provide adequate protection. The Contractor shall be fully responsible for co-ordinating the interfaces between equipment and the controls system to ensure that the controls objectives are met. No additional payments will be made where controls interfaces are transferred between equipment and controls system packages.

Wiring

All electric wiring shall be carried out under this contract. The Contractor shall employ a suitably qualified electrical contractor (RECI qualified and a member of the ECSSA) to carry out all necessary electrical work including wiring the controls panel & all associated control items. Any wiring diagrams or instructions as supplied by the specialist supplier shall be handed over to the electrical contractor. The mechanical contractor shall ensure that the full price



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for this work is included in the tender price. Most of the electrical work shall be confined to the boiler room however new control items will be required to be located throughout the school building within selected rooms as indicated. Control cabling shall be housed in steel conduits throughout including routes to temperature sensors throughout the school building. The Contractor shall provide certification from the supplier to the Employer's Representative certifying that commissioning has been carried out.

There are some existing devices in the boilerhouse that shall be retained and reconnected to the existing MCC controls panel.

Commissioning and Handover

The controls specialist shall provide a checklist for the electrical contractor listing all terminations required. This checklist shall be in a format that can be checked off by the electrical contractor to confirm that all points are wired. The controls specialist shall provide a checklist to the Employer's Representative showing each point connected to the system, confirming that it has been wired and that signals are received from the point in the correct format.

For temperature sensors or other equipment requiring calibration, the controls specialist is required to sign to say that each point has been commissioned against a calibrated device (that contains a valid calibration cert). Proof of the calibration cert must be provided to the Employer's Representative on request.

The Contractor shall ensure his tender figure includes fully for complete testing and commissioning by the controls specialist. The Contractor shall provide certification from the supplier to the Employer's Representative certifying that commissioning has been carried out. The Contractor shall also allow for a satisfactory demonstration and handover of the Building Management System to the Employer's Representative.

The Contractor and Controls Specialist shall allow for returning to site on two occasions following substantial completion to carry out seasonal test and further commissioning to ensure that the controls system is working adequately. The two number visits shall be carried out during the winter period and the summer period. During these two visits, the control system shall be thoroughly checked and the Controls Specialist shall meet with the Client/End user to see that the system is working correctly and is understood by the Client.

Site Visit:

The BMS supplier shall include for a site visit to the site to carry out a survey of the existing items and what control items are new and what items are to be retained. The Contractor shall include in his tender price for a thorough site survey of the existing BMS controls installation.



52.0 DRAINAGE & REFUGE DISPOSAL

52.01 Soils & wastes pipework

General:

A system of uPVC soils and wastes pipework shall be provided for under this contract throughout the new extension by the Mechanical Contractor as indicated on the drawings, for the removal of water-borne soil and waste matter from all sanitary fittings, sinks, equipment, etc. This contract includes for soils and wastes above the ground floor slab only, up to and including connection to the drain provided by others at ground level. All underground drainage by others.

All waste pop-ups/builders waste floor sockets in the building shall be provided by others. These waste pop-ups/builders waste floor sockets shall be installed in the Ground Floor slab and the Mechanical Contractor shall allow for connecting all the new waste pipework in the building to these new builders sockets.

The Mechanical Contractor shall extend all waste pipework from these waste pop-ups in the Ground Floor slab to all the sanitary ware fittings and items as indicated on the drawings. See drawings for the exact layout of the waste pipework installation in the building and the sizes of the pipework required.

Waste pipework:

All new soils and waste services pipework to be installed in the new extension shall be installed in uPVC plastic pipework. Refer to drawings for soils and waste routes and sizes.

Cleaning and access points:

The soils and wastes shall be designed as a single stack system. Rodding points for cleansing the soils and wastes system shall be provided throughout. Access points shall be provided at low level as indicated on the drawings all above the flood level of the lowest sanitary fitting. The Mechanical Contractor shall be responsible for including all access points required to safely clean and maintain the complete soils and wastes installation without requiring destructive intrusion into the system.

The Mechanical Contractor shall be responsible for including all access points required to safely clean and maintain the complete soils and wastes installation without requiring destructive intrusion into the system. Access points shall include access doors above flood level at each floor in all SVP's.



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In the event that the Employer's Representative deems any part of the system to be provided with inadequate access for cleaning the Contractor shall fit additional cleaning doors without charge to the contract.

The exact setting out of ground sockets to suit the actual sanitary ware or any other equipment to be installed shall be the responsibility of the Main Contractor, however the Mechanical Contractor shall make a representative available to the Main Contractor to assist with the planning and setting out of all ground sockets and also all soils and wastes points throughout the new extension.

Soil vent pipes/soil stacks:

As indicated on the drawing, a number of soil vent pipes/soil stacks shall be installed for the waste pipework from the toilet areas. All vent pipes shall be installed in uPVC plastic pipework throughout. Refer to drawings soil vent pipes routes and sizes.

New soil vent pipes shall be installed by the Mechanical Contractor as indicated on the drawings for the venting of the waste pipework from the toilets in the new extension. Soil vent pipes shall rise vertically through the building to terminate above roof level in locations indicated on the drawings. These vent pipes shall be fitted under this contract. Final locations to be agreed with the Employer's Representative.

All soil vent pipes/stacks shall exit the roof and shall extend 1000mm above the finished roof.

All soil vent pipes shall be complete with weathering sleeve and vermin guard.

52.02 Connection to equipment

The Mechanical Contractor shall be responsible for the installation and connections of all sanitary fitments, WC's, WHB's, sinks, etc., throughout the new extension as indicated on the drawings. All these items shall be supplied free issue by others to the Mechanical Contractor for fitting.

The Mechanical Contractor shall allow for connecting the new uPVC soils and wastes pipework for the new sanitary fitments, kitchen equipment, sinks, etc. to the waste pop-ups in the new extension as indicated on the drawing.

The Mechanical Contractor shall allow for all final uPVC waste connections to all WHB's, sinks, WC's, etc. as indicated on the drawings. All sanitary ware shall be supplied free issue to the Mechanical Contractor by the Main Contractor.



52.03 Insulation on waste pipework

General:

Insulation shall be applied to all internal soils and wastes pipework located in ceiling voids, service shafts, box-outs, etc.

The Mechanical Contractor shall allow for the supply and installation of the insulation on the required waste pipework in the ceiling voids, service shafts, box-outs, etc.

Insulation:

All new uPVC waste pipework above the ceiling, in service voids, box-outs, etc. shall be insulated using Isover Climpipe, Rocklap H&V, (or equivalent) foiled back mineral wool insulation, or equivalent. All insulation shall adhere to standards B.S. 5422:2009 and B.S. 5970:2012. The Contractor shall allow for the supply and installation of all insulation for the waste services pipework in the ceiling void, in service voids, box-outs, etc.

The insulation shall be of preformed sections of rigid mineral wool incorporating an aluminium foil laminate cover and fitted in accordance with the manufacturer's instructions.

The insulation shall also be applied to all connections, bends, tees and valves.



Insulation shall adhere to the following specifications:

- **Type:**

Reinforced foiled back mineral wool insulation with a self-adhesive overlap to ensure a strong vapour barrier as Isover Climpipe, Rocklap H&V, or equivalent.

- **Thickness:**

As highlighted above.



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- Thermal conductivity:

- 0.033 W/mk at mean temperature of 10°C.
- 0.036 W/mk at mean temperature of 50°C.
- 0.043 W/mk at mean temperature of 100°C.

- Thermal performance:

To comply with B.S. 5422:2009.

- Fire performance:

To comply with Euroclass A2L, S1, d0 fire rating when classified with BS EN 13501-1

Class 0 compliance. The factory applied aluminium foil facing shall meet the highest standards required by BS476: Part 6 'Fire propagation' and B.S. 476: Part 7 'Surface spread of flame'.

- Service temperature:

The temperature on the aluminium facing should not exceed 80°C.

- Smoke and toxicity:

Shall achieve the criteria for smoke generation and toxicity as given in the IMO Resolution MSC 61 (67). (Smoke and Toxicity Test to Part 2, Annex 1 and 2 of the Fire Test Procedures Code)

- Certification:

CE Marked.
B.S. 5422:2009.
B.S. 476: Part 7
B.S. 5970:2012
CE 0402-CPD-SC0408-10.



53.0 WATER SERVICES

53.01 Internal mains water services pipework and installation

General:

Mains water services shall be provided throughout the new extension as indicated on the drawings.

The mains water services system shall be connected to the existing mains water system in the existing building.

Connecting to the existing mains water services pipework:

The Mechanical Contractor shall allow for connecting the new mains water services pipework back to the existing mains water services pipework in the attic space of the existing building in the location as indicated on the drawings.

The contractor shall review the extend of the works on-site in order to make connection to the existing mains water services pipework. Mechanical Contractor shall allow for all necessary items in order to make connection.

New internal mains water services pipework:

All new internal water services pipework for the mains water services pipework to be installed in the new extension shall be installed in light gauge copper to I.S. EN 1057:2006.

It shall be suitable for bronze welding. Tubes shall be to uniform thickness, smooth, clean and free from internal and external defects. All ends shall be cut clean square with the tube axis.

All mains water services pipework shall be installed in copper.





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Copper tube for all internal mains water services pipework shall be as follows:

- Irish copper tube
- CE marked
- Complaint with BS EN 1057
- Material Analysis:
 - Material Grade Phosphorus de-oxidised copper; Cu-DHP or CW024A as defined in BS EN 1976.
 - Minimum Copper Content 99.90% (including silver).
 - Phosphorus 0.015-0.040%.
 - Total Impurity Maixma 0.060% (excluding phosphorus and silver).

Where possible, all the main runs of the mains water services pipework shall be installed above the ceiling in the ceiling void and as a result, shall be insulated.

All the mains water services pipework in the building that will drop down the walls from the high level pipework shall be shall be surface mounted. The Mechanical Contractor shall ensure a neat installation and all pipework shall be installed parallel to walls, ceilings and partitions.

All mains water services pipework shall be sleeved as the pass through floor slabs and internal blockwork walls.

The whole of the pipework shall be bronze welded with approved filler rods and flux. The filler rod shall contain a small amount of phosphorous or silicon to prevent any oxidization in the joint when made. Compression fittings shall not be used.

The composition of phosphor bronze and filler rod shall be typically as follows:

- Brass: 60% copper, 40% zinc (with silicon or phosphorous additives)
- Phosphor Bronze: 95% Copper, 4.5% tin, 0.5% phosphorous.

Flux having a borax base shall be used in paste form, which shall be uniformly spread over the surface to be jointed. If flux powder is to be used, it shall be wetted to form a paste prior to jointing. Flux shall not be used in powder form.

Bends shall be made from the pipework. Up to 38mm shall be made with spring bending tubes and the radii shall not be less than 3 times the diameters of tube. All exposed pipework shall be thoroughly cleaned and surfaces prepared to a smooth polish finish by using emery cloth. Surfaces scored or scratched or otherwise damaged shall not be acceptable.



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Pipework fittings:

Pipe brackets shall be heavy G.M. screw-on type. Pipework shall be arranged neatly and shall have a clearance from finished floor level of 100mm. Any hot and cold pipework run in the ceiling void spaces shall be supported as specified for heating pipework.

Allow for a gradient of approximately 1:60 in the direction of the flow of water. 'U' bolts shall be fitted at intervals of 6m for controlling lateral movement. Brackets shall be fitted at the following spacings:

<u>Pipe bore</u>	<u>Support centres</u>
15mm	1.2m
22mm	1.2m
28mm	1.5m
35mm	1.5m
40mm	1.8m
54mm	1.8m

Labelling:

After insulating all new mains water services pipework in the new extension, all new mains water services pipework installed in the new extension shall be labelled with appropriate colour identification bands and flow indication arrows.

All labels must be neat, lined up with other labels, oriented for easy view, and securely fixed. Any labelling installed which does not fit this description shall be removed and replaced. Labels on pipework shall be provided at least once within the new extension compartment and every 10m on long runs within a single compartment such as a corridor.

Insulation:

All mains water services pipework within unoccupied areas (shafts, service voids, ceiling voids, furniture, walls or false ceilings) shall be insulated. Allow for the fitting, installation and connection of mains water supply pipework to all the sanitary ware and the water storage tank as indicated on the drawings.

See Section 53.04 for further information on the insulation of the pipework. See drawings for routes, sizes, etc. of pipework.

Main Isolation valves:

Allow for the supply and installation of all the necessary isolation valves on the new mains water services pipework to certain areas in the new extension as indicated on the drawings.



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All valves shall be lockable and shall be WRAS approved for use with mains water supply.

Main isolation valves shall be Crane D171 level valves, or equivalent.



Local Ballofix Valves:

Allow for the supply and local installation of ballofix isolation valves to all mains water supply pipework to the new sanitary ware fittings as indicated on the drawings so that the mains water supply to each sanitary ware fitting can be easily isolated.

Ballofix valves are to be installed on all mains water supplies to all new sanitary ware fittings so that they are capable of independent isolation.

Ballofix valves shall be as follows:

- Chrome plated brass isolation valve.
- Supplied with a simple screwdriver slot operation for isolation.
- Compression ends to BS EN 1254-3



Labels:

The Mechanical Contractor shall provide steel plate labels with the following inscribed 'Drinking Water' at each drinking water location.

53.02 Cold water services pipework and installation

General:

Cold water services shall be provided throughout the new extension as indicated on the drawings.

The cold water services system shall be fed from the existing cold water system. A feed from the existing cold water storage tank shall supply the new extension.



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Connecting to the existing cold water services pipework:

The Mechanical Contractor shall allow for connecting the new cold water services pipework back to the existing cold water services pipework in the attic space of the existing building in the location as indicated on the drawings.

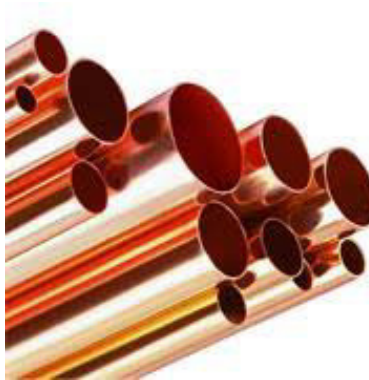
The contractor shall review the extend of the works on-site in order to make connection to the existing cold water services pipework. Mechanical Contractor shall allow for all necessary items in order to make connection.

New cold water services pipework:

All new internal water services pipework for the cold water services pipework to be installed in the new extension shall be installed in light gauge copper to I.S. EN 1057:2006.

It shall be suitable for bronze welding. Tubes shall be to uniform thickness, smooth, clean and free from internal and external defects. All ends shall be cut clean square with the tube axis.

All cold water services pipework shall be installed in copper.



Copper tube for all internal cold water services pipework shall be as follows:

- Irish copper tube
- CE marked
- Complaint with BS EN 1057
- Material Analysis:
 - Material Grade Phosphorus de-oxidised copper; Cu-DHP or CW024A as defined in BS EN 1976.
 - Minimum Copper Content 99.90% (including silver)
 - Phosphorus 0.015-0.040%
 - Total Impurity Maixma 0.060% (excluding phosphorus and silver)



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Where possible, all the main runs of the cold water services pipework shall be installed above the ceiling in the ceiling void and as a result, shall be insulated.

All the cold water services pipework in the building that will drop down the walls from the high level pipework shall be surface mounted. The Mechanical Contractor shall ensure a neat installation and all pipework shall be installed parallel to walls, ceilings and partitions.

All cold water services pipework shall be sleeved as they pass through floor slabs and internal blockwork walls.

The whole of the pipework shall be bronze welded with approved filler rods and flux. The filler rod shall contain a small amount of phosphorous or silicon to prevent any oxidation in the joint when made. Compression fittings shall not be used.

The composition of phosphor bronze and filler rod shall be typically as follows:

- Brass: 60% copper, 40% zinc (with silicon or phosphorous additives)
- Phosphor Bronze: 95% Copper, 4.5% tin, 0.5% phosphorous.

Flux having a borax base shall be used in paste form, which shall be uniformly spread over the surface to be jointed. If flux powder is to be used, it shall be wetted to form a paste prior to jointing. Flux shall not be used in powder form.

Bends shall be made from the pipework. Up to 38mm shall be made with spring bending tubes and the radii shall not be less than 3 times the diameters of tube. All exposed pipework shall be thoroughly cleaned and surfaces prepared to a smooth polish finish by using emery cloth. Surfaces scored or scratched or otherwise damaged shall not be acceptable.

Pipework fittings:

Pipe brackets shall be heavy G.M. screw-on type. Pipework shall be arranged neatly and shall have a clearance from finished floor level of 100mm. Any hot and cold pipework run in the ceiling void spaces shall be supported as specified for heating pipework.

Allow for a gradient of approximately 1:60 in the direction of the flow of water. 'U' bolts shall be fitted at intervals of 6m for controlling lateral movement. Brackets shall be fitted at the following spacings:

<u>Pipe bore</u>	<u>Support centres</u>
15mm	1.2m
22mm	1.2m



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28mm	1.5m
35mm	1.5m
40mm	1.8m
54mm	1.8m

Labelling:

After insulating all new cold water services pipework in the new extension, all new cold water services pipework installed in the new extension shall be labelled with appropriate colour identification bands and flow indication arrows.

All labels must be neat, lined up with other labels, oriented for easy view, and securely fixed. Any labelling installed which does not fit this description shall be removed and replaced. Labels on pipework shall be provided at least once within the new extension compartment and every 10m on long runs within a single compartment such as a corridor.

Insulation:

All cold water services pipework within unoccupied areas (shafts, service voids, ceiling voids, furniture, walls or false ceilings) shall be insulated. Allow for the fitting, installation and connection of cold water supply pipework to all the sanitary ware and the water storage tank as indicated on the drawings.

See Section 53.04 for further information on the insulation of the pipework. See drawings for routes, sizes, etc. of pipework.

Main Isolation valves:

Allow for the supply and installation of all the necessary isolation valves on the new cold water services pipework to certain areas in the building as indicated on the drawings. Main isolation valves shall be Crane D171 level valves, or equivalent.



Local Ballofix Valves:

Allow for the supply and local installation of ballofix isolation valves to all cold water supply pipework to the new sanitary ware fitments as indicated on the drawings so that the cold water supply to each sanitary ware fitment can be



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easily isolated. Ballofix valves are to be installed on all cold water supplies to all new sanitary ware fittings so that it they are capable of independent isolation.

Ballofix valves shall be as follows:

- Chrome plated brass isolation valve.
- Supplied with a simple screwdriver slot operation for isolation.
- Compression ends to BS EN 1254-3



53.03 Hot water services supply pipework and installation

General:

Hot water services supply pipework shall be provided throughout the new extension of the building as indicated on the drawings.

For new sinks and wash hand basins, new hot water services pipework shall connect to the existing hot water supply in the existing building for hot water supply to the sink or WHB. Ensure that the adjustable thermostat is not exposed on the water heater.

New hot water services supply pipework:

All new internal water services pipework for the hot water services supply pipework to be installed in the new extension of the building shall be installed in light gauge copper to I.S. EN 1057:2006.

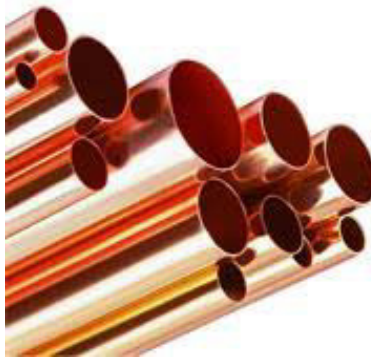
It shall be suitable for bronze welding. Tubes shall be to uniform thickness, smooth, clean and free from internal and external defects. All ends shall be cut clean square with the tube axis.

All hot water services supply pipework shall be installed in copper.



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Copper tube for all internal hot water services supply pipework shall be as follows:

- Irish copper tube.
- CE marked.
- Complaint with BS EN 1057.
- Material Analysis:
 - Material Grade Phosphorus de-oxidised copper; Cu-DHP or CW024A as defined in BS EN 1976.
 - Minimum Copper Content 99.90% (including silver)
 - Phosphorus 0.015-0.040%
 - Total Impurity Maixma 0.060% (excluding phosphorus and silver)

Where possible, all the main runs of the hot water services supply pipework shall be installed above the ceiling in the ceiling void and as a result, shall be insulated.

All the hot water services pipework in the extension of the building that will drop down the walls from the high level pipework shall be shall be exposed and surface mounted. The Mechanical Contractor shall mark the size and location of the chasing required for the hidden pipework to the Main Contractor.

All hot water services supply pipework shall be sleeved as the pass through floor slabs and internal blockwork walls.

The whole of the pipework shall be bronze welded with approved filler rods and flux. The filler rod shall contain a small amount of phosphorous or silicon to prevent any oxidization in the joint when made. Compression fittings shall not be used.

The composition of phosphor bronze and filler rod shall be typically as follows:

- Brass: 60% copper, 40% zinc (with silicon or phosphorous additives)
- Phosphor Bronze: 95% Copper, 4.5% tin, 0.5% phosphorous.



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Flux having a borax base shall be used in paste form, which shall be uniformly spread over the surface to be jointed. If flux powder is to be used, it shall be wetted to form a paste prior to jointing. Flux shall not be used in powder form.

Bends shall be made from the pipework. Up to 38mm shall be made with spring bending tubes and the radii shall not be less than 3 times the diameters of tube. All exposed pipework shall be thoroughly cleaned and surfaces prepared to a smooth polish finish by using emery cloth. Surfaces scored or scratched or otherwise damaged shall not be acceptable.

Pipework fittings:

Pipe brackets shall be heavy G.M. screw-on type. Pipework shall be arranged neatly and shall have a clearance from finished floor level of 100mm. Any hot and cold pipework run in the attic space shall be supported as specified for heating pipework.

Allow for a gradient of approximately 1:60 in the direction of the flow of water. 'U' bolts shall be fitted at intervals of 6m for controlling lateral movement. Brackets shall be fitted at the following spacings:

<u>Pipe bore</u>	<u>Support centres</u>
15mm	1.2m
22mm	1.2m
28mm	1.5m
35mm	1.5m
40mm	1.8m
54mm	1.8m

Labelling:

After insulating all new hot water services supply pipework in the new extension of the building, all new hot water services supply pipework installed in the building shall be labelled with appropriate colour identification bands and flow indication arrows.

All labels must be neat, lined up with other labels, oriented for easy view, and securely fixed. Any labelling installed which does not fit this description shall be removed and replaced. Labels on pipework shall be provided at least once within the building compartment and every 10m on long runs within a single compartment such as a corridor.

Insulation:

All hot water services supply pipework within unoccupied areas (shafts, service voids, ceiling voids, furniture, walls or false ceilings) shall be insulated.



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Allow for the fitting, installation and connection of hot water supply pipework to all the sanitary ware and the water heaters as indicated on the drawings. See Section 53.04 for further information on the insulation of the pipework. See drawings for routes, sizes, etc. of pipework.

Main Isolation valves:

Allow for the supply and installation of all the necessary isolation valves on the new hot water services supply pipework to certain areas in the building as indicated on the drawings. Main isolation valves shall be Crane D171 level valves, or equivalent.



Local Ballofix Valves:

Allow for the supply and local installation of ballofix isolation valves to all hot water supply pipework to the new sanitary ware fittings as indicated on the drawings so that the hot water supply to each sanitary ware fitting can be easily isolated. Ballofix valves are to be installed on all hot water supplies to all new sanitary ware fittings so that they are capable of independent isolation.

Ballofix valves shall be as follows:

- Chrome plated brass isolation valve.
- Supplied with a simple screwdriver slot operation for isolation.
- Compression ends to BS EN 1254-3



53.04 Insulation on water services pipework

General:

All new water services pipework installed in the new extension (at high level exposed, in the ceiling void, in plantrooms, in walls, services, voids, service shafts, etc.) shall be insulated as described below. There is not a requirement to insulate the pipework exiting the wall at low level to the necessary sanitary ware fittings or any surface mounted pipework at low level.



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Copper pipe work shall be insulated as follows:

- Pipes from 15mm to 42mm: 30mm thick insulation
- Pipes from 42mm to 76mm: 35mm thick insulation
- Pipes from 76mm: 40mm thick insulation

Insulation:

All copper pipework installed in the building for water services shall be insulated using Isover Climpipe, Rocklap H&V, (or equivalent) foiled back mineral wool insulation, or equivalent.

All insulation shall adhere to standards B.S. 5422:2009 and B.S. 5970:2012. The Contractor shall allow for the supply and installation of all insulation for the water services pipework throughout the new extension of the building.

All new pipework shall be insulated with foil backed insulation and shall be insulated as described above and clad in aluminium foil. The Contractor shall allow for the supply and installation of all insulation for the water services pipework.

The insulation shall be of preformed sections of rigid mineral wool incorporating an aluminium foil laminate cover and fitted in accordance with the manufacturer's instructions.

The insulation shall also be applied to all connections, bends, tees and valves.



Insulation shall adhere to the following specifications:

- Type:
Reinforced foiled back mineral wool insulation with a self-adhesive overlap to ensure a strong vapour barrier as Isover Climpipe, Rocklap H&V, or equivalent.



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- Thickness:

As highlighted above.

- Thermal conductivity:

- 0.033 W/mk at mean temperature of 10°C.
- 0.036 W/mk at mean temperature of 50°C.
- 0.043 W/mk at mean temperature of 100°C.

- Thermal performance:

To comply with B.S. 5422:2009.

- Fire performance:

To comply with Euroclass A2L, S1, d0 fire rating when classified with BS EN 13501-1.

Class O compliance. The factory applied aluminium foil facing shall meet the highest standards required by BS476: Part 6 'Fire propagation' and B.S. 476: Part 7 'Surface spread of flame'.

- Service temperature:

The temperature on the aluminium facing should not exceed 80°C.

- Smoke and toxicity:

Shall achieve the criteria for smoke generation and toxicity as given in the IMO Resolution MSC 61 (67). (Smoke and Toxicity Test to Part 2, Annex 1 and 2 of the Fire Test Procedures Code)

- Certification:

CE Marked.
B.S. 5422:2009.
B.S. 476: Part 7.
B.S. 5970:2012.
CE 0402-CPD-SC0408-10.
'Part L' Compliance.



53.05 Connection to equipment and sanitary ware

The Mechanical Contractor shall be responsible for the installation and connections of all sanitary fittings, sinks, etc., which shall be supplied free issue by others to the Mechanical Contractor for fitting.

The Mechanical Contractor shall allow for connecting the new water services pipework to all the new sanitary fittings, sinks, etc. in the new extension as indicated on the drawing. Refer to the drawings for locations, sizes of pipework, types of pipework, etc.

The Mechanical Contractor shall allow for connecting the new water services pipework to all the new sanitary ware as indicated on the drawing.

53.06 Thermostatic mixing valves

Thermostatic mixing valves (TMV's) shall be fitted at all new wash hand basins and sinks throughout the new extension to prevent scalding as indicated on the drawings. The Mechanical Contractor shall allow for the supply and installation of all TMV's.

All TMV's shall be located such that a maximum dead leg of 200mm only is achievable on the blended water supply. All TMV's must adhere to the following specifications:

- Must be 'TMV 3' and WRAS approved.
- Supplied with ½" flat faced union connectors terminating in 15mm compression connections.
- Suitable for a minimum dynamic supply pressure of 0.15 bar.
- TMV's must give a flow rate of least 0.1 litres/second at an inlet head of 1.5 metres.
- Limited to a maximum temperature of 43°C to prevent scalding.
- Valve body shall be D7R brass and feature a locked temperature shroud with preset maximum temperature stop facility.
- Comply with BS EN 1111 and BS EN 1287 and be suitable for use with low pressure systems.
- Be suitable for under basin installation.
- Provide safe thermostatic shutdown.
- Be complete with isolation valves, check valves, easily removable strainers and service free cartridges.
- Shall be suitable for low-pressure loss systems.
- TMVs must never be connected to the mains water supply. They must only be connected to the hot water distribution services and cold water distribution services.
- The body shall be DXR brass nickel plated with a white plastic locking shroud.



Suitable valves as Rada (low-pressure loss) 215-t3dk, or equivalent.



53.07 Control valves and ballofix valves

See sections 53.01, 53.02, 53.03 and 53.04 for information on control valves and ballofix valves.

53.08 Pressure test

The Mechanical Contractor shall hydraulic pressure test all new water services pipework in the building once all the pipework is installed. Pipework shall be tested prior to final connection to the sanitary ware items.

The pipework shall be pressure tested to 7 bar and shall remain drop tight for a period of at least 12 hours.

If pressure has dropped at all from noted mark, the installation cannot be regarded as sound and shall not be commissioned until the escape is repaired and the installation re-tested. If pressure remains stable, then installation can be deemed sound.

Comply with procedures given in the 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.

Advise appropriate personnel, in advance, of the time pressure tests may be witnessed. Keep record of pressure tests and issue them to the Employer's Representative, and include them within the handover documentation.

53.09 Sterilisation of the water system

General:

After satisfactory completion of the whole of the cold, mains and hot water services system for the new extension shall be chlorinated and sterilised.

The Mechanical Contractor shall allow for all works involved in sterilising the water services pipework in the new extension as described below.



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The following sterilisation procedure shall be carried out for the cold, hot and mains water services in the new extension of the building:

Sterilisation Procedure:

All mains, hot and cold water services shall be sterilised as follows before the system is brought into use:

- i) The pipes etc. shall be cleaned by flushing through to remove all dirt and debris and then emptied prior to sterilisation.
- ii) The necessary quantity of sterilising chemical to give a chlorine concentration of 20mg per litre shall be prepared in accordance with the manufacturer's instructions. If hypochlorite having 35% available chlorine is used, the proportions shall be 145 kg to 1000 litres of water.
- iii) A contact time of 24 hours shall be allowed when each section is full. If less than 10mg/litre is residual the system shall be re-chlorinated. Should reserves still not be established the contamination shall be located and a method of cleaning recommended.
- iv) After successful chlorination the system shall be drained and refilled with mains water.

Disposal of Sterilising Water:

Sterilising water shall be disposed of into a foul sewer and never into a surface water sewer or water course.

Protective clothing and goggles shall be provided for the operatives carrying out this work in accordance with the Health and Safety at Work Act.

Bacteriological Test:

After the cold water pipework has been emptied and the mains has been refilled to the existing water tank, a sample of the water must be taken from the existing tank for bacteriological analysis.

Great care must be taken when obtaining samples for testing and only sterile containers should be used. This sampling shall be carried out in the presence of the Engineer and/or his/her representative.

A copy of the Bacteriological test report must be submitted to Dublin Corporation, Water Division, Main laying Section.



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Allow for taking a sample as described above from the existing tank and testing as described above.

Certificate of Sterilisation:

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:

Project Name:
Name of Contractor/Sub-contractor:
Service:
Method of Sterilisation:
Period of Sterilisation:
Signatures for Contractor/Sub-contractor:
Witness:
Date of Sterilisation:

53.10 Sanitary ware

All sanitary ware shall be provided by the Main Contractor. The sanitary ware shall be provided free issue by the Main Contractor to the Mechanical Contractor for fitting and installing. The Mechanical Contractor shall be responsible for the installation of all sanitary fitments. Refer to section 53.05 for further information on the connection and fitting of the sanitary ware.



54.0 GAS SERVICES

54.01 External underground gas pipework

Refer to sections 50.02 above for further information

54.02 External overground gas pipework

Refer to sections 50.03 above for further information

54.03 Internal gas pipework in the existing boilerhouse

General:

As highlighted in sections 50.03 and 50.04, the Mechanical Contractor shall allow for supplying and installing a new LPG gas supply to the new boilerhouse in the new extension building. This new gas supply shall then be subsequently connected to the new boiler in the boilerhouse as indicated on the drawings.

Sections 50.03 and 50.04 highlights how the gas pipework will get into the new boilerhouse and this section specifies the works to the gas pipework from when it enters the new boilerhouse at low level.

The Mechanical Contractor shall allow for connecting to the new incoming gas pipework at low level in the boilerhouse and connecting this gas line to the new boiler in the existing boilerhouse as indicated on the drawings.

Refer to item 50.03 and 50.04 for further information on underground and overground gas pipework required to the existing boilerhouse.

The gas installation in the building shall comply fully with I.S. 820:2019 Non-Domestic Gas Installations.

Internal gas pipework in new boilerhouse:

Allow for the supply and installation of new gas pipework to the boiler in the boilerhouse as indicated on the drawings. Sizes, routes and locations of all gas pipework are as indicated on the drawings.

No gas pipework shall be run through unvented voids. All pipework must be sleeved when passing through structural walls.

All internal gas pipework shall be carried in mild steel. No plastic polyethylene pipe shall enter the building or be installed in the building.



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All new internal gas pipework internally in the building shall be installed in black steel pipe Class B seamless medium gauge, Blue band to B.S. 1387 with all joints welded, steel butt welding to B.S. 1965 to match pipe.

Fitting material shall be steel butt welding B.S. 1965 to match pipe or steel welding to B.S. 10 table E. No joints are to be installed on the pipework and all pipework shall be welded throughout to be in accordance with I.S. 820:2019.

All new internal gas pipework installed in the building shall have all joints welded throughout its run.

Jointing by means of threaded joints will only be tolerated where this is necessary for connection to items of plant. Where this is necessary the joint shall only be made using an approved jointing tape as PTFE as per BS 3212.

The Mechanical Contractor shall supply and install pipework, brackets and supports as required for the gas installation as indicated on the drawings.

The gas pipework installation in the building shall comply fully with I.S. 820:2019 Non-Domestic Gas Installations.

Welding:

All new internal gas pipework installed in the building shall have all joints welded throughout its run.

All pipework welding shall be in accordance with the relevant BS specification or where BS does not apply shall be of the highest standard of workmanship and shall be subjected successfully to any test required by the Engineer.

All gas services pipework shall be welded in accordance with the requirements of BS 2640 and 2971, copies of which shall be retained on site during course of installation.

The Mechanical Contractor shall ensure that all operatives engaged on welding are familiar with the requirements of this BS Specification and are normally capable of welding to the standards therein laid down.

Bracketing and supports for gas pipework

All new gas pipework shall be adequately bracketed and supported.

Pipework shall be run on suitable unistrut brackets that are either supported off the floor or the wall.

Exceptional care shall be exercised when supporting and bracing the gas pipework.



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Supports shall be arranged to be as near as possible to changes in direction and joints.

The following are the bracket intervals for the steel gas pipework:

BORE (mm)	HORIZONTAL (m)	VERTICAL (m)
15	2.0	2.5
20	2.5	3.0
25	2.5	3.0
32	2.7	3.0
40	3.0	3.5
50	3.0	3.5
65	3.0	3.5
80	3.0	3.5
100	3.0	3.5
125	4.0	4.0

Painting of gas pipework:

All new internal gas pipework in the building shall be painted with two coats of yellow paint by the Mechanical Contractor.

The Mechanical Contractor shall allow to make good all surfaces before painting the gas pipework. The Contractor shall allow for the following to paint the gas pipework.

- **Step 1:** Thoroughly clean the pipework and prepare for painting.
- **Step 2:** Apply a good primer to the internal pipework.
- **Step 3:** Paint the internal gas pipework with two coats of Yellow Gas Paint (Ochre paint) to highlight that it is gas pipework.

Pressure testing of pipework:

General:

The Mechanical Contractor shall allow for carrying out a strength and soundness test on all the internal gas pipework installed.

In the event of a failure of a test, the defect shall be repaired, defective part replaced, and the pipe replaced. After rectification works have been completed, the test shall be completed.



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The test shall be carried out using air, nitrogen or another inert gas. Water shall not be used as a test fluid. Oxygen or distribution fuel gas shall also not be used

Test equipment:

The test equipment used for the test shall be capable of being read in graduations of at least 1% of the required test pressure.

- For pressures $\leq 100\text{mbar}$, a water gauge (manometer) with a millimetre scale should be used.
- For pressures $\leq 300\text{mbar}$, a mercury or High Specific Gravity manometer should be used.
- For pressures $\geq 300\text{mbar}$, a verified gauge should also be used.

Test pressure:

The test pressure chosen for a strength and soundness test to be carried out on any pipework shall be a function of its intended maximum operating pressure (MOP) as indicated below. The applied test pressure shall not exceed the pressure that any component of the pipework is capable of withstanding. Test pressure and stabilisation periods for gas pipework shall be as follows:

Maximum operating pressure (MOP)	Test pressure (for NG)	Test pressure (for LPG)	Temperature stabilisation min
greater than 2 bar and less than or equal to 5 bar	$1,40 \times \text{MOP}$	$1,40 \times \text{MOP}$	15 ^a
greater than 100 mbar and less than or equal to 2 bar	$1,75 \times \text{MOP}$	$1,75 \times \text{MOP}$	10
greater than 40 mbar and less than or equal to 100 mbar	$2,5 \times \text{MOP}$	$2,5 \times \text{MOP}$ (minimum 150 mbar)	5
less than or equal to 40 mbar	100 mbar	150 mbar	5

^a For test pressures greater than 2 bar it is necessary to condition the pipework before the test commences to allow for the elastic qualities of PE (creep).

Maintain this pressure without pumping for at least 1 hour without any drop in pressure.

Repeat test as directed until system is proven gas tight. Comply with all supplier's requirements.

Upon completion of pressure testing, each system shall be purged with its own gas. The entire installation shall comply with I.S. 820:2019 Non-Domestic Gas Installations.



Testing and commissioning:

Once the strength and soundness test has been successfully completed, the Mechanical Contractor shall provide a declaration commissioning cert of successful completion of the test.

This shall be completed by the person responsible for the test and shall include the following information:

- Date and time of test.
- Description of 'Strength and Soundness Test'.
- The diameter of pipework tested.
- The duration of the test.
- The pressure of the test.
- Type and sensitivity of the gauge used.
- Result of test.
- Confirmation that the gas pipework installation is installed in compliance with I.S. 820:2019.
- Name and signature of the competent person that completed the test.

54.04 Isolation valves

New gas valves in new pipe work up to and including 50mm nom. bore shall be full bore ball type lever valves without transition couplings. Valves in pipe work over 50mm nom. bore shall be angle disc lugged butterfly type between steel flanges.

Certified gas lever valves shall be installed on all gas pipework. Valves shall be suitable for natural gas and LPG.

Gas lever valves shall be EN331 approved valves. Valve shall have a lever handle, brass body with a nickel coated finish. The lever shall be a plated steel lever with yellow plastic coating.

The isolation valve shall clearly indicated via permanent markings, stating its purpose and indicated its 'ON' and 'OFF' positions.





54.05 Gas detection system for the boilerhouse

General:

A new gas detection system shall be supplied and installed by the Contractor in the existing boilerhouse. The Mechanical Contractor shall allow for the supply and installation of a new gas detection system and gas solenoid valve on the new gas pipework entering the existing boilerhouse as indicated on the drawings. The gas detection system and associated gas solenoid valve shall be located as indicated on the drawings.

All electrical works shall be carried out by the Electrical Contractor and the Mechanical Contractor shall allow for liaising with the Electrical Contractor for all required electrical attendances to the new gas detection system.

The solenoid valve shall be installed on the gas line entering the existing boilerhouse. The Contractor shall allow for the following with the gas detection system:

- Gas detection control panel.
- Gas solenoid valve.
- All required gas detectors (Natural gas) and carbon monoxide.
- All other accessories as required.

Model:

The gas detection system shall conform to the following parameters:

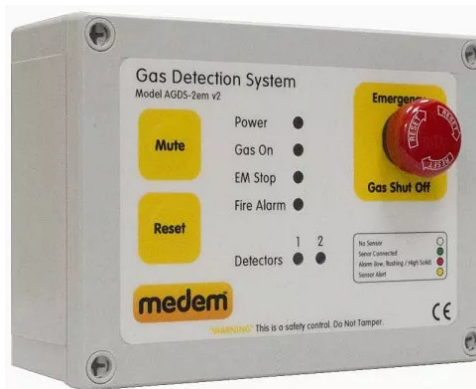
- Suitable gas detection system shall be as 'Medem 'AGDS-2 EM v2'' (or equivalent). The dimensions of the panel shall be 180mm wide by 130mm high by 70mm deep.
- Shall be a two-channel gas detection system.
- Panel shall have an OLED display for displaying system status during both installation and normal use, also for displaying diagnostics.
- The gas detection control panel shall be provided and shall conform to EN 50054 and shall be CE and BSI certified.
- The Contractor shall allow for the following detectors to be installed with the system:
 - Gas detector (LPG gas). Sensor shall be located at low level on the wall (150mm above finished floor)
 - Carbon monoxide detector. Sensor shall be located at high level on the ceiling (150mm below the ceiling)
- Panel to be wall mounted with emergency knock-off button, reset button, mute button and have LED indication for power on, gas-on, fire alarm and emergency stop.



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- Self-diagnosis of the panel. If the remote sensors are wired incorrectly or if they develop a fault during operation, the fault light shall activate.
- The control panel housing shall be an ABS enclosure, rated IP65.
- The sensor(s) are to be wired to the control panel using a four core signal and low voltage cable and be powered up from this source. The detectors are typically daisy chain wired.
- If an alarm begins (at 5% LEL) then the pre-alarm light on the affected sensor/s will illuminate and the unit will emit a beep but the valve will remain open – if the gas levels continue to rise the panel will go to high alarm (at 10% LEL), a constant buzzer will sound and the valve will close – the affected sensor will be indicated on the panel and the light on the gas sensor concerned will turn from green to red confirming the location of the alarm.
- The solenoid valve shall be IP65 rated, shall be wired in series to the gas detection panel as per manufacturer's instructions. Slam shut valve as Banico, or equivalent.
- Panel to have terminals for the acceptance of a fire panel alarm signal in order to close the gas valve served by that panel during a fire alarm.
- The pressure sender unit and the gas solenoid valve to be supplied with a fixing kit for connection on site.
- The gas solenoid valve shall be connected to and controlled off the control panel in the Store.
- The 230volt mains supply to the panel should be from a 13amp fused switch.
- The solenoid valve is connected to the terminals marked "Valve" on the panel connections.
- System shall have a 10-year warranty.



Function:

- Gas detection in the Boilerhouse.
- Carbon monoxide detection in the Boilerhouse.
- Providing a means of isolating the gas during an emergency.
- Panel shall have LED indication for power on, detectors status, gas-on, fire alarm and emergency stop.



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Operation:

- The gas supply to the existing building shall be linked to the gas safety panel by means of a solenoid valve.
- The system shall close on the activation of gas leak via the remote gas sensors.
- The system shall close on the activation of low pressure in the pipework.
- The system shall close on the activation carbon monoxide in the existing boilerhouse.

Ancillaries:

- Gas detection system as the 'Medem 'AGDS-2 EM v2'' panel.
- Gas solenoid valve (line sized to suit).
- Suitable gas detector (natural gas). Detector shall be located at high level on the wall at 150mm below the ceiling due to the gas being natural gas.
- Suitable carbon monoxide detector. Detector shall be located at high level on the wall 150mm below the ceiling.
- All detectors shall be IP44 rated.

Commissioning:

- The Contractor shall include for a Medem Engineer to attend site for as long as is necessary to commission the system and to familiarise the Client's representative with the operation of the panel.
- The Contractor shall include for the testing and commissioning of the system by the equipment supplier.
- A commissioning certificate shall be issued on completion with full instructions on the operation of the system.

Interface to the fire alarm system:

The new gas detection system shall be connected and interfaced to the fire alarm system for the building. The Mechanical Contractor shall liaise with the Electrical Contractor on this item.

55.0 SPACE COOLING SERVICES

See section 57.0 for further information.



56.0 SPACE HEATING SERVICES

General:

This section covers the space heating installation extending from where the LPHW pipework leaves the plantroom, Section 51.0 deals with the heating centre. The Contractor shall include for the supply, installation, testing and commissioning of a LPHW heating system as shown on the drawings and described in this specification. fully modulating boiler, pipework, pumps, BMS controls, associated fittings, other heating equipment, etc. shall be fitted in the plantroom. Care is to be taken to avoid running pipe work runs over electrical services and distribution boards.

The space heating installation is a low-pressure hot water, accelerated and sealed system. The system is designed for a flow temperature of 82 degrees C and return temperature of 71 degrees C. Heat emitters have been sized to maintain an indoor temperature of 21 degrees C in permanently occupied areas and a temperature of 18 degrees C in transit areas and stores, when the outdoor air temperature is -4 degrees C.

Upon completion there shall be the same number of circuits but the contractor shall allow for connecting into an existing heating circuit in the existing building for the new extension.

Control of heat emitter output shall be by weather compensation. The boiler shall be weather compensated to reduce the overall system temperature. Once the optimum start routine period is complete, weather compensation shall be provided by modulation of the existing boilers flow water temperature in proportion to the external air temperature.

Frost protection is also included. Spare tappings shall be provided on the main flow and return low loss header to serve any possible future expansion.

Individual circuits shall be served from the existing low loss flow and return header located in the boilerhouse. The installation shall be served by the existing gas supply as shown on the drawings.

The Contractor shall include for the testing and commissioning the existing LPHW heating circuit once all works are completed. All testing must be witnessed by Employer's Representative.

56.01 Radiators

The Mechanical Contractor shall allow for supplying and installing all radiators as indicated on the drawings. The Contractor shall also allow for all necessary



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LPHW (Low Pressure Hot Water) flow and return pipework to all radiators from the existing boilerhouse.

Supply, install and fit radiators as specified in the schedule as indicated on the drawings. New steel panel surface mounted convector radiators shall be supplied and installed by the Mechanical Contractor throughout the new extension as indicated on the drawings. The Mechanical Contractor shall measure up on site and confirm to the Employer's Representative that the radiators scheduled are suitable in all respects for the locations indicated. Final locations of all radiators to be agreed on site. Radiators shall not be ordered until all locations and sizes have been agreed with the Employers Representative on site.

Radiators shall be fitted throughout the new extension as per drawings. All radiators shall exhibit a smooth rounded top, without any sharp vertical weld seams or edges for safety reasons. Radiators with grilles will not be accepted.



Radiator schedule is as follows:

RADIATOR SCHEDULE								
Reference		Qty	Location	Output Per Rad (Watts)	Length (mm)	Height (mm)	Width (mm)	Type
RAD:	R-01 to R-03	3	New Classroom 01	2413	1630	440	180	MAXW.044.163.180.233.WT
RAD:	R-04 to R-06	3	New Classroom 02	2413	1630	440	180	MAXW.044.163.180.233.WT
RAD:	R-07	1	Proposed Lobby	718	630	440	130	MAXW.044.063.233.WT

Notes:

1. All radiator outputs selected based on a flow temperature of delta 50°C.
2. Some radiators shall be fitted with a 2-port valve and thermostat arrangement. Refer to drawings to see what radiators are to be supplied with 2-port valve and thermostat.



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3. Radiators must be EN 442 certified and shall be tested to EN 442. Radiators shall be pressure tested to 20 bar and suitable for a working pressure of 3 bar.
4. Connections to horizontal radiators to be BOE (Bottom opposite end, type 240) and TOE (Top opposite end) to column radiators. For radiator output of less than 3.5 Kw 15mm connections are required. 22mm connections required for output greater than 3.5 Kw.
5. Refer to drawings for radiator layout.
6. Radiators shall be manufactured from flat steel tubes with a steel thickness of 1.5mm.
7. Certain radiators are not standard sizes, allow for delivery time.
8. Radiators to be supplied in epoxy polyester coat finish to RAL colour 9016 (white) unless stated otherwise.
9. All radiator submittals to be issued to Engineer for approval prior to order.
10. Dimensional tolerances shall be in accordance with EN442.
11. The Maxi 2020 range has been future proofed to have the ability to incorporate a 12V impeller to optimise outputs down as low as 20 degree temperatures.
12. Robust casing with 1.5mm thick steel 'U' channels riveted together for an ultra strong front panel.
13. The unit can be used for free cooling.
14. It will have the ability to work as a stand alone unit or interface with a BMS of your choice.
15. 30 year guaranteed low water content heat exchanger for energy saving.
16. Brass collector to reduce pressure drop and avoid possible bio metallic reaction.
17. Dust repellent paint finish on the heat exchanger to reduce accumulation of dust.
18. NZEB ready.
19. Anti-bacterial finishes.



56.02 LPHW Pipework and pipework supports

General:

New LPHW (Low Pressure Hot Water) heating flow and return pipework shall be installed throughout the new extension from the existing boilerhouse to all the radiators in the new extension as indicated on the drawings. Refer to the drawings for location, routes and sizes.

LPHW pipework:

All new LPHW (Low Pressure Hot Water) heating flow and return pipework to be installed throughout the new extension shall be black steel pipe Class B seamless medium gauge, Blue band to BS EN 10255.

All mild steel pipe and tube shall be dual certified to BS EN 10217-1:2002, fully traceable back to the manufacturer and shall be supplied with 3.1 mill test certification. All of our BS EN 10255:2004 steel pipe shall be compliant with the European Pressure Equipment Directive (PED) 2014/68/EU.

All new LPHW heating and flow services pipework shall be installed in gun barrel steel.

New LPHW flow and return pipework shall be supplied throughout the new extension from the existing boilerhouse to all the new heat emitters throughout the new extension. Pipework shall be as specified in paragraph above. All LPHW flow and return pipework and the LPHW headers in the existing boilerhouse shall also be as specified above.

Where possible, the main runs of heating pipework shall be installed in the ceiling void above the suspended ceiling.

All LPHW flow and return heating services pipework shall be supplied, installed, tested and commissioned by the Mechanical Contractor.

LPHW pipework installed below the ceiling:

All new mild steel LPHW flow and return pipework installed below the ceiling shall have all joints welded, steel butt welding to B.S. 1965 to match pipe. Specification of pipework as highlighted above.

LPHW pipework installed above the ceiling:

All new mild steel LPHW flow and return pipework installed above the ceiling shall have all joints welded, steel butt welding to B.S. 1965 to match pipe or shall have threaded joints. Specification of pipework as highlighted above.



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Painting of Heating Services Pipework:

All new LPHW (Low Pressure Hot Water) flow and return heating services heating distribution pipework installed throughout the new extension shall be provided with one coat of red oxide paintwork prior to fitting insulation. Failure to provide this paintwork prior to insulation will result in the removal of insulation for painting.

The Contractor shall allow to make good all surfaces before painting the heating services flow and heating services return pipework. The Contractor shall allow for the following to paint the heating services pipework.

- **Step 1:** Thoroughly clean the pipework and prepare for painting.
- **Step 2:** Prior to installing the insulation, paint the heating services pipework with one coat of red oxide paint.

All tubing fittings and supports shall be coated with application of lacquer or rust-inhibiting priming paint. Pipe-work which penetrates fire walls or floors shall be painted with one coat of rust inhibiting priming paint before fire stopping is applied. The Contractor shall ensure that fire stopping will not proceed prior to the piping being treated.

Bracketing and supports

All new LPHW flow and return pipework in the new extension shall be adequately bracketed and supported.

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

Pipework run above suspended ceiling shall be fixed by adjustable hanger or brackets as BOSS Flamco or similar approved.

Pipework run in the attic space shall be run on suitable unistrut brackets that are either supported off the floor or off the wooden trusses.

Exceptional care shall be exercised when supporting and bracing pipework to ensure that no hammering or vibration takes place and that the complete system operates in a quiet manner even when valves are closed off quickly against full pressure.



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Where pipework is installed, brackets shall be dimensioned and mounted so as to accommodate the insulation 15mm clear of the surface wall. Brackets shall allow for thermal expansion and ample clearance to be allowed when setting out brackets for large pipes. Supports shall be arranged to be as near as possible to changes in direction and joints.

Where pipework is exposed the Employers Representative approval shall be obtained as to the location and method of fixing of pipe supports before putting the work in hand, to ensure the required standard of neatness is achieved.

Where floor level pipes are likely to be subjected to abuse additional floor type brackets shall be used in locations to be decided by the Employers Representative. They shall comprise a split pipe ring, pipe nipple and backplate secured to the floor.

All adjacent pipework following the same route shall be bracketed at the intervals specified for the smallest pipe in the run.

The following are the bracket intervals depending on the material of pipework:

BORE (mm)	HORIZONTAL (m)	VERTICAL (m)
15	1.5	1.8
20	1.5	2.1
25	1.8	3.0
32	1.8	3.0
40	2.4	3.0
50	2.4	3.5
65	2.7	4.0
80	3.0	4.0
100	3.0	4.6
125	3.7	5.5
150	4.5	5.5

Pipework sleeves

Pipe sleeves of appropriate diameter and of the same material as the pipe shall be fitted where pipes are installed through walls, duct covers, ceilings and floors. Sleeves shall be round out and free from burrs and project 5mm on either side of finished wall surfaces.

Adequate allowance shall be made for thermal expansion. Pipes passing through sleeves shall be positioned to allow for this movement. The sleeves shall be arranged to finish flush with the plaster or other wall finish and be of one length.

The following table shall be used as a guide for the size of sleeves.



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PIPE BORE (mm)	BORE OF SLEEVE (mm)
15	25
22	32
28	38
35	51
42	51
54	63

Welding:

All pipeline welding shall be in accordance with the relevant BS specification or where BS does not apply shall be of the highest standard of workmanship and shall be subjected successfully to any test required by the Engineer. All pipework shall be welded in accordance with the requirements of BS 2640 and 2971, copies of which shall be retained on site during course of installation.

The Contractor shall ensure that all operatives engaged on welding are familiar with the requirements of this BS Specification and are normally capable of welding to the standards therein laid down.

Threading Fittings:

Where threaded fittings are specified they shall be in black malleable iron, banded type, individually tested to BS 143 and 1256: 1986 and screwed to BS 21: 1985. All bends used shall be of the long radius type, elbows will not be allowed.

Jointing of threaded fittings for water carrying pipework shall be by means of carefully stranded flax evenly covered in jointing compound and wound on to the male thread so as to bind around the thread during the screwing of the fitting. Care should be taken to clean off all loose strands of flax after the joint is completed.

Supply and commissioning:

The Contractor shall allow for supplying and commissioning the entire LPHW system throughout the new extension. The Contractor shall employ a suitable commissioning company carry out the commissioning of the heating system.

Automatic Air Vents

Fit automatic air vents at all high points on all heating pipes at high level in the new extension as indicated on the drawings. Fit automatic air-vents on the highest point of the flow and return pipework in the building as indicated on the drawings.

The Contractor shall ensure that pipes are laid with the correct gradient to eliminate air locks and to allow for adequate venting. Automatic air-vent shall be



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as Honeywell Vent EA122, or equivalent. The valve shall have the following features:

- Integral stop valve. Enables seat to be cleaned without draining the system
- Vacuum break ensures air collection
- 3/8" BSP connections
- Expanding disc under cap.
- 1/8" to 1/2" adaptor



Circuit Valves:

Fit control valves on flow and return LPHW pipework to allow isolation of the LPHW heating flow and LPHW heating return pipework in the new extension. Valves shall be full-way pattern with gland surfacing boxes complete with iron hand wheels screwed or flanged as necessary with cast iron bodies, gunmetal wearing parts and bronze seating's.

Valves shall be as Crane D151 isolation valves for gate valves or Crane F611 for butterfly valves, or equivalent.



Regulating Valves:

The Contractor shall allow for the supply and installation of Flow measuring/Double Regulating Valves on all pipework and circuits as indicated on the drawings.



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Commissioning Valves:

The Contractor shall include in his price for the supply and installation of fixed orifice double regulating valve commissioning sets on the heating circuits to each 2-port valve arrangement. The number and size of valves shall be as indicated on the drawings and where required for satisfactory commissioning, operation and maintenance.

The Contractor shall ensure that the valves are installed immediately before the two-port valve. Valves shall not be mounted with the test plugs pointing in a downward direction; otherwise they may act as dirt pockets. Measuring devices must provide flow measurement accuracy to within $\pm 5\%$ under the design service conditions and must be suitable for the application such that the differential pressure produced is consistent with achieving measurement accuracy.

Valves shall be as Crane D931 fixed orifice double regulating valves, or equivalent.

Fixed orifice double regulating valves shall be as Crane D931/D933/D934 and shall adhere to the following:

- Fixed orifice performance.
- Hand wheel and pressure tappings oriented for maximum convenience.
- Insertion test points for quick connection.
- PN25 pressure rating.
- Adaptor kit for use with copper tube.



Strainers:

Strainers must be installed to protect to the two-port valves or circuits as indicated. Strainers shall be cast iron or bronze body, self cleaning 'Y' pattern full size, of connecting pipe, designed for 10 bars of water services and heating.

Strainers shall be 1/16" perforated SS on water services and 1/32" perforated SS on heating. Strainers 50mm and smaller shall be screwed; strainers larger than 50mm shall be flanged, with blow-down cocks. Strainers must be suitable for the pressures and service of the piping system in which they are to be installed.



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Strainer bodies for line sizes up to 50 mm must be of bronze to IS EN 1982: 1999. Strainer pressure ratings must be at least 150% of maximum service pressure in the application. See drawings for quantities required. Size of strainers shall match the pipe size of the circuit where the strainer is to be installed.

Strainers shall be as Crane D297, Crane FM276, or equivalent.



Labelling:

All new LPHW flow and return pipework installed above the ceiling throughout the new extension shall be labelled with appropriate colour identification bands, flow indication arrows and zone numbers.

All labels must be neat, lined up with other labels, oriented for easy view, and securely fixed. Any labelling installed which does not fit this description shall be removed and replaced.

Labels on new pipework shall be provided at least once within the new extension compartment and every 10m on long runs within a single compartment such as a corridor.

All labels must be neat, lined up with other labels, oriented for easy view, and securely fixed. Any labelling installed which does not fit this description shall be removed and replaced. Labels on pipework shall be provided at least once within the building compartment and every 10m on long runs within a single compartment such as a corridor.

Expansion and Contraction

Arrange supports and fixings to accommodate pipe movement caused by the thermal changes. Generally allow the flexure at changes in direction. Allow for movement at branch connections. Select pipe rings and clips appropriately to allow axial movement due to expansion.

Provide expansion loops in all straight heating pipework runs with a length of greater than 20m. Use expansion bellows where the installation of loops is not



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possible due to space constraints. Expansion devices shall only be employed where it is found to be impossible to take up expansion within the system.

56.03 Insulation

General:

All new LPHW flow and return heating services pipework installed in ceiling voids, box-outs, etc. shall be insulated as described in section 51.01 above.

Refer to section 51.01 for information on insulation required on all internal LPHW heating flow and return services pipework installed in ceiling voids, box-outs, etc.

Painting of Pipework prior to insulating:

Refer to section 56.02.

56.04 Radiator valves

The Mechanical Contractor shall allow for all necessary radiator control valves for all radiators. Control valves for radiators shall be of the easy clean pattern chromium plated with grey grip moulded hand wheels on the flow and lock shield chromium plated valves on the return. Radiator valves are shall be Scanflow (F.F.) type, or equivalent.

56.05 Two-port valves & associated thermostat

General:

All the radiators in the classroom as indicated on the drawings shall be provided with individual room temperature control by means of two-port motorised valves that are fed from a digital room temperature stat. Quantities as indicated on the drawings.

Where applicable, the two-port valve shall be installed at high level in the ceiling void in the adjoining corridor as indicated on the drawings.

See specific detail on the heating services drawing for the specific piping arrangement for each two-port valve installation. In total there is 1no room where the two-port valve and thermostat arrangement shall be installed. See drawings to confirm quantities, locations and pipe sizes.



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Digital Room Stats:

All rooms stats as indicated that are to be installed in conjunction with the two-port valve to control the heating within the specified rooms shall be digital stats as specified and indicated below. See drawing for quantities and locations.

These digital room stats shall provide the following functions:

1. Clearly display the room temperature.
2. Clearly display the room set point temperature.
3. Allow the user to easily adjust the set point temperature.
4. Operate on a 230V mains power supply (battery stats are not acceptable).
5. Provide a 230V power control to a two-port motorized valve.
6. If alternative makes are proposed, they must run on mains power and be as robust as the above. If an alternative is proposed, provide a sample.

The stats shall adhere to the following specifications:

- Temperature range: 0°C - 35°C
- Mounting type: Surface
- Digital display: Yes
- Dial lock: Yes
- Built-in sensor: Yes
- Accuracy: +/- 1.0°C
- Electrical supply: 230VAC
- Electrical rating: 3amp
- IP rating: IP30
- Dimensions (approx.): 92mm high x 92mm wide x 34mm deep.
- Guarantee: 2years

The Mechanical Contractor shall hand over all necessary items to the Electrical Contractor for wiring complete with any wiring diagrams or instructions as supplied by the specialist supplier. Wall mounted digital/electronic room thermostats shall be as EPH CDT, Heatmiser DS1-L, Seitron TAD 02M, or equivalent. The Contractor shall include for the supply and fitting of these valves and thermostats.





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Two-port Valves:

Two-port valves shall be installed on the pipework into the classroom to control the heating within the room. See drawing for quantities, locations and piping arrangements. Two-port valves shall have the following specifications:

- Motor Supply Voltage: 230 V AC
- Frequency: 50 Hz
- Power Consumption: 6 W
- Motor Insulation Rating: Class 'F'
- Maximum Working Pressure: 10 Bar
- Maximum Water Temperature: 95° C
- Maximum Ambient Temperature: 52° C
- KV value: 7.3
- Switch Rating: 3(0.5) A
- High Temperature Silicon Cable: 1100mm
- Actuator head: Yes. Supplied with valve.
- Valve Body: Brass with spring loaded
Mica filled PTFE shoes
- Actuator: Power to Open
Spring to Close
- Approvals: Valve to be VDE approved, ISO
9002 compliant.

Two-port valves shall be as Myson, Honeywell, EPH, (or equivalent). Valve shall be 15mm/22mm Zone Valve and shall be supplied with and actuator head. The Contractor shall include for the supply and fitting of these valves as indicated on the drawings.



56.06 Flush out and pressure test

Flush out of new pipework:

Upon completion of the LPHW flow and return pipework installation in the new extension but before fitting any radiators; all pipework shall be thoroughly flushed out with clean water until water flows clear from the system. Once that is completed, all new pipework shall then be pressure tested as highlighted below.



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Pressure testing of new pipework:

The Mechanical Contractor shall hydraulic pressure test all new flow and return LPHW pipework in the unit to 7 bar and shall remain drop tight for a period of at least 12 hours. If pressure has dropped at all from noted mark, the installation cannot be regarded as sound and shall not be commissioned until the escape is repaired and the installation re-tested. If pressure remains stable, then installation can be deemed sound.

Comply with procedures given in the 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.

Advise appropriate personnel, in advance, of the time pressure tests may be witnessed. Keep record of pressure tests and issue them to the Employer's Representative, and include them within the handover documentation.

Test certificates for the testing of all pipework shall be provided by the Contractor for the testing of the pipework.

Power flushing:

The entire heating pipework system shall be power flushed using 'Fernox Powerflush II', or equivalent.

56.07 Commissioning

The Mechanical Contractor shall allow for commissioning the entire new flow and return pipework throughout the new extension and the boilerhouse once all works are completed within the building. The Contractor shall employ a suitably qualified company to carry out the commissioning of the LPHW heating and flow pipework.



57.0 VENTILATION WORKS

General

The Mechanical Contractor shall be responsible for all ventilation works and shall ensure that the full price for this work is included in the tender price. This section of the Specification outlines the ventilation services installation and describes the particular requirements of the relevant services to be installed. This section is intended to be read in conjunction with all other technical and non-technical sections of the Specification and with the tender drawings. Where this section is at variance with any other sections of the tender documents, the tenderer shall obtain clarification from the Employers Representative before tendering. Failure to do so will be deemed to imply that the most onerous requirements have been included for.

Ductwork materials, construction and installation must comply with the relevant parts of the following publications:

- HVCA DW/144: Specification for sheet metal ductwork - low, medium and high pressure/velocity systems
- HVCA DW/143: A practical guide to ductwork leakage testing
- HVCA DW/154: Specification for plastics ductwork
- HVCA DW/171/172: Guide to good practice for kitchen ventilation systems
- HVCA DW/191: Guide to good practice for glass fibre ductwork
- HVCA TR/17: Guide to good practice, cleanliness of ventilation systems
- HVCA DW/TM2: Internal cleanliness of new ductwork installations
- BS 5588 & BS 476: Fire resisting ductwork and fittings construction.

57.01 Extract ductwork for toilet areas

General:

The Mechanical Contractor shall allow for the supply, installation, testing and commissioning of the complete extract ventilation system for the toilet areas as indicated on the drawings. The extract system for the toilets shall comprise of associated ductwork and in-line extract fans & wall mounted fans as indicated on the drawings.

Ductwork:

All extract air ductwork for the toilet areas as highlighted on the drawings shall be installed in galvanised steel ductwork. Routes and sizes as indicated on the drawings.



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All new extract ductwork for the toilet areas shall exit the new extension of the building horizontally through the external wall and roof as indicated on the drawings. Routes and sizes as indicated on the drawings.

All new extract ductwork for the toilet areas shall be galvanised sheet metal. See section 57.02 below for specification below on ductwork required for the extract ventilation systems.

All of extract ductwork shall be circular.

Installation:

All of extract ductwork shall be circular. Allow for all necessary connections in order to connect the ductwork to the internal grills and external louvres for the extract systems in the new extension.

The Mechanical Contractor shall allow for the supply and installation of all internal grills and external louvres for the extract ventilation system for the toilet areas. Refer to items 57.04 for further information.

All main runs of new extract ductwork for the toilet areas shall be situated within the walls where possible. All ductwork shall be installed in the wall at high level. Allow for all necessary, materials, ductwork, ductwork drops, bracing, etc. for installing the extract ductwork.

The main runs of extract ductwork shall be installed at approximately 2600mm above finished floor level.

The Mechanical Contractor shall liaise with all other trades on site during installation and also for briefing staff on the correct operation of all aspects of the installation.

57.02 Galvanised sheet metal ductwork

All new ventilation ductwork throughout the new extension for the extract ductwork shall be of the best quality galvanized sheet steel fabricated in accordance with good practice in a neat and workmanlike manner, true to size and internally free from sharp edges and obstructions.

It shall comply with the provisions of DW/ 144 - Specification for Sheet Metal Ductwork - published by the HVCA in 1982, and when erected be free from vibration and damping, rigid and truly air tight under operating conditions.

Standards:

- | | |
|------------------------------------|-------------------------|
| a) Pressure Classification: | Class B medium pressure |
| b) Leakage Classification: | Class B medium pressure |



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- c) **Positive and Negative Pressures:** 1,000Pa Positive. 500Pa Negative.
- d) **Materials:** Galvanised ductwork shall be made from continuously hot-dipped zinc coated wide strip sheet/plate and slit wide strip to BS.EN10142. GradeDX51D+Z, coating type Z275. The material shall be suitable for profiling and bending.
- e) **Negative Pressure Classification:** Class B medium pressure.

Special Requirements:

Air Leakage Testing:

All low pressure supply and extract ductwork is to be leakage tested in accordance with DW/143 and the leakage limits in table B16.15 of the CIBSE Guide and DW/144. Air leakage limits shall be 0.009 x p^{0.65} litres / m² of duct surface area.

Protective Finishes:

Where galvanised ductwork is located outdoors and un-insulated, or where the galvanising is broken during the manufacturing process and installation, it shall be treated in accordance with Clause 2.20 of Section 2. All steel ductwork supporting members and flanges shall also be protected in accordance with Clause 2.20. Outdoor ductwork must be protected, whether insulation or any other covering is applied or not, with two coats of chlorinated rubber paint. The surface must be properly de-greased and prepared for the paint. Colour of paint to be selected.

Hanging of ductwork from ceiling in new extension

The Contractor shall allow for installing the ductwork in the attic space. In order to complete this, the Contractor shall allow for hanging the containment for the ductwork from the new roof structure and installing suitable supports in order for the unitstrut to be installed in the attic space.

The brackets and unistrut for the ductwork shall be installed at approximately 3200mm above finished floor level in the extension of the building.

In order to install the ductwork at high level, the Contractor shall allow for the following:

- Dropping 10mm threaded rod from the roof/ceiling slab at 500mm distances over the length of the ductwork run. Allow for a drop of approximately 1000mm.



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- The threaded rod shall be hung from the roof/ceiling slab via 10mm G-Clamps or supports shall be drilled into the ceiling for supports.
- The base supports for the ductwork shall be 41mm double channel unistrut. Supports shall be placed at 500mm distances over the length of the ductwork run. Allow for a drop of approximately 1000mm.
- Allow for connecting the threaded rods to the double-channel unistrut.

Hanging of ductwork from ceiling in the existing building

The Contractor shall allow for installing the ductwork exposed at high level in the building. In order to complete this, the Contractor shall allow for hanging the containment for the ductwork from the ceiling structure and installing suitable supports in order for the unitstrut to be installed at high level.

The brackets and unistrut for the ductwork shall be installed at approximately 3000mm above finished floor level exposed at high level in the existing building.

In order to install the ductwork exposed at high level, the Contractor shall allow for the following:

- Dropping 10mm threaded rod from the roof/ceiling slab at 500mm distances over the length of the ductwork run. Allow for a drop of approximately 300mm.
- The threaded rod shall be hung from the roof/ceiling slab via 10mm G-Clamps or supports shall be drilled into the ceiling for supports.
- The base supports for the ductwork shall be 41mm double channel unistrut. Supports shall be placed at 500mm distances over the length of the ductwork run. Allow for a drop of approximately 300mm.
- Allow for connecting the threaded rods to the double-channel unistrut.

57.03 Flexible ducting

Flexible ducting shall be used to connect the circular ductwork to each grille, fan and any other ventilation unit. Flexible ducting shall be of the acoustic type, SONADEC 25 AA3 (or equivalent) as supplied by 'Ventac'. Lengths of flexible ducting to grilles shall not exceed 1000mm.

57.04 External louvres

Supply and install all external louvres as indicated on the drawings.



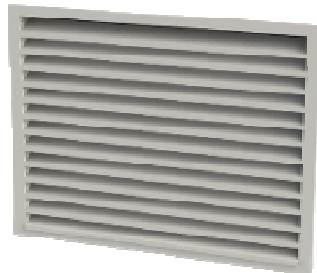
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EXTERNAL EXTRACT LOURVES (TYPES 'EEG' and 'EPG')					
Ref No.	Qty	Type	Ductwork connection to louvre (mm)	Nominal size of grill (mm)	Overall size of grill (mm)
EEG.01 to EEG.04	4no	WL38 rectangular cast external louvre with 45° degree blade slope	100mm diameter	150mm high by 150mm wide	210mm high by 210mm wide

Notes:

- Louvres shall have a metal aluminium finish.
- Louvres shall have a stainless steel bird mesh.
- Suitable for external use.
- Samples of all grille / diffuser types to be provided on request.
- All louvres shall be spray painted to a RAL colour to match the external cladding on the building. The grilles shall be finished with a polyester powder coating to RAL colour to match the external cladding on the building. Therefore, the Contractor shall allow for the powder coating of the grilles to a the selected RAL colour which is to be approved by the architect/client. Include for spray painting the grilles as highlighted above.





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EXTERNAL EXTRACT COWLS (TYPES 'RTC')					
Ref No.	Qty	Type	Ductwork connection to louvre (mm)	Neck size of grill (mm)	Overall size of grill (mm)
RTC.01 to RTC.04	4no	Unitex WB125	125mm diameter		
- Galvanised steel construction additionally protected by a dark brown epoxy powder coat finish - Weather apron in stock aluminium - Shall be supplied with weather apron for pitched roof - Shall be supplied with adaptor for connection to ductwork 					

Power coating and spraying of all external louvres:

All louvres shall be spray painted to a RAL colour to match the external colour on the building.

The louvres shall be finished with a polyester powder coating to RAL colour to match the external cladding on the building.

Therefore, the Contractor shall allow for the powder coating of the grilles to a the selected RAL colour which is to be approved by the architect/client. Include for spray painting the grilles as highlighted.

57.05 Extract fans

General:

Extract fans shall be installed for the toilet areas as indicated on the drawings. These fans shall be supplied and installed by the Mechanical Contractor under the provision of this contract.



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The Mechanical Contractor shall allow for all necessary accessories and connections. Supply & fit all extract fans as indicated in the drawings.

The Mechanical Contractor shall liaise with the Electrical Contractor for extract fan power supply locations and wiring details for the wall and ceiling mounted fan controllers.

Extract fans for toilets:

The Mechanical Contractor shall allow for the supply and installation of the following extract fans for the toilets:

Ref No.	Location	Type	Duty	CAT No.	Control	Specific fan power
EF.01 to EF.08	toilets	Wall/Ceiling Mounted Extract Fan	160m ³ /hr @ 70Pa	Lo-Carbon Silhouette 125B/T/HT High	Controlled by a speed controller	0.18 W/l/sec

All the extract fans shall adhere to the following specification:

- Models Basic/Timer/Humidity – Installation options.
- Low power consumption – Lower running costs.
- Quite running.
- Fully opening and closing shutters.
- 1 or 2 speeds selectable at installation.
- Non transparent shutters.
- Ball bearing motors for vertical or horizontal application.
- Unique humidity sensor track.
- 5 year motor warrantee.
- IPX4 rated.
- Suitable for wall, ceiling and panel mounting.
- Extract fans to be as supplied by Vent Axia, Systemair or equivalent.

57.06 Volume control/balancing dampers

Supply and install volume control damper valves on the branches of ductwork as indicated on the drawings. Sizes shall match the size of the duct where the damper is indicated to be located.

Dampers shall be manufactured from aluminium and shall be complete with spigot connections as required. Balancing dampers shall be opposed blade type balancing dampers, complete with operating lever, quadrant and locking device.



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Manual dampers shall include a device for positioning and locking the damper blades. The positions of all manual dampers, as set after final regulation, shall be indelibly marked at the adjusting devices.

Standard volume control dampers for rectangular ductwork shall be as 'HVC-NCA Series 900 (Model B)' for rectangular duct (or equivalent) as supplied by Lindab, or equivalent.



Standard volume control dampers for circular ductwork shall be as 'HVC-NCA Series 900 (Model C)' for circular duct (or equivalent) as supplied by Lindab, or equivalent.



All dampers shall adhere to the following specifications:

- Shall be tested to DW144 Class D at a static pressure of 2000Pa for a minimum time of 15 minutes with negligible leakage recorded.
- Aluminium blades
- Stainless steel jamb seals.

57.07 Labelling and identification

All new ductwork (including above ceilings) shall be labelled with appropriate colour identification bands and flow indication arrows. Labels shall be provided on all ductwork indicating the function of each duct, the air quantity being carried, the air velocity and the direction of flow.

Where access doors into ducting are provided, these shall be labelled to indicate their function. The labels shall consist of laminated plastic tape 19mm high with self-adhesive backing and block capital lettering 12 mm high.

The Contractor shall identify and label in a clear and legible manner all ductwork services runs in accordance with DW / 144 Appendix B.



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All identification shall be by means of self-adhesive flexible plastic labels, engraved plastic labels or stencilled lettering with permanent paint. All identification label colours to BS 4800 shall be in accordance with Table 18 of Appendix B.

All items of equipment such as heat recovery units, fans, dampers, etc. whatsoever, supplied and fitted by the Contractor under this section of the contract shall be provided with labels of approximate size 150 mm x 80 mm x 1.63 mm s.w.g. In general, all labels on equipment shall be engraved on rigid plastic plates and secured to the item of equipment by means of screws.

57.08 Commissioning

The Contractor shall allow for commissioning the entire ventilation once all works are completed within the new extension. The Contractor shall employ a suitably qualified company to carry out the commissioning. This shall include flow rates for each grill and the balancing of the dampers and fans to achieve the required flow rate in each room as indicated on the drawings.

The ventilation systems shall be regulated by proportional balancing as specified in the codes. The Contractor shall obtain from the Engineer a list of design flow rates and acceptable tolerances before commencing balancing operations.

The Contractor shall provide a commissioning report confirming the actual flow rate of each grill to the design flow rate and the reason for any discrepancies.



58.0 PROTECTIVE SERVICES

58.01 Fire extinguishers

Supply and fit the fire extinguishers and fire fighting equipment for the building as indicated on the drawings. Exact locations to be decided on site in conjunction with the Employer's Representative. All fire extinguishers shall conform to the relevant standards. Allow for supplying the suitable and relevant wall signage for each fire extinguisher which indicates what type of extinguisher it is. Fire extinguishers shall be as follows (refer to drawings for quantities and locations):

Types of fire extinguishers are as follows:

- **Type A:** 6litre Foam
- **Type B:** 6kg Dry Powder
- **Type C:** 2kg CO2
- **Fire Blanket:** Fire Blanket to BS 6575

The Contractor shall also allow for the following:

- Providing wall brackets for all extinguishers and allow for mounting all extinguishers
- Providing and install wall mounted signage above all fire extinguishers identifying fire point, and extinguisher usage.
- Providing a fire assembly appoint sign and mount externally in the location indicated by the clients representative
- Agreeing exact locations and mounting heights with client's representative prior to mounting extinguishers.



59.0 COMMISSIONING AND HANDOVER

59.01 Commissioning of the systems

Extent Of Works

This section covers the commissioning of all services.

Order Of Commissioning

The Contractor shall allow for the commissioning of the services in the following order:

- a) Domestic cold water
- b) Mains water
- d) Boiler, gas services, LPHW services and heating controls
- e) Hot water
- f) Ventilation
- g) BMS

Principles And Procedures Of Commissioning

The Contractor shall carry out tests in accordance with C.I.B.S.E. commissioning codes and the following B.S.R.I.A. Application guides:

- Commissioning of Pipework systems: design considerations.
- Pre-commissioning cleaning of water systems.
- The commissioning of water systems in buildings.
- The commissioning of air systems in buildings.

Cleaning And Flushing Out

Before the Engineers authority to commence filling the system prior to commissioning is given, the Contractor shall satisfy the Engineer by means of a written report that the procedures as laid down in the Commissioning Codes as to system cleanliness have been complied with. The report shall set out in detail the procedures adopted in flushing out, cleaning by forced circulation, or chemical cleaning and inhibiting should this be decided. The report should set out, separately for each service, the personnel involved, locations dealt with and dates and times of operations, the flow rates and pressures involved, and other such matters as the Engineer may deem pertinent.

Mechanical Checkout

The Contractor shall submit a list of all plant items and ductwork and of the physical and mechanical checks, as set out in the codes, that have been carried



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out before system filling, and shall certify to the Engineer that these checks have been carried out.

Filling Of Systems

When the Engineer is satisfied as to the physical and mechanical checks that have been carried out, the Contractor shall fill the system with treated water to a prepared plan agreed by the Engineer, filling from the bottom upwards, where possible, so that air is moved to the appropriate points at a higher level in the system for venting.

Electrical Checkout

Before the Engineers' permission is granted to run pump sets, fans and other rotating equipment, or to apply heat, the Contractor shall satisfy the Engineer by means of a report that all electrical checks have been carried out, as set down in the Codes, and that all checks prior to pump and fan start up have also been completed.

Initial Setting To Work

When the Contractor has indicated to the Engineer that all checks have been carried out, he shall arrange to operate the systems generally in the order. Initial setting to work shall be carried out before heat is applied to the system so that design primary rates of circulation shall be established and any likelihood of primary flow rate variations due to modulation of unbalanced secondary systems have been eliminated. Before start up of the plant the Contractor shall report to the Engineer on the start up of each system and shall assure the Engineer of their satisfactory operation before start up of the plant.

Regulation of Flow

Circulating flow systems shall be regulated by proportional balancing as specified in the codes. The Contractor shall obtain from the Engineer a list of design flow rates and acceptable tolerances before commencing balancing operations.

Commissioning Records And Reports

All checks, measurements and adjustments must be recorded in writing at the time they are made by the commissioning staff, and copies made available immediately to the Engineer. The form that this report will take shall be agreed with the Engineer prior to commissioning.

When the Contractor is satisfied that the plant and systems have been correctly commissioned, he shall submit a final report to the Engineer, setting out all matters relevant, including all modifications and modifications to the systems



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and their controls, and listing all valve, damper and control settings, and normal operating flows, pressures, temperatures, running and starting currents and other operating characteristics. The final format of this report shall be agreed with the Engineer before completion.

Handover Of Systems

When the Contractor has satisfied the Engineer that all commissioning has been completed satisfactorily, that the Clients staff have been adequately briefed on all plant and in all maintenance procedures, that all spares have been duly handed over and placed in stores, and that all instruction and maintenance manuals, together with all record drawings, have been delivered to the Client and the Engineer, the Engineer shall issue Completion Certificates to the Contractor. Each section of the plant shall then be handed over to the Clients representative in the presence of the Engineer.

59.02 O&M manuals

The Contractor shall provide a Class D Operating & Maintenance manual.

To facilitate submission of record drawings, the Contractor shall keep on site a complete set of all drawings used on the Contract Works, on which he shall mark alterations to the designs shown thereon as such alterations are carried out. THIS PROCEDURE SHALL BE STRICTLY ADHERED TO.

Three prints shall be supplied of each drawing in addition to 3no compact disks containing all drawings in AutoCAD 2008 Format.

All operation and maintenance manuals along with their associated record drawings shall be prepared in accordance with the requirements of BSRIA document 1/ 871 Operating and Maintenance Manuals for Building Services Installations.

Three complete sets of Operating and Maintenance Manuals and record drawings shall be supplied to enable the Employer to operate and maintain the systems correctly. The manuals must therefore contain all necessary technical information on each item of equipment and the associated components which have been used to assemble and construct the system(s). Three no. hard copies and three no. soft copies of the final approved O&M documentation will be required.

In addition, manuals for each system must contain information on the design intent of the system, commissioning and testing results and reports of how the components of the system are adjusted to achieve the design intent, line diagrams to show how the system is arranged in the building giving the location of all equipment and components, its control system, how the system must be set in the normal operating mode and in the event of any emergency, routine check



that must be made and a list of spares which should be kept and a list of any special tools which may be required.

The manuals must be prepared in such a way that an Engineer without any previous knowledge of the Project may use them to operate and maintain the system.

Contents of Manual

The Operating and Maintenance Manual shall be specific in respect of the complete Contract Works and shall include the following sections:

- Section 1 Description
- Section 2 Plant and Engineering Systems
- Section 3 Operating and Maintenance Procedures
- Section 4 Commissioning and Testing
- Section 5 As-Built drawings

Section 1 – Description

This section shall comprise:

- A detailed description of each building services system
- General description of all plant and equipment
- Design data for the system and for each item of plant which affects the performance of the system

Section 2 - Plant and Engineering Systems

This section shall comprise:

- Detailed technical information as published.
- Manufacturers drawings (where applicable) showing all components of the plant item with each component number in accordance with the parts list
- Parts list for each item of plant
- Manufacturers addresses and telephone numbers
- Complete instructions for ordering replacement parts in a manner that will prevent errors or misunderstanding including order number for each plant
- Installation instructions as provided by manufacturer
- Colour coding identification schedule for each building services system



Section 3 - Operating and Maintenance Procedures

- A step-by-step method of starting, operating and shutting down a system and how this affects other systems. The procedure for an emergency shut-down.
- A list of routine checks that should be made and the frequency of the checks.
- A comprehensive schedule of routine maintenance based on Manufacturer's recommendations for items of plant etc. This program should state clearly what work should be done for each day, week, month, year or given number of hours.
- A list of tools and keys which will be required in the operation and maintenance of the systems.
- Fault finding procedures.

Section 4 - Commissioning and Test Report

The report for each system shall contain a record of all the parameters which affect the performance of the system at the time of commissioning. A similar report shall be prepared for tests which have been made. The report shall be comprehensive and shall contain a record of the settings of all valves and controls and any other adjustable components so that the system may be reset to the commissioned state by reference to the report.

Presentation

- Indexing System

Each volume shall be numbered and shall be divided into sections using an appropriate numbering system

- Paper Sizes

The manual will contain manufacturer's literature which will be different sizes. Large pages will be folded and small pages will be fitted in plastic pockets with a reinforced edge punched for filing in A4 lever arch files. The page size shall be standardised for all volumes using A4 paper (210 x 297mm) with four holes punched centrally in the longer side 80mm apart

Diagrams shall be prepared on A4 or A3 (297 x 420mm) paper

- Section Dividers

Stiff cardboard section dividers with extended tabs shall be used; these shall be SUMMIT Ring Book Guides or equivalent.



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- Files for Manual

A4 lever arch files with rigid plastic coated covers shall be used which shall be EMGEE or equivalent

Inlaid lettering on the front cover shall indicate the title, i.e. Operating and Maintenance Manual, the Name of the Project and Volume Number. A label shall be fitted in the window on the spine of the file listing its contents.

The Trade Contractor is advised that all Record Drawings and O & M Manuals in the form described herein must be handed over to the Engineer prior to the issue of a Practical Completion Certificate for the Trade Contract Works. Failure to issue these Record Drawings and O & M Manuals will also defer the issue of the Practical Completion Certificate until such time as they are received.

If the Trade Contractor fails to issue such documentation on time, then the Engineer will have the right to engage such other third parties to prepare these Record Drawings and O & M Manuals and any resultant cost incurred by him shall be borne and set against the Contract.

Identification of Services and Plant

All cable trays and trunking shall be labelled clearly with colour coded bands which identifies its content.

Section 5 – As-built Drawings

The Contractor shall include for a complete set of as-built drawings which shall incorporate all works carried out and completed by the Contractor. All services, trunking/tray, routes and circuits within the building shall be identified on these drawings.

To facilitate submission of record drawings, the Contractor shall keep on site a complete set of all drawings used on the Contract Works, on which he shall mark alterations to the designs shown thereon as such alterations are carried out.