

MECHANICAL SPECIFICATION

Corlann Clare
Proposed Extension to Offices
Gort Road

Project No: 26.3142-MFC-V1-XX-SP-M-5900

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Stage	Revision	Date	Prepared	Checked	Approved
Tender	0	05 May 2026	MF	JM	MF

A GENERAL PRELIMINARIES

A.1 STANDARD ENGINEERING SPECIFICATION

The Standard Mechanical and Electrical Building Services Engineering Specification shall be read in conjunction with all or any of the sections included in the Specification Summary Sheet.

The complete Specification of Works to be carried out shall include all forms of tender, forms of contract and contract drawings.

The aforementioned may be separate or combined together in one or more bundle to comprise the Tender Documents which shall be read as a whole, and **all** items shall be included for in the submitted priced Tender with **no** exclusions or qualifications.

A.2 DEFINITIONS

In the Standard Engineering Specification, the following words and expressions shall have the meanings hereby assigned to them except where the context otherwise requires: -

"The Employer" shall be as defined on or with the Form of Tender.

"The Contract Administrator" shall mean the appointed representative Defined, on or with the Form of Tender. The contract administrator for the mechanical, electrical and lift services shall be the consulting engineer.

"The Contract" shall mean the Form of Contract described on or with the Form of Tender.

"The Works" shall mean the whole of the Works described in the Specification to be executed by the Mechanical, Electrical, and Lift Contractor.

"The Specification" shall mean the complete Specification of Works described above.

"The Main Contractor" shall mean the firm appointed to carry out the whole of the Contract where applicable.

"The Mechanical and Electrical Contractor" shall mean the firm appointed to carry out the whole of the Works described in the complete Specification.

Where the Form of Tender states that the Mechanical and Electrical Works shall be carried out under a Sub-Contract with a Main Contractor then the Mechanical and Electrical Contractor shall be referred to, and act as, a "Sub-Contractor".

A.3 COMMUNICATIONS

The Contractor shall communicate only with the Consulting Engineer.

A.4 VISITS TO SITE

Tenderers shall visit the site by prior arrangement with the Contract Administrator before completing their tenders and will be deemed to have satisfied themselves on the full nature of local conditions as regard accessibility, transport and storage of materials, the supply of, and

conditions affecting labour and to have obtained all necessary information on all matters affecting the execution of the Works.

Claims on the grounds of want of knowledge in such respect, will **not** be admitted.

A.5 INSPECTION OF ARCHITECTURAL/STRUCTURAL DRAWINGS

Where the Works are part of a building project, Architectural/Structural or other Services drawings will be available for inspection during the tender period at the Contract Administrator's offices within normal working hours. Tenderers will be deemed to have inspected these drawing and included for all matters relating to the execution to the Works.

Claims on the grounds of want of knowledge in such respect will **not** be admitted.

A.6 LABOUR & SUPERVISION

The Contractor shall employ experienced and qualified workmen to carry out the Mechanical Works. Such workmen may be assisted by apprentices or labourers, but always during the execution of the Works, their numbers shall not exceed the number of skilled workmen.

The Contract Administrator may at any time request proof of the level of qualification and / or competence of any person involved with the Contract on behalf of the Mechanical, Electrical, or Lift contractor and if not satisfied may request their replacement.

The Contractor shall employ one representative, whose name shall have been previously communicated in writing to the Contract Administrator, to superintend the carrying out of the Works on site. The said representative shall be present on the site at all times during working hours and any orders or instructions which the Contract Administrator may give to the said representative shall be deemed to have been given to the Mechanical, Electrical, or Lift Contractor.

The Contract Administrator shall have the power to request the contractor to remove from the works any person employed by them who in their opinion is incompetent or misconducts themselves or does not comply with the above paragraphs of this clause. Any person or persons so removed shall not be employed again on the works without the permission of the person who requested their removal.

A.7 IDENTIFICATION

The Contractor shall ensure that all his operatives carry an identification card c/w Photograph when requested.

The contractor shall, prior to commencement of any work on the premise, report to the responsible person for that premise and produce his/her identification card for all operatives intending to carry out work.

A.8 WORKING HOURS

Work shall be carried out during the normal working hours of the site. However, it shall not be carried out outside the hours of 8.00 am to 6 pm, on Mondays to Fridays without the written approval of the client.

A.9 OVERTIME

Payment of overtime will not be considered unless written authority is given by the Client, and only then with agreement.

A.10 PROHIBITION OF TRANSFER OF CONTRACT

No part of the contract, or any interest in it shall be Transferred or assigned by the contractor directly or indirectly to any person or persons whomsoever.

A.11 SITE MEETINGS

Periodical meetings will be held at the site as and when required by the design team.

The contractor shall arrange to have an accredited representative present at each of these meetings.

The Contractor shall have previously communicated the name of the contractor's representative in writing to the design team.

A.12 SCHEDULE OF RATES

A Schedule of rates giving details of prices and quantities for each section of the work **will be required** to accompany the submission of tender.

This schedule must show the rates of **each** piece of apparatus, labour rate for erection, rates per unit length (inclusive of labour) for the installation of each size of cable, conduit, trunking etc.

The final grand total shall agree with the tender figure.

A.13 VALUATION OF VARIATIONS

The Specialist Contractor's price is lump sum fixed price, there will be no variations to the Contract Sum, unless additional works are instructed by the Employer's Representative, and these will be carried out in accordance with the appropriate clauses.

Notwithstanding the Conditions of the Contract, no work shall be commenced upon any variation or cost incurred, unless otherwise authorized by the Contract Administrator, before:

- a) The value of the variation has been agreed.
- b) The Contract Administrator's written instruction has been issued.
- c) The Main Contractor's official order has been received.

A.14 PAYMENTS

In the case where the Mechanical and Electrical Services Installer is named Sub-Contractor, payments will be made via the Main Contractor and the appropriate retention and Main Contractors Discount will be deducted.

On the issue of the Certificate of Practical Completion, or the Certificate of Taking Over, retention shall be held as prior agreed.

At the discretion of the Contract Administrator, after twelve months of the Defects Liability Period has elapsed, all retention monies will be released, providing a Certificate of Indemnity is received from the Mechanical and Electrical Services Contractor, indicating that the Employer is indemnified against the cost of remedying any defects, including consequential damage to the building, to fabric and furnishings and the cost of builder's work associated with the remedying of such defects and consequential damage which shall appear in the latter six months of the twelve months Defects Liability Period of the Contract.

B PARTICULAR PRELIMINARIES

B.1 CONTRACT DRAWINGS & SPECIFICATION

The Contract Drawings are intended to show the general arrangements of the various items of the Works as described in the Specification to be supplied and installed under the Contract. They do not necessarily show exact runs or full details of all accessories, fitting etc, required and in some instances are merely diagrammatic.

However, the Specification and Drawings must be understood to cover everything required to make a first class installation and the Contractor should include for all items necessary for the proper execution of the Works in his Tender.

Anything shown on the Drawings which is not included in the Specification, or anything herein and not shown on the Drawings shall be deemed to be required as part of the Contract.

Any anomalies, which arise between Drawings or between Drawings and the Specification, should be reported to the Consulting Engineer before the Tender is submitted. Such discrepancies must be pointed out at the time of tendering and will not be accepted as a basis for extra claims and work during the progress of the installation. All Contract Drawings and the Specification are the property of the Employer.

All tender and contract drawings including specifications shall be issued in PDF format. If paper copies are required from the consultant, a charge for paper copies shall be applied. Payment for such copies shall be made in full at handover of the paper copies. The following charges shall apply:

A1 – Black and White	€2.50 per sheet
A1 – Colour	€4.00 per sheet
A0 – Black and white	€3.50 per sheet
A0 – Colour	€5.00 per sheet

Specification up to 150 pages €5.00 per copy

B.2 WORKING DRAWINGS

Notwithstanding the provision of the Contract Drawings the Contractor shall be responsible for taking his own particulars and providing at his own expense all necessary working and detail drawings as requested by the Consulting Engineer, copies of which must be first submitted for comment before the work is put in hand. Comments on working drawings will not relieve the Contractor of his responsibility to ascertain exact building dimensions and location of other services.

Where the Contractor chooses to prepare the working drawings utilising AutoCAD or equivalent, base building outline discs in .dwg or .dxf format will be provided at cost.

For ducting, pipework and containment installations, the Contractor shall submit for the Consulting Engineer's approval, either in electronic format or, three paper copies of drawings showing the proposed routes, dimensioned to show the exact points of vertical/horizontal runs

and positions. If any of the services are installed prior to comment, or not in accordance with the issued drawings, the Consulting Engineer will be entitled to instruct these to be altered, at the Contractor's cost, to comply with his requirements.

The Contractor will be responsible for taking dimensions from site for all equipment to be specially fabricated and for preparing his own detailed working drawings from these measurements. Such drawings shall be submitted, either in electronic format or, in triplicate for the Contract Administrator's comment before manufacture is commenced.

The Consulting Engineer's comment of working drawings will not relieve the Contractor of his responsibility for errors and incorrect setting out. The Consulting Engineer's comment is to be general and is not intended to serve as a check and does not relieve the Contractor from furnishing the materials and performing the work as required by the Drawings and Specification.

The Contractor shall be responsible for any discrepancies, errors or omissions in the working drawings and other particulars supplied by him, whether such drawings and particulars have been approved, in principle, by the Consulting Engineer or not, provided that such discrepancies, errors or omissions be not due to inaccurate information or particulars furnished in writing to the Contractor by the Consulting Engineers.

Following the comments of any working drawing the Contractor shall formally issue two copies of the approved drawing to the Consulting Engineers.

B.3 SETTING OUT

The Contract Drawings are for tendering purposes only and are not to be used for setting out. Except where specific dimensions are given, the Contractor will verify all setting out on site and shall make use of all detail, large scale, furniture, and internal wall elevation drawings held by the Main Contractor.

Notwithstanding the submission, approval and issue of Working Drawings, the exact positions of all services, plant and equipment must be agreed on site with the Consulting Engineer before they are set out. Drawings shall not be scaled for this purpose.

The Contractor shall accurately set out the works and he shall keep them correct in every way according to the Drawings and Specification.

In all instances where services such as gas, hot and cold water, heating, electricity, Telecom. TV, etc. run in conjunction with and/or parallel to any service installation, the setting out of the whole of the services is to be approved before work is commenced on that portion of the installation.

B.4 BUILDERS' WORK

The following work shall be deemed to be Builders' Work, which shall be provided by the Main Contractor: -

- a. Cutting away through walls, floors, and ceilings for passage of all mechanical and electrical services etc. and making good after.
- b. Chasing of walls for conduits, accessory boxes, pipework, and fittings

- c. Auxiliary timber noggins and the like for supporting luminaires and ceiling mounted accessories.
- d. All underground pipe ducts, lighting column pits, trenching etc.
- e. All painting of surface services.
- f. Removal and replacement of other parts of the building fabric as may be necessary.
- g. Items of general and special attendance.
- h. Taking delivery, unloading, taking on store, Hoisting materials, Power for fixing Scaffolding, Protecting completed installation

The Contractor shall inform the Main Contractor of the location and details of any of the above Builders' Work required by marking out on site or, if requested, by drawings.

The Contractor shall be responsible for the accuracy of the Builders' Work information and shall recompense the Main Contractor for any abortive work carried out due to inaccurate information.

The Contractor shall be fully responsible for the levels and squareness of fittings when fitted to chases etc., and to this end will ensure the accuracy of all works carried out in this connection by the Main Contractor.

The Contractor shall permit nothing to be done which may injure the stability of the works and no cutting through floors, walls, etc. will be allowed, other than where required by the Drawings, without the sanction of the architect.

The contractor shall be provided with general attendance, free of charge, general attendance shall include only allowing use of scaffolding, mess rooms, sanitary accommodation providing space only for office accommodation and for storage of plant and materials.

B.5 FIRE PROTECTION

When opes are cut through wall or floors to enable services to pass through, the Main Contractor must make them good with incombustible material. Internal fire barriers in conduit, trunking, ducts, etc. shall be the responsibility of the Mechanical and Electrical Services Installer.

B.6 FIXINGS

The Contractor shall include for all drilling and plugging for the erection of all materials and equipment required by the Specification. This shall include the fixing of metalwork, screws, clips, bolts, brackets, saddles, etc. for the proper support of services and for the suspension or support of services.

In any building partially or fully occupied by the Employer or other person's noise and hindrance whilst carrying out any of the above shall be kept to a minimum.

The architect's and the Main Contractor's approval shall be obtained as to all methods of fixing proposed before the work is commenced and, in particular, the approval shall be obtained, in writing, before welding, drilling, burning, cutting, cartridge injecting or altering structures or foundations in any way.

The Contractor shall rectify at his own expense any damage whatsoever caused by negligence on the part of his workmen to decorations, paintwork, building fabric or structure etc.

B.7 PAINTWORK

The Contractor shall be responsible for protecting all equipment that has been installed from damage, and shall thoroughly clean all equipment before it is handed over. Any damaged paintwork shall be made good in a colour and type of paint to match the original.

Mild steel or iron brackets or other items to be built in are to be painted before building in. In the case of materials or plant which is delivered to the site already primed, the Contractor shall ensure that the primer is suitable for the type of paint to be subsequently applied and shall make good any damage to the primer before further coats are applied.

All items that are to be painted shall have an under-coating and a finishing coat in addition to a primer appropriate to the material being painted, the finishing coat shall be to a colour to be approved by the Consulting Engineer.

All paints, including priming, undercoats and finishing coats shall be of the best quality, and shall be obtained from a reliable, and are to be used in accordance with the Maker's instructions. Painting shall be done in accordance with the best practices in the Trade, all surfaces to be painted, must be thoroughly prepared, including removal of dust, grease, and protective coatings, and in the case of iron and steel, the removal of rust and scale by abrasion, followed by the application of an anti-rust solution to remove pitted rust.

B.8 WORKMANSHIP

Workmanship shall conform to the highest standard of current Mechanical and Electrical installation practice. The Consulting Engineer reserves the right to reject any work, which in his opinion does not meet such a standard. Rejected work shall be rectified immediately or taken down within two days and corrected as soon as is practically possible.

B.9 MATERIALS

Unless otherwise specified all material to be used throughout the installation shall be new and shall be of EU manufacture.

All materials shall be of the best of their particular type and the Contractor may be called upon to submit for approval samples of the various materials intended for use in the execution of the work. All materials are to comply with the appropriate Standards and regulations.

Materials, which are specified, to be supplied by a particular Manufacturer shall **not** be varied without the written approval of the Consulting Engineer.

In these specifications trade names and/or suppliers are sometimes used for the purpose of brevity and clarity of technical, aesthetic, and functional intent. Such references are for the conveniences of the tenderer in clearly indicating the standard of technical, aesthetic, and functional requirements sought by the specifier. The intention is not to favor one product over another or to eliminate other products/suppliers.

Other materials/suppliers may be put forward for consideration as equivalent materials to those stated in the specification.

Approval for substitution of equivalent materials/suppliers will be given where the alternative material/supplier are demonstrable equal in full accord with the original specification.

Equivalence of an offered substitution will be judged on the basis of objective, clear and verifiable independent proof of similar compliance with equal standards to those specified.

Where appropriate verification is provided through a detailed technical dossier, drawings, data sheets and/or a test report from a recognized body, a material/product substitution will be permitted by the architect who is the client representative. Any increased costs arising whatsoever from such a substitution in terms of redesign, rescheduling, health, and safety issues etc. shall be borne by the Contractor.

Alternative suppliers/installers will need to prove their ability to perform their sub-element part of the main contract through the submission of proof of their technical and/or professional capacity (education, experience, equipment etc.).

The contracting authority, through its architect who is the client representative, will determine on a case by case basis, from a technical, aesthetic, and functional perspective, what constitutes an equivalent standard/product. Verification will take place only after the award of contract, as part of the contract management regime. Sufficient time is to be allowed to check submissions and provide samples as indicated in this specification.

When for any reason the Contractor proposes a change from the specified materials for approval, he shall provide samples, free of charge, to the Consulting Engineer for evaluation together with all back up technical and other reference information requested by the Consulting Engineer.

The Contractor shall ensure that all materials, which are installed or stored on site, are properly protected. The Consulting Engineer reserves the right to reject any materials which are damaged or corroded due to poor storage, installation, or lack of protection, or materials which do not comply with the Specification.

Rejected materials, whether installed or stored, shall be removed from site within two days and replaced as soon as is practically possible.

It shall be the Mechanical and Electrical Services Installer's responsibility to ensure that all materials are ordered and delivered to site in sufficient time to enable him to complete his work within the period of contract. No additional claims will be allowed for non-compliance.

B.10 PRODUCTS SPECIFIED BY NAME

It should be noted that, for tender purposes, the reference to any particular item or product within this specification lays down the parameters required for that product. These parameters will include type and standard of aesthetic finish, applied technology/inter-component compatibility, thermal capabilities, technical suitability, and physical dimensions.

Alternative products may be offered if full details are submitted in writing, at the submission of any tender for evaluation and approval by the Consulting Engineer. Any such alterations shall

be detailed in the form of a separate schedule indicating any projected cost savings against any scripted product.

B.11 TESTING AND COMMISSIONING

At an early stage of the Project the Contractor shall compile a programme of testing and commissioning of all services contained in this Specification document.

The Contractor shall further provide a method statement supported by risk assessments detailing the procedures for carrying out the on-site tests.

The opportunity shall be afforded to the Consulting Engineer, or his appointed representative, to witness all or any tests carried out either on site or at manufacturer's works, and to facilitate this, the Contractor shall give not less than **eight days' notice** of tests to the Consulting Engineer.

The Contractor shall provide all necessary facilities and equipment to carry out all tests and inspections either on site or at manufacturer's works.

An 'approved' engineer shall be appointed by the Contractor to supervise the whole of the testing, commissioning, performance testing and instruction of Client's staff together with all specialized personnel (including manufacturer's representatives) and all of their activities shall be coordinated by him.

All equipment, material and systems contained in this Specification document shall be tested and if such inspection/test fails, the process shall be repeated until satisfactory results are obtained.

Comprehensive records of all commissioning and testing shall be maintained and shall contain the following information: -

- a) Project title
- b) Details and date of test
- c) Instruments used, serial numbers, calibration dates
- d) Signatures of those witnessing test
- e) Mechanical and Electrical Services Installer's name
- f) Specific location of the item(s) in the Works

All such documentation shall be included in the O & M manuals.

Fuel for testing shall be provided by the Mechanical and Electrical Services Installer.

B.12 COMPLETION DETAILS

At the completion and final hand over of the project, the Contractor is required to have carried out the following: -

- a. Fully completed all works detailed in the Specification and shown on the Contract Drawings.
- b. Fully completed all works relating to Variations to the Contract, for which Architect's Instructions have been issued, thus forming part of the Contract.

- c. Submitted to the Consulting Engineer, all duly completed inspection and Completion Certificates.
- d. Submitted to the Consulting Engineer, Record Drawings.
- e. Submitted to the Consulting Engineer, a Maintenance Manual and Job Profile.

All of the above shall be produced in such a format as to allow for ease of inclusion into the Building Log Book.

B.13 INSTRUCTION PERIOD

After an installation has been completed, tested, and handed over to the Employer, and when instructed, the Contractor shall supervise and be completely responsible for the running of the plant detailed in this Specification, for a period during which he shall demonstrate to the persons appointed by the Employer to be in charge, the running conditions, operation of the plant, correct setting and maintenance controls etc. to attain the desired results.

The Contractor should ensure that the person(s) is familiar with the positions of equipment and facilities for the isolation of the installation, particularly under emergency conditions. The instructional period may not take place immediately on completion, but when considered desirable by the Consulting Engineer.

B.14 OPERATION & MAINTENANCE MANUALS

Prior to the issue of the Practical Completion Certificate for Works, comprehensive Operation & Maintenance Manuals finalized in detail and approved shall be provided. It is advised that great importance will be placed upon the quality, accuracy, clarity, and completeness of the Operation & Maintenance Manuals and upon their being made available promptly.

A complete draft copy of the manual must be submitted not less than **2 weeks before** the date of Practical Completion. Any amendments necessary in the light of any comments shall be made and the manual re-submitted for the Consulting Engineer's approval.

Only after the Consulting Engineer's approval are the final copies of the manual to be produced.

The finalised copies are to be provided to the Consulting Engineer not less than **2 weeks before** the date of Practical Completion

Failure to issue these in time will result in withholding the Practical Completion Certificate.

From time to time, as required throughout the execution of the Works, evidence of adequate and accurate records, to enable the ultimate completeness and accuracy of the Operation & Maintenance Manuals, shall be progressively examined as the work on site proceeds.

All Operation & Maintenance Manuals shall be provided in triplicate together with CD-ROM containing all documentation, following the issue of one set for approval.

The Operation & Maintenance Manuals shall be adequate for the following purposes: -

- a. To record clearly the layout of the various sections of the Works as actually installed, and to identify and locate all component parts thereof especially isolation points, distribution boards etc.
- b. To make it possible to comprehend the extent and purposes of the Works and the method of operation thereof.
- c. To set out clearly the extent to which maintenance and servicing is required and how, in detail, it should be executed.
- d. To provide sufficient and readily accessible information properly to facilitate the ordering of spares and replacements.

The Operation & Maintenance Manuals shall be correlated so that the terminology and the numerical and/or other references used therein are consistent with and similar to those used in the physical identification of component parts of the Works.

Operating and Maintenance Instructions shall be provided and shall comprise the following as applicable (all contained in volumes strongly bound in flexible covers and suitable for heavy usage over a long period), written to be read in conjunction with the Record Drawings:

- a. A general description of the scope, purpose, and manner of working of each system or apparatus forming part of the Works.
- b. A detailed description of the scope, purpose, and manner of working of each system of automatic controls and/or monitoring instruments.
- c. A detailed description of the scope, purpose and manner of working of each system of special services.
- d. Data on general design parameters and normal operating conditions (e.g., voltage, current etc.) based on commissioning tests.
- e. Clear and comprehensive instructions for the switching on, starting up, running, and closing down of each such system or apparatus.
- f. Clear and comprehensive instructions for dealing with emergency conditions for each system or apparatus.
- g. Instructions in respect of any precautionary measures from time to time necessary (e.g., against corrosion or freezing).
- h. Instructions in respect of the care of apparatus when subject to seasonal disuse.
- i. Instructions as to the nature, extent, and frequency of servicing necessary to properly maintain the Works in good condition and as to the materials to be used for the purpose. This information may be supported in detail, but not replaced by, maintenance instructions provided by the suppliers of particular component apparatus.
- j. The names and addresses of suppliers of all major components of the Works as may be required to obtain spare parts or replacements.

Copies of manufacturers' data shall be supplied with respect to the nature, type and method of operation of individual pieces of equipment, together with their detailed maintenance instructions. Such data, in the form of individual booklets and the like, shall be indexed and cross referenced to the Operating and Maintenance Instructions and presented suitably protected in box files or folders.

An asset list of all equipment and services together with all associated technical information pertinent to such services and information shall be included.

A copy of all Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records for the installations and equipment, etc., used in the installations.

B.15 RECORD DRAWINGS

Prior to the issue of the Practical Completion Certificate for the Works, comprehensive Record Drawings finalized in detail and approved shall be provided. It is advised that great importance will be placed upon the equality, accuracy, clarity and completeness of the Record Drawings and upon their being made available promptly.

Draft copies of the drawings must be submitted not less than **2 weeks** before the date of Practical Completion. Any amendments necessary in the light of any comments shall be made and the drawings re-submitted for the Consulting Engineer approval.

Only after the Consulting Engineer approval are the final copies of the drawings to be produced.

The finalised drawings are to be provided to the Consulting Engineer not less than **2 weeks** before the date of Practical Completion

Failure to issue these in time will result in withholding the Practical Completion Certificate, or alternatively the Consulting Engineer may produce them, and the **actual** production cost will be contra-charged to the Mechanical and Electrical Services Installer.

From time to time, as required throughout the execution of the Works, evidence that adequate and accurate records such as will ensure the ultimate completeness and accuracy of the Record Drawings shall themselves be progressively examined as the work on site proceeds.

All Record Drawings shall be provided in triplicate, following the issue of one set for approval. In the case of drawings and diagrams prepared by the installers, they shall be produced on AutoCAD v 2008, with 3 no CD-ROMs and 3 no sets of prints provided.

Drawings prepared by suppliers of component items shall be in the same form as above, except where they are incorporated in Instruction Manuals when paper is acceptable. The Record Drawings shall include the information listed in the following paragraphs, as applicable. All such drawings shall clearly be endorsed **RECORD DRAWING** near to the title block and shall be drawn to a scale of not less than one hundredth full size, which shall show the following as installed: -

- a. The location, including level if buried, of Public Service connections provided, together with the points of origin and termination, size and materials of cables, ducts, pipes and/or other relevant information.

- b. Location, identity, size and details of all apparatus and control equipment served by, or associated with, each of the various services. The information with respect to size and details may be presented in schedule form subject to the prior agreement of the Contract Administrator.
- c. The location and identity of each room or space housing plant, machinery or apparatus.
- d. Main and sub-main cables, showing original, route, termination, size and type of each cable.
- e. Distribution diagram, or diagrams, which shall show size, type and length (to within one yard for imperial measure or one meter for metric measure) of each service.
- f. Control wiring diagrams, which shall show all equipment supplies as part of the Works.
- g. Manufacturer's drawings and internal wiring diagrams which shall show all special equipment supplied as part of the Works.

B.16 DEFECTS LIABILITY, MAINTENANCE & SERVICING

Notwithstanding the conditions of the Contract the Contractor shall be responsible for any defects which may occur, for a period of 12 months from Practical Completion, in the entire installation detailed in the Specification with the exception of GLS Tungsten lamps for which the Employer will take responsibility.

Following notification of a defect the Contractor shall rectify the item within 24 hours except as may be agreed otherwise with Consulting Engineer.

The Client will carry out routine maintenance to the installation in accordance with the documentation issued by for all building engineering services thus ensuring that such installation is maintained and serviced correctly thus meeting all statutory requirements.

B.17 EMERGENCY CALL OUT

For the duration of the contract and for the defects period an Emergency Call out Service must be available 24 hours per day at all times including week-ends and bank holidays.

The Call Out is to be covered as soon as possible and the operative attending site must be on site within 2 hours of receiving the Emergency Call Out notice.

If the Contractor is unable to respond to the call out within the time specified, attendance by others operating on a representative basis for the Contractor will be acceptable but the standard and performance of the representative is entirely the responsibility of the contractor

In the event of failure by the Contractor to respond to the call out within the time stipulated, the Client reserves the right to employ and pay others to carry out the work involved, and the costs incurred will be deducted by the Client from any monies due to the Contractor under this contract or will be recoverable from the Contractor by the Client as a debt.

This latter action will in no way invalidate the guarantee inherent in the defects liability period implicit in the terms of the contract.

The cost to the Contractor of putting the equipment and associated Systems into working order will be at the contractor's expense and at no cost to the Client unless the work involved, or the fault attended to is deemed by the Client to be outside the terms of the contract.

To facilitate the call out procedure the Installer **upon** placing of an order with him for the contract works will be required to give a Call Out telephone number or numbers where 24 hour contact will be available, and the Client will give corresponding 24 hour Call Out contact numbers for the relay of information.

Included in this Emergency Call out Procedure is the attendance to any operational fault or breakdown to any temporary plant that may be installed as part of the contract.

B.18 COMPLIANCE WITH REGULATIONS

The whole of the installation carried out under this contract must comply with the following regulations and requirements, together with the latest revisions and amendments or substitutes, which apply at the time of installation.

- Building Regulations.
- Local Authority Bye-Laws, Regulations and Notices.
- The local Fire Authorities requirements.
- The relevant C.I.B.S.E. requirements.
- British, Irish and EU Standards, whether applicable in part or whole.
- Relevant British Standard Codes of Practice. BS 7671: 2008, Requirements for Mechanical, Electrical and Lift Installations
- ETCI: National Rules for Electrical Installations: IS10101
- ISEN62305: 2006 Code of Protection against lightning
- BS 848 Method of testing performance.
- Fire tests on building materials and structures
- BS 5274 Requirements for fire hose reels in fixed installations.
- BS 5432 Specification for portable metal bodies fire extinguishers.
- I.C.P 3 & 4 Codes of Practice for piped natural gas installations in buildings.
- DW 144.2 Codes of Practice for low pressure ventilation ducting and fittings
- DW 172 Codes for Kitchen Ventilation Systems
- BS 5750 Specification for design, manufacture, installation, final inspection
- BS 848 Method of testing performance.
- CIBSE CC A Air Distribution Systems - CIBSE Commissioning Code A. 199
- CIBSE CC B Boilers - CIBSE Commissioning Code B. 2
- CIBSE CC C Automatic Controls - CIBSE Commissioning Code C.
- CIBSE CC M Commissioning Management - CIBSE Commissioning Code M.
- CIBSE CC R Refrigeration Systems - CIBSE Commissioning Code R.
- CIBSE CC W Water Distribution Systems - CIBSE Commissioning Code W
- TM 13 CIBSE TM13 Minimizing The Risk of Legionnaires' Disease.
- CIBSE C CIBSE Guide C - Reference Data 2007
- Non domestic Gas Installations: I.S.820:2000
- Domestic Gas Installations: I.S.813:2000
- F-Gas Regulations

C GENERAL CONDITIONS OF CONTRACT

C.1 EXTENT OF WORK

The works involve the following:

New Mechanical Services fit out of an extension to First floor unit which will be completely refurbished. The fit out will be for Corlann Ireland. The services to be supplied and installation include the following:

- Partial Strip out and removal of existing Services
- Air conditioning
- Ventilation
- Water Services
- Above ground drainage
- Controls

The contractor is required to visit the existing site during the tender period to determine the full extent of services already installed.

C.2 FREEDOM OF INFORMATION

Information in relation to this tender may be made available on demand in accordance with Freedom of Information Act 2003. You are asked to consider if any of the information supplied by you in the tender should not be disclosed because of its sensitivity. If this is the case, you should, when providing the information, identify same and specify the reasons for its sensitivity. The Client will consult with you about sensitive information before making a decision on any Freedom of Information request received.

If you consider none of the information supplied by you as sensitive, please make a statement to that effect. Such information may be released in response to a "Freedom of Information Request.

C.3 DEFINITIONS

In reading this Specification, or any other tender documentation including drawings, the following terms shall have the accompanying meanings assigned to them:

Throughout this document the term "Client" shall be deemed to refer to:

Name: Corlann Ireland

Address: Banner House, Ennis

Throughout this document the term "Architect" shall be deemed to refer to:

Name: Ian Sheehy

Address: Bansha, Askeaton, Limerick

Throughout this document the term "Engineer" shall be deemed to refer to:

Name: Moloney Fox Consulting,

Consultant Address: 46 O'Connell Street, Limerick

C.4 CONTRACT TYPE – PUBLIC WORKS

GCCC Form of Contract

The Main Contract Form shall be the current version of the Minor Public Works Contract reference PW-CW6 as published by the Department of Finance.

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

C.5 AWARD OF CONTRACT

Contractors will not be remunerated for any trouble or expenses they may incur in making up their tenders. It is the responsibility of prospective tenderers to obtain for themselves, at their own expense, any additional information necessary for the preparation of their tender.

The award of contract will be made at the discretion of the client and will be made to the contractor whose tender has determined to be the most economically advantageous tender and who meets the required standards capability and financial responsibility.

C.6 BILL OF QUANTITIES

The completed Bill of quantities shall be furnished by the successful tenderer within 7 days. The bill shall list separately the material costs and labour costs.

C.7 CHANGE ORDERS / CHANGE OF REQUESTS

No addition will be made to the Contract Sum if the tenderer has failed to ascertain, before tendering, all the requirements for carrying out the works, which inspection of the Site or of the Specification and Tender Drawings would have disclosed.

No change will be made to the Contract sum unless the variation is authorized by an instruction from the Client's Representative.

Within 14 days of the date of issue by the Client's Representative of any instructions varying the content of the Contract works, submit such pricing information to the Consultant M & E Engineer as he requires. Variations shall be valued in accordance with the Valuation Rules of the Contract, excepting that, where work is omitted, it shall be fully measured, and the quantities priced at the unit rates included in the Schedule of Rates or Tender Summary, as appropriate.

The Contractor's price is lump sum fixed price, there will be no variations to the Contract Sum, unless additional works are instructed by the Employer's Representative

C.8 VALUATIONS FOR INTERIM CERTIFICATES

At the time of every valuation of the works for interim certificates, submit to the Consultant Engineer a statement showing:

- a. The gross amount (including retention) claimed in the current application.
- b. A detailed breakdown of the amounts allocated to each section of the contract Works as detailed in the Tender Summary, and the relevant amount claimed for each section.
- c. The amount certified to date by the Clients Representative. Statements shall not include any equipment or material stored off site.
- d. Amounts in terms of valuations shall not be included unless these statements are issued by the Contractor.

C.9 LOCAL LABOUR

The contractor shall insofar as practicable and without affecting the efficiency of the work employ locally as deemed necessary.

C.10 PHASING OF WORKS

The contractors shall co-ordinate their programme of works in line with the main contractor's programme. The sub-contractors shall produce a sub contractor's programme in line with the main contractor's programme.

D STANDARDS, REGULATIONS & DIRECTIVES

D.1 STANDARDS

The whole of the installation carried out under this contract must comply with the following regulations and requirements, together with the latest revisions and amendments or substitutes, which apply at the time of installation.

General:

- Current Building Regulations, Ireland (Dept. of Housing, Local Govt & Heritage)
- Local Authority Bye-Laws, Regulations and Notices.
- The local Fire Authorities requirements.
- All relevant C.I.B.S.E. requirements including CIBSE Guides, Application Manuals, Commissioning Codes, and Technical Memoranda
- Irish, EU, & British Standards, whether applicable in part or whole.
- NSAI National Rules for Electrical Installations, IS10101.
- Construction Products Regulation (CE Marking)

Water Services:

- Irish Water Code of Practice for Water Infrastructure
- IS EN 806-1 Water for Human Consumption
- BS 8558 Domestic Water Services in Buildings
- WRAS Water Regulations Approval Scheme
- HSPC National Guidelines for the Control of Legionellosis in Ireland
- CIBSE TM13 Minimizing The Risk of Legionnaires' Disease.
- CIBSE Commissioning Code W: Water Distribution

Ventilation & A/C (Refrigeration):

- BESA DW144 Sheet Metal Ductwork
- BESA DW143 Ductwork Testing
- BESA DW145 Installation for Fire and Smoke Dampers
- BESA DW172 Kitchen Ventilation Systems
- BESA RAC80 DX Airconditioning & Heat Pump Equipment
- BS9999 2017-Fire Safety in the design management and use of buildings COP
- BS5588-9 Code of Practice for ventilation & A/C Ductwork
- IS EN 15650-2010 Ventilation for Buildings - Fire Dampers
- IS EN 15423:2008 Fire precautions for air distribution systems in buildings
- F-Gas Regulations
- CIBSE Commissioning Code A: Air Distribution Systems
- CIBSE Commissioning Code R: Refrigerating Systems

Gas/Oil

- Non domestic Gas Installations: I.S.820:2019
- Domestic Gas Installations: I.S.813:2014 + A1 2017
- Registered Gas Installers of Ireland (RGI) Technical Guidance Document
- Institute of Gas Engineers & Managers (IGEM) UP Series Guidance

Protective Services

- IS EN 671: Fixed Fire-Fighting Systems (Hose Reels)
- IS 291: Selection, Commissioning, Installation of Portable Fire extinguishers
- IS EN 12845: Fixed firefighting systems. Automatic sprinkler systems.

Heating Systems & Controls

- I.S. EN 15450 – Design of Heat Pump Heating Systems
- BS 6880-1:1988 Code of practice for LTHW heating systems >45kW
- IS EN 12098 Control equipment for hot water heating systems
- IS EN 442-1 2014-Radiators and convectors
- CIBSE Commissioning Code B: Boilers
- CIBSE Commissioning Code C: Automatic Controls
-

D.2 HEALTH & SAFETY

The Contractor shall take account of the general principles of prevention as stated below:

- Safety Health and Welfare at Work (Construction) Regulations, 2013
- Health and Safety Authority: "Guidelines to the Safety Health and Welfare at Work (Construction) Regulations, 2005".
- Architects Council of Europe: "Memorandum on Council Directive 92/57/EEC", January 1994.
- Construction Industry Research and Information Association: "Control of Risk: A Guide to the Systematic Management of Risk from Construction", Report FR/CP/32, 1995.

D.3 WORK SAFETY PROTOCOL (COVID 19)

The project will be subject to the requirements of the Work Safely Protocol (the "Protocol"), published jointly by the Department of Business, Enterprise and Innovation and the Department of Health in consultation with the Labour Employer Economic Forum on 9th May 2020

The contractor shall include in their tender for the following in their tender:

- Augmenting site infrastructure and welfare facilities such as toilets, canteen, isolation spaces, and access, egress, and circulation routes to meet the standards set out in the Protocol.
- Cleaning to the standard required in the Protocol.
- Covid-19 supervisor role(s) as necessary to meet the requirements of the Protocol.
- Covid-19 Personal Protective Equipment (PPE) to meet the requirements of the Protocol.
- Social distancing to meet the requirements of the Protocol.

The contractor shall include realistic prices in their tender against these items. The contract sum will be deemed to include for the implementation of all measures - including hygiene, access management, materials procurement and delivery, work sequencing and work practices - required to construct the work safely and to minimise the risk of disease contagion for the Contractor's Personnel, the Employer's Representative, Employer's Personnel and third parties visiting the site.

Should there be a reason to impose greater restrictions on movement to combat any significant increases in the spread of the virus to the extent that construction activities cease in the manner imposed between 28 March 2020 and 18 May 2020, the contractor is entitled to an extension of time in accordance with the form of tender and schedule, part 1K (PW-CF1 to PW-CF5, or sub-clause 2.7 of CW-PF6), but no financial recompense.



Where the project involves an extension and/or alterations to an existing building, additional precautions will be required in relation to Covid-19 to ensure the safety of occupants of the existing building. Such precautions would involve, at a minimum, maintaining social distancing between Contractor's personnel and other personnel, wearing of appropriate PPE and sanitizing any work areas in the existing building on a daily basis.

E MECHANICAL TENDER SPECIFICATION

E.1 PROTECTIVE SERVICES

E.1.1 FIRE EXTINGUISHERS - GENERAL DESCRIPTION

The Fire Fighting services scope of works for this project includes the following

- Supply and installation of 2kg CO₂, 6kg Fluorine Free Foam, and 6kg Dry Powder ABC type fire extinguishers, complete with suitable fire point signage and support brackets in locations identified on the drawings
- Supply and Install Fire Blankets as indicated on the drawings

The contractor shall employ a protective fire equipment specialist to supply, install, commission, and certify the fire extinguisher installation in the building.

The quantity and location of extinguishers on the drawings are indicative for pricing purposes.

The contractors' specialist shall confirm the final location and types of all Portable Fire Extinguishers and advise the Consulting Engineer of any recommended changes required to meet current standards and recommendations, prior to installation of the extinguishers.

The contractor shall include for the supply and installation of Fire Extinguishers in accordance with IS219 2015, in particular:

- Located where they will be readily seen and available for use by persons following an escape route in the event of fire and mounted using brackets, cabinets or stands which are fit for purpose
- Located along the normal paths of travel including near exits, corridors, staircases, lobbies, and landings
- Sited within 20m from any point (Class B) or 30m (Class A)
- Sited near special fire risks but not to be inaccessible in the event of fire
- With carrying handle no more than 1m from the floor.

TYPE F1 – SFFF FOAM EXTINGUISHERS (Synthetic Fluorine-Free Foam)

Specification

Capacity: 6 litre

Fire Rating: 27A / 144B

Weight: 9.3kg

CE certified

Kitemarked

Design standard: BS EN 3

Type: Stored pressure

Charge: Environmentally Friendly PFAS Free Foam Concentrate

Finish: Epoxy polyester gloss red

Valve: chrome plated brass/ black steel levers

Delivery hose: Black reinforced PVC

Dimensions: 501mm High x 198mm Wide (160mm diameter)

TYPE F2 - CO₂ EXTINGUISHERS

Specification

Capacity: 2kg

Fire Rating: 34B

Duration: 12 seconds
Weight: 5.5kg
Carton size: 570x185x140
CE certified
Kitemarked
Design standard: BS EN 3
Cylinder: BS 5045 Part 3
Safety Disc: 180/190 bar
Fill Ratio: 0.667
Material: Aluminium Alloy 6082 BS 1474
Finish: Epoxy polyester gloss red
Valve: chrome plated brass/ black steel levers
Dimensions: 515mm x 170mm

TYPE F3 - DRY POWDER EXTINGUISHERS

Specification
Capacity: 6kg
Fire Rating: 27A / 183B
Duration: 15 seconds
Weight: 9.95kg
Carton size: 500x190x160
CE certified
Kitemarked
Design standard: BS EN 3
Type: Stored pressure
Working pressure: 13.5 Bar
Charge: ABC multi-purpose dry powder
Cylinder: Steel to ISO 3574: CR4
Finish: Epoxy polyester gloss red
Valve: chrome plated brass/ black steel levers
Delivery hose: Black reinforced PVC
Dimensions: 490mm x 185mm
Transportation Classification: Nonflammable, non-toxic gas
Class No. 2.2
Un No.1044

TYPE F4 – WET CHEMICAL EXTINGUISHERS

Specification
Capacity: 6litre
Fire Rating: 13A / 113B / 75F
Duration: 35 seconds
Weight: 10.5kg
Carton size: 575x175x175
CE certified
Kitemarked
Design standard: BS EN 3
Type: Stored pressure
Working pressure: 13.5 Bar
Charge: 6 ltr Wet chemical
Cylinder: Steel to ISO 3574: CR4
Finish: Epoxy polyester gloss red

Valve: chrome plated brass/ black steel levers

Delivery hose: Black reinforced PVC

Dimensions: 550mm x 162mm

Transportation Classification: Non-flammable, non-toxic gas

The Mechanical Services contractor shall supply, deliver, and install in the positions indicated on the drawings CO2, Foam or Dry Powder fire extinguishers of a capacity and type stated above.

The extinguishers shall be of the trigger release type painted red and manufactured in accordance with BS EN 3:1996. A zone of colour of up to 5% of the external area, positioned immediately above or within the section used to provide the operating instructions, may be used to identify the type of extinguisher. This zone should be positioned so that it is visible through a horizontal arc of 180° when the extinguisher is correctly mounted. The colour-coding should follow the recommendations of British Standard 7863

The extinguishers shall be installed wall mounted using good quality wall support brackets.

All Fire extinguisher locations to be complete with wall mounted fire point signage and fire extinguisher type notices.

Maintenance Schedule

On completion of the installation the Mechanical Services Installer shall hand over the Contract Administrator, under cover of signature, a log book containing individual maintenance check sheets (in plastic pockets) for each of the extinguishers installed complete with details of the extinguisher, location, and date of installation

In addition to the check sheets the log book shall contain a drawing of the premises reduced to A4 or 'pull-out' A3 indicating the position of all extinguishers together with the recommended maintenance regime

E.1.2 FIRE BLANKETS

The Mechanical Services Installer shall supply, deliver and install in the positions indicated on the drawings fire blankets of the type stated in Part F of the Specification Document or on the Contract drawings to BS 7944:1999 and BS EN 1869:1997.

E.2 HOT & COLD WATER SERVICES INSTALLATION

E.2.1 GENERAL DESCRIPTION

The Water services scope of works for this project includes the following:

- Strip out and removal of some elements of the existing installation.
- Supply and install new water services to new staff canteen as indicated and specified on the drawings
- Test and commission new installations

E.2.2 WATER SUPPLY (WATER FITTINGS) REGULATIONS

The Mechanical Services Installer is to give the Local Water Authority reasonable access to inspect the installations as it proceeds to ensure that current Water Supply regulations are complied with.

The whole of the work shall be carried out in accordance with the Water Supply Authority requirements and the installer shall include the cost of the testing, stamping or other charges which the Water Authority may request.

E.2.3 MAINS & COLD WATER

All new Mains water and hot and cold water services pipework internally shall be copper. Contractor is to connect to the existing pipework as indicated.

E.2.4 COLD WATER STORAGE TANKS

The Mechanical Services Installer shall supply, deliver, and install cold water storage tanks of the type and capacity indicated on the drawing(s) and/or Part F of the Specification Document, with secure cover.

The tanks shall be constructed in accordance with the appropriate Irish, European & British Standard Specification and Local Water Authority Requirements.

All connections to the tanks shall be made by means of screwed bosses or flanges welded on. Each tank provided shall comply with BS 4213:1991 and BS EN 13280:2001 and shall be fitted with a drain cock and ball valve suitable for the available water pressure, together with an overflow discharging outside the building. The overflow discharge shall be fitted with a wire guard or hinge flap to prevent the entry of birds, insects, vermin, etc.

The Mechanical Services Installer's attention is drawn to the Water Authority's requirements regarding the relative levels of the overflow and ball valve in order to avoid contamination of the mains water supply.

Unless otherwise stated, all tank supports, and bearers will be supplied and fixed by the Main Contractor.

E.2.5 HOT WATER CALORIFIER

These will be as indicated & scheduled on the drawings or part F of the Specification Document.

E.2.6 THERMOSTATIC MIXING VALVES & ASSOCIATED EQUIPMENT

The Mechanical Services Installer shall supply, deliver, and install thermostatic mixing valves and associated equipment in accordance with Part F of the Specification Document and design drawing(s).

Mixed water outlet temperatures from thermostatic mixing valves shall be set by the installer in accordance with the following table: -

Fitting	Location	Draw-off Temperature
Basin (Standard)	Staff W.C.'s	42°C
Basin (Spray)	Public W.C.'s	42°C
Cleaners Sink	Cleaners Stores	60°C
Slop Hopper/Sluice	Sluice Rm/Toilets	60°C
Sink Unit	Public	42°C
Sink Unit	Staff	60°C
Bucket Tap	Toilets/Kitchens	60°C
Showers	Public	42°C
Foot Baths	Swimming Pools	42°C
Baths	Bathrooms	42°C
Sinks	Kitchen & staff area	60°C
Basins	Bedrooms	42°C
Baths	Residential areas	43°C
Showers	Residential areas	43°C

The valves shall have chromium plated finish and be complete with non-return valves and strainers on the hot and cold inlet connections when required.

Mixing valves shall have lockable temperature controls and shall be provided with loose keys, which shall be handed to the Contract Administrator upon contract completion.

The mixing valves and associated equipment shall be securely fixed to the fabric of the building and care must be taken to fix them in such a manner that they do not constitute a danger to the occupants.

Mixing valves must be type TMV 3 conforming to Building Regulations Part M unaffected by fluctuations in water pressure and shall 'fail safe' if the cold water supply fails.

E.2.7 THERMOSTATIC SHOWERS

The Contractor shall supply and install thermostatic mixing showers as indicated on the drawings. They shall be chrome finish unless indicated otherwise.

Thermostatic Showers shall be factory set to a maximum temperature of 41°C. The shower mixers shall be suitable for either high or low pressure (between 0.1 to 5 bar) .

Controls shall be by means of a combined flow and temperature handle. Supply and install flow limiters for use in cases of high or unequal pressures.

The shower mixers shall be fitted with in-built dirt strainers and non-return valves

The contractor shall supply and install associated Shower Head and Rail with each shower mixer.

For Each shower head to be installed, the contractor shall supply the client with an additional spare shower head for maintenance/servicing. The spare shower heads shall be fitted with a different colour insert to differentiate both sets of shower heads.

E.2.8 THERMOSTATIC TAPS

The Contractor shall supply and install thermostatic taps as indicated on the drawings. They shall be chrome finish unless indicated otherwise on the drawings.

Thermostatic taps shall be factory set to a maximum temperature of 42°C. The taps shall be suitable for either high or low pressure (between 0.1 to 5 bar).

Controls shall be by means of a combined flow and temperature handle. Supply and install flow limiters for use in cases of high or unequal pressures.

The taps shall be fitted with dirt strainers and non-return valves

E.2.9 COPPER PIPE & FITTINGS

All copper pipes and fittings shall be in accordance with BS EN 1057:2006 + A1 2010, BS EN 12449:1999; and BS EN 12451:1999. Fittings for copper pipes shall be in accordance with BS EN 1254-1- 5:1998 and all amendments.

When used for external underground mains, copper tube shall be fitted in straight lengths only not exceeding 6 metres and care taken that the ends are not distorted prior to fittings being attached.

All copper pipes in the boiler house shall be flanged on sizes 65mm and greater and including smaller sizes where indicated on the drawing.

Copper pipes above ground shall be to BS EN 1057:2006 + A1 2010 type R250 (Half Hard) with a Tensile Strength of 250MPa

Soft Copper pipes below ground (where indicated) shall be to BS EN 1057:2006 type R200 (Annealed) and be supplied as PVC covered coils

Generally above ground levels where pipes are visible in rooms and appearance is of utmost importance, the fittings to be used on light gauge copper tubing shall be Yorkshire capillary type copper fittings and shall be of a single manufacture throughout the installation.

Fittings shall be made up using the correct Tin / Silver solder and flux with both tube and fitting clean both before and after soldering.

Fittings shall be in accordance with BS EN 1254-1: 1998; BS EN 1254-2: 1998, AMD 5097, 1986, AMD 5651, 1987, AMD 7067, 1992 and installed as detailed above in the General Clause. 'End feed' copper fittings installed in strict accordance with the manufacturer's recommendations are also acceptable. All fittings to be Local Water Authority approved and carry the appropriate Kite mark.

Cold water mains and tank where fitted in ducts, trenches voids or ceiling voids in proximity to heating or domestic hot water services, must be insulated to clauses relating to insulation in order to obviate condensation.

All cold water pipework must be insulated as indicated in this tender Specification Document and thoroughly protected against possible frost damage.

All external mains to be laid to minimum depth of 750mm and maximum 1,350mm on graded bed with graded backfill of inert material.

E.2.10 MULTILAYER PEX/ALU/PEX PIPE & FITTINGS

Multilayer PEX/ALU/PEX pipe shall be of Polytherm "Presstite" manufacture, multilayer cross-linked polyethylene/aluminium barrier pipe unless stated otherwise or equal and prior approved.

The pipework and fittings manufacturer shall be ISO 9001 certified. Multilayer piping systems shall be in accordance with ISO 21003 2008, Parts 1,2,3,5 and 7.

The pipe shall have the following layers (inside to out): PE-Xc, Adhesive, Aluminium, Adhesive, PE-X external coating. The internal aluminum band shall be butt welded, not overlapped, and provide a 100% oxygen tight barrier.

The pipework and jointing system shall be WRAS approved, and suitable for potable water, heating, and sanitary installations.

Fittings shall be from the same manufacturer as the pipework itself. Fittings shall be dezincified brass bodied with a stainless steel sleeve and shall be compressed onto the pipe using an electric powered press-fit tool approved by the pipe & fittings manufacturer. Fittings shall have a viewing window to facilitate control of pipe depth. All materials in contact with water shall comply with DVGW W 534 and DVGW W 270.

Internal pipe surface roughness shall be no greater than 1.5 micrometres. Maximum operating temperature of the pipework & fittings shall be 95°C, and maximum operating pressure 10 bar.

Install pipework and fittings in accordance with manufacturer's instructions to allow for linear expansion. Pipes must not be installed directly in plastered walls but must be fitted with a sleeve.

Maximum distances between pipe fixings/supports for multilayer pipes shall be as per the manufacturer's recommendations, but in any event no greater than 1m for pipes up to 32mm diameter. Pipes should be fixed within 300mm either side of a 90° bend.

Install expansion loops at intervals where recommended by the manufacturers instructions.

When making connections between pipes or fittings, ensure the following:

- Pipe ends are cut square
- Pipe ends are deburred using a deburring tool and bevelled
- Ensure the fitting is clean and push in pipe into the end
- Close the press-fit jaw and activate the gun in accordance with manufacturer's instructions

Ensure that all personnel making press-fit connections are adequately trained. Ensure that press-fit tools are calibrated as per manufacturers recommendations.

E.2.11 THERMAL BALANCING VALVES

Where indicated on the drawings, thermal balancing valves shall comply with the following:
The valve shall be capable of carrying out the following functions: -

Hydronic balancing of the DHW secondary circulation:

The valve shall be supplied with a regulation device with visible markings.

Automatic thermal regulation & balancing of the DHW secondary circulation

The valve shall be set to control the temperature of the DHW secondary return water at 57 degrees. The function of the valve will automatically increase or decrease the flow in proportion with the water temperature being sensed by the thermostat contained within the valve. The valve will always maintain a minimum nominal flow rate to ensure that no "dead legs" are present in the installation. A lockshield cap with sealing wire shall be fitted to prevent unwanted adjustment.

Automatic system pasteurisation

The valve shall allow automatic system pasteurisation to be periodically carried out. To achieve this, the hot water stored temperature must be elevated. Once the thermostatic regulation device senses that the temperature of water flow is 6k above the valve set point, the valve will open further to allow the flow rate to increase and allow elevated water temperatures around the DHW secondary circulation pipework. When the water temperature reaches 73 degrees the valve will return back to its thermal regulation mode and reduce the flow of water back to the minimum flow rate thereby allowing other points of the system to be pasteurised.

Isolation

Isolation is to be achieved by use of a DRV facility

Temperature measurement

The valve shall be equipped with a thermometer to show the water temperature.

Drain

The valve shall be equipped with a drain point with a hose union connection.

Insulation

The valve shall be supplied complete with a purpose made pre-formed thermal insulation lagging jacket.

Manufacturer: Oventrop GmbH & Co. KG
Model Ref's: - Aquastrom T Plus

E.2.12 POSITIONS OF MAINS IN DUCTS

The positioning and arrangements of pipework in ducts, chases, false ceilings, and roof spaces shall be in accordance with the Contract Drawings.

E.2.13 PIPE SUPPORTS

The whole of the pipework shall be supported on non-ferrous rings or similar pipe brackets as detailed on the Contract Drawings or as indicated in Part F of the Specification Document, rigidly fixed to the fabric of the building but allowing the pipework to move under conditions of expansion and contraction. These brackets shall be fitted in accordance with the appropriate drawing and table indicated elsewhere.

It must be noted that ferrous supports, thimbles or sleeves shall not be in contact with the water supply installation. Where screw-on brackets are required, brass back plate male together with single pipe ring by Yorkshire or approved equal are to be used.

The spacing of pipe supports shall not exceed the centres given in the table below:

Pipe Supports - Copper Pipework

Size	Uncovered	Insulated
15mm	1.200 m	1.200 m
22mm	1.800 m	1.500 m
28mm	2.400 m	1.800 m
35mm	2.400 m	1.800 m
42mm	3.000 m	2.400 m
54mm	3.000 m	3.000 m
76mm and over	3.600 m	3.600 m

Where plastic pipelines incorporate metal valves of other heavy fittings it is essential to support and valves directly rather than allow their weight to be carried by the plastic pipe. For the same reason it is usually advisable to fix pipe supports on either side of flanged connections, especially where metal backing plates are used. Moulded plastic fittings should also be supported.

Pipe Supports – Plastic Pipework

Maximum recommended horizontal support distance for Plastic pipes in above ground installation: -

Nominal Bore All Classes 20°C.

15mm	0.600 m
20mm	0.680 m
25mm	0.762 m
32mm	0.840 m
40mm	0.9 m
50mm	1.07 m
65mm	1.22 m
80mm	1.37 m

For vertical installation of plastic pipes, the above support distances may be doubled.

NOTE: Where normal ambient or working temperature exceeds 20°C the support distances should be reduced. Continuous support is required where temperatures approach 60°C.

E.2.14 VALVES & STOP COCKS

Valves and Stop Cocks shall be provided in the positions shown on the drawings. Stop Cocks must be provided on all the branches to sanitary fittings etc. Valves to single sinks to be ballfix with screwhead, or Pegler ref: 808.

Where a header is provided to supply a range of sanitary fittings, a stop cock shall be fitted on the branch feeding header.

Isolation Valves:

Full flow 1/4 turn lever ball valves up to and including 50mm. DZR body, chrome plated full bore ball, PTFE seats and stem seal. BS EN 13828. BSP ended. OVENTROP REF:107 90. (Or equal and prior approved)

Regulating Valves:

“Hydrocontrol VTR” Double regulating valves up to and including 50mm. Bronze body & bonnet, DZR stem & disc, PTFE disc seal. BS 7350. BSP Ended OVENTROP REF: 106 01. (Or equal and prior approved)

Strainers:

Bronze 'Y' type strainer up to and including 80mm. BSP Ended
OVENTROP REF: 112 00. (Or equal and prior approved)

Drain Cocks:

All low points which will not automatically drain through draw off points shall be fitted with screw down drain cocks.

Specification: "Y" type drain valve.

OVENTROP REF: 168 52 04 (or equal and prior approved)

E.2.15 CHECK VALVES

The Mechanical Services Installer should note that to comply with the Water Supply (Water Fittings) Regulations 1999, check valves must be installed in the supply pipe connection serving all Equilibrium Ball Valves.

The valve shall be installed between the Equilibrium Ball Valve and isolating stop cock and must be fitted strictly in accordance with the manufacturer's instructions.

E.2.16 UNIONS

Sufficient unions must be inserted in the pipework to facilitate the easy disconnection of any section of the pipework without disturbance to the fabric of the building.

E.2.17 SLEEVES

Where copper pipes pass through floors, walls, partitions, etc., non-ferrous metal sleeves must be provided with ends neatly finished off flush with the surface so that the tubes may be withdrawn without disturbance to the fabric of the building with cover plates, as directed.

Where pipes pass through Fire Compartment Walls, fire stop precautions shall be required as denoted in Building Regulation B3 Section 11 and BS 476 Part 20

E.2.18 DEZINCIFICATION

All fittings used in conjunction with the hot and cold water services shall be manufactured from a "non-dezincification" alloy.

E.2.19 TERMINATION POINTS

The installation shall be connected direct to all outlet points unless stated otherwise on the Contract Drawings.

E.2.20 URINALS

All supplies to such appliances to be controlled by means of "miser valve" or equal approved controller to eliminate excessive use of water consumption.

E.2.21 'DRINKING WATER' LABELS (MAINS SUPPLY)

The Mechanical Services Installer shall provide at each drinking water point, 1no 75mm x 50mm label marked 'DRINKING WATER' fixed to wall with 4 No. brass screws. The labels shall be of the black on white 'Traffolyte' type.

E.2.22 'NOT DRINKING WATER' LABELS (TANK SUPPLY)

The Mechanical Services Installer shall provide at each tap supplied from the cold water tank service, 1no 75mm x 50mm label marked 'NOT DRINKING WATER' fixed to wall with 4 No. brass screws. The labels shall be of the red on white 'Traffolyte' type.

E.2.23 TEMPERATURE GAUGE PROVISION

To assist in the control of Legionella bacteria in water systems the Mechanical Services Installer shall provide, where indicated on the Contract drawings, pipe pockets for the later addition of temperature gauges.

E.2.24 CHLORINATION

In accordance with BS 6700, when the installation is completed, it shall be thoroughly flushed out and then filled with water dosed with 10 parts per million of chlorine. This water shall be allowed to stand in the system for a period of not less than 4 hours when tests for residual chlorine will be made at selected points including terminal points and wash out positions.

The tests must show at least 0.2 parts per million of residual chlorine. On successful completion of this test, the main must be well flushed out with clean water and left filled.

Results of analysis of water samples for hot and cold water systems shall be forwarded to Contract Administrator prior to practical completion.

The Mechanical Services Installer is at liberty to have this work carried out by a specialist contractor, but its costs must be included in the tender and Certificate that it has been done must be supplied.

E.2.25 TESTING ON COMPLETION

On completion of the installation, and before the issue of the Certificate of Practical Completion the Mechanical Services Installer shall carry out time and temperature draw off tests to ensure all risks of legionnaire's disease are eliminated.

GENERAL TESTING & COMMISSIONING OF WATER SYSTEMS

Testing

Pressure test all water services pipework

Operating gauge pressure less than 3.5 bar, test gauge one and a half times operating pressure.

Operating gauge pressure 3.5 - 7.0 bar, test gauge pressure twice operating pressure.

For below ground pipework test to 7 bar or twice the working pressure (whichever is the greater) for 4 hours.

Comply with procedures given in 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.

Test concealed or buried pipework before any permanent covering is applied.

Advise appropriate personnel, in advance, of the time pressure tests may be witnessed.

Carry out Hydraulic Pressure Testing as described in HVCA Guide to good Practice for Site Pressure Testing of Pipework. Test section by section for one hour, as the work proceeds and prior to application of thermal insulation.

Keep record of pressure tests and issue them to the Employer's Representative and include them within the handover documentation.

Commissioning

Commissioning codes

Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the HTM technical memorandums, (HTM:04-01 The control of Legionella hygiene, "safe" hot water, cold water and drinking water systems, Part A), BSRIA Application Guides for water systems and air systems to achieve the standards set in the CIBSE Commissioning Codes.

Preliminary checks

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

Use pre-commissioning checklist from BSRIA Application guide 2/89.

Setting to work and regulation

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

Measurement

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

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

Performance test records

Keep a systematic record of tests. Include the test record with the O & M's

Flushing

Carry out flushing of water systems in accordance with BSRIA Application Guide 1/2001 Pre-commission cleaning of pipework systems.

All water used for pressure testing, flushing and system filling is of good quality.

Leave remaining pipework sections full and treated after pressure testing.

Install all necessary pipework ancillaries to enable a Specialist to carry out flushing,

inspection and witnessing of water systems in accordance with BSRIA Application Guide AG 1/2001. Pre-commission cleaning of water systems.

Temporary connection from the mains must be in compliance with the Water Supply Regulations, or by installation of a temporary tank and pump arrangement. Domestic water systems are to be flushed and disinfected in accordance with the requirements of BS 6700, and to the satisfaction of the local water supply authority. Flush systems using mains water until the water is clear.

Witnessing

When the system has been cleaned, obtain written confirmation from the Employers Representative that the system, including water storage tanks has been inspected. If the system is found to be dirty at any stage after the cleaning has taken place, then the Contractor shall re-clean and sterilise the system unless a signed witnessing certificate is produced.

Chemical cleaning and solids removal

Carry out chemical cleaning procedure in accordance with BSRIA Application Guide 1/2001 *Pre-commission cleaning of pipework systems*.

Sterilization – General

After flushing process, carry out sterilization in accordance with BS 6700. Prior to sterilization ensure each system is flushed, cleaned and drained. Provide temporary connections to system terminal points suitable for introduction of sterilization chemicals and fluids and 22mm minimum valved drain connection on incoming main immediately downstream of mains isolating valve. Fill system with clean, fresh water.

Sterilization - Mains Water System

Carry out the following operations in accordance with BS 6700. Flush system and introduce sterilisation chemical. Take samples from all sentinel points to ensure correct chlorine concentration. Leave system to stand for period of time indicated. Repeatedly flush system with clean water until all traces of chlorine have been removed - leave system filled. Submit samples to registered laboratory for microbiological analysis and report. Immediately prior to handover, retake samples and submit for analysis and report.

Sterilization - Water Storage Systems:

Carry out the following operations in accordance with BS 6700 and Health and Safety Executive Approved Code of Practice and Guidance - Legionnaires' disease - control of legionella bacteria in water systems.

Carry out operations on all water storage tanks and cisterns, cold and hot. Carry out procedures as for mains water systems.

Documentation:

Within handover documentation include the following:

Certificate confirming that the water systems have been cleaned, sterilised and tested
Details of routine cleaning and sterilisation required that will be required by the end user.

E.3 SOILS & WASTES SERVICES

E.3.1 GENERAL DESCRIPTION

The Soils and Waste services scope of works for this project includes the following:

- Strip out and removal of existing above ground drainage services to sink in training room.
- Supply and install soils and waste services to new Canteen as indicated and specified on the drawings.
- Supply and install new condensate drainage services to Air conditioning services.
- Test and commission new installations

The internal sanitary plumbing installation is to be installed so as to comply with the recommendation of BS EN 12056-2:2000, BS EN 1329:2000 and BS 4514:2001.

The pipework and fittings shall be of one manufacturer and shall be installed entirely in accordance with their recommendations.

Wastes from sinks and basins shall be solvent welded MuPVC, and from W.C.'s and overflows shall be solvent welded PVC-U, sizes as detailed in Part F of the Specification Document and indicated on the Contract drawings.

All above ground waste pipework in commercial kitchens / Canteen areas / Survey areas shall be completed in HDPE pipework with solvent welding throughout. HDPE pipework to be resistant to temperatures of up to 90degC continuous and 100degC for short periods of time. HDPE pipework to UV resistant, have high impact resistance, internal smooth bores and non-toxic in the event of fire. HDPE pipework to be compliant with DIN EN 1519 and DIN 19535 Part 2

E.3.2 SANITARY PIPEWORK ABOVE GROUND

General sanitary pipework for WC rooms, Toilet suites, shower room and washrooms

Pipework systems to be completed 'Wavin Compact Soil Pipe' for pipe and fittings as described herein.

- The Compact Soil pipe 'Wavin Compact Soil Pipe' shall be structure wall construction manufactured in accordance with EN1453-1:2000, and comprising PVC-U smooth internal and external layers with 50% recycled PVC-U core.
- The Compact Soil pipe 'Wavin Compact Soil Pipe' shall have the following dimensions:

Nominal Diameter (mm)	Wall Thickness (mm) Minimum	Wall Thickness (mm) Maximum	Average Weight (Kg/m)
110	3.2	3.5	1.64
160	3.2	3.8	2.44

- The Compact Soil pipe 'Wavin Compact Soil Pipe' shall be either plain ended solvent weld system or have a single socket complete with a fixed ring-seal system.

- The Compact Soil pipe 'Wavin Compact Soil Pipe' shall bear a Quality Mark designation such as the Kitemark or equivalent, with accompanying certification demonstrating third party independent conformance to EN1453-1:2000.
- The accompanying Compact Soil fittings 'Wavin Compact Soil Fittings' shall be PVC-U solid wall construction manufactured in accordance with BS EN1329-1:2000.
- The Compact Soil fittings 'Wavin Compact Soil Fittings' shall be compatible for use with 'Wavin Compact Soil Pipe' in either solvent weld or fixed ring seal system in nominal diameters 110mm and 160mm.
- The Compact Soil fittings system 'Wavin Compact Soil Fittings' shall have bossed connectors for 50mm waste pipe and adaptors for 32mm and 40mm respectively, with keyway to ensure fall in waste pipe and include 6 bossed manifold fitting.
- The Compact Soil fittings 'Wavin Compact Soil Fittings' shall bear a Quality Mark designation such as the Kitemark or equivalent, with accompanying certification demonstrating third party independent conformance to BS EN1329-1:2000.
- The Compact soil pipe system 'Wavin Compact Soil System – Pipe & Fittings' shall be colour Olive and manufactured in accordance with Quality Management System IS EN ISO 9001: 2008 and Environmental Quality System IS EN ISO14001: 2004.

Kitchen areas or other areas of high temperature water discharges

All above ground waste pipework in commercial kitchens / Canteen areas / Survey areas shall be completed in HDPE pipework with solvent welding throughout. HDPE pipework to be resistant to temperatures of up to 90degC continuous and 100degC for short periods of time. HDPE pipework to UV resistant, have high impact resistance, internal smooth bores and non-toxic in the event of fire. HDPE pipework to be compliant with DIN EN 1519 and DIN 19535 Part 2.

Copper pipework may also be used in certain applications. Typical examples where copper drainage pipework would include:

Condensate drains from Ovens
Waste pipes from boiler taps unit
Waste pipes from high temperature commercial dishwashers.

E.3.3 TRAPS

All traps are to incorporate a 75mm water seal. Wash hand basins require a 32mm diameter trap. Sinks and urinals require a 40mm diameter trap.

Traps associated with Laboratory equipment to be dilution type of Vulcathene manufacture and as detailed in Part F of the Specification Document and /or as indicated on the Contract drawings.

E.3.4 MATERIALS

All 100mm diameter soil and vent systems are to utilize materials complying with BS 4514:2001.

All 36, 42 and 50mm diameter soil and vent systems are to utilize materials complying with the recommendation of BS EN 274-1:2002, BS EN 274-2:2002, BS EN 274-3:2002.

Any laboratory wastes shall be Vulcathene manufacture, incorporating a Mechanical Jointing System.

All copper pipework shall be fabricated from solid drawn phosphorous arsenical copper tubes complying in all respects with B.S. 2871 Part 1. Table X as manufactured by Yorkshire Limited or equal approved.

Copper fittings and other items shall comply with the Water Supply (Water Fittings) Regulations 1999 as listed in the water fittings and material directory.

Fittings shall be in accordance with BS EN 1254-1: 1998; BS EN 1254-2: 1998, AMD 5097, 1986, AMD 5651, 1987, AMD 7067, 1992 and installed as detailed above in the General Clause. 'End feed' copper fittings installed in strict accordance with the manufacturer's recommendations are also acceptable.

End feed copper fittings may used but in all cases, fittings shall be made up using the correct Tin / Silver solder and flux with both tube and fitting clean both before and after soldering.

All cuts in copper pipework shall be reamed to restore the full bore of the tube and the Contract Administrator shall reserve the right to have any joints disconnected for the purpose of checking that the full bore has been restored.

All pipework shall follow the lines of walls both vertically and horizontally and shall be spaced sufficiently far apart to allow for lagging separately (where necessary).

Joints must be wiped clean of surplus solder and flux to avoid discolouring and heat resistant mats must be used to prevent damage, to the fabric of the building, decorations, and woodwork, etc.

All fittings must be resistant to dezincification.

All 90° bends are to be formed using fittings with the exception of bends in cupboards, ceiling spaces etc., which may be pulled and bends in floor ducts or trenches, which **must** be formed without joints.

Multiple droppers to fitments and appliances where exposed to view shall be kept as close together as bracket fixing will allow.

All the copper fittings to be used with tin / silver solder only. The use of all aggressive type soldering fluxes where the label or instructions state that they are based on chlorides and / or self-cleaning is NOT permitted.

All plastic pipework shall comply with BS EN 1452.

E.3.5 BRACKETS

Care must be given to the supporting of the internal drainage systems and the Manufacturer's recommendations must be strictly adhered to.

All pipework must be adequately supported whether vertical or horizontal.

Plastic pipework expands and contracts with changes in temperature – whether ambient temperature or the nature of the discharge through the pipework. Expansion joints must be provided to accommodate thermal movement.

Pipe brackets must be used to anchor expansion joints with intermediate support provided to steady pipework between these joints.

Pipework must be supported at changes of direction.

Pipe Size mm	Maximum Vertical mm	Support Distance Horizontal mm	Maximum Support Distance between Expansion Joints mm
32	1200	500	2000
40	1200	500	2000
50	1200	900	2000
82	2000	900	4000
110	2000	1000	4000
160	2000	1000	4000

Steel brackets must be used on interior vertical soil stacks

E.3.6 ACCESS

Sufficient access points must be allowed so as to enable efficient inspection and maintenance.

E.3.7 OVERFLOWS & WARNING PIPES

The Discharge positions are indicated on the Contract drawings.

E.3.8 FIRE BARRIERS

Where PVC pipes pass through Fire Compartment Walls, fire stop precautions shall be required as denoted in Building Regulation B3 Section 11 and BS 476 Part 20.

E.3.9 SANITARY WARE

The supply and fixing of Sanitary Ware on certain contracts may be the responsibility of the Mechanical Services Installer. Details of this equipment will be given in Part F of the Specification Document and indicated on the Contract drawings.

All drainage works shall comply with BS EN 12056.

The Mechanical Services Installer is to allow for the removal and re-fixing of Sanitary Ware twice to suit other trades.

The mechanical contractor is **not** responsible for supplying sanitary ware on this project. However, the mechanical contractor is responsible for fitting all fixtures and making final service connections to same.

E.3.10 AIR ADMITTANCE VALVES

Automatic Air Admittance Valves, in accordance with BS EN 12380, may be used in lieu of Vent stacks where indicated on the drawings.

These units are to be fitted to the manufacturer's recommendations.

E.3.11 TESTING

On completion all traps shall be filled with water and an air or smoke test carried out on the soil installations. In the case of Air tests, the pressure indicated on the "U" tube shall remain constant for five minutes, and with the smoke test no smoke shall be observed to leave any joint.

All necessary equipment for testing shall be provided by the Mechanical Services Installer.

Any defects shall be made good, and the test repeated until satisfactory results are obtained. Any sections of the installation which will be rendered inaccessible shall be tested before these sections are covered.

E.4 VENTILATION SYSTEM

E.4.1 GENERAL DESCRIPTION

The ventilation Scope of works for this project includes the following

- Supply and install new heat recovery Ventilation Services as indicated on the drawings.
- Supply and install supply and return air ducting
- Supply and install supply and return air grilles
- Supply and install fire dampers
- Supply and install roof cowls
- Test and commission the ventilation systems.

E.4.2 STANDARDS

The systems must conform to the following standards and codes of practice.

HVCA DW/144 Specification for Sheet Metal Ductwork 1998

HVCA DW/143 A Practical Guide to Ductwork Leakage Testing 2000

DWTM1 Acceptance Scheme for new products: Rectangular Cross Joint Classification

DWTM2 Guide to good practice: Internal Cleanliness of New ductwork installations

DWTM3 Guide to Good practice for the Design for the installation of Fire and Smoke Dampers

TR/17 Guide to Good practice: Cleanliness of Ventilation systems

BS 5588

BS EN 1886

EU Regulation 517/2014 (F-Gas Regulations)

E.4.3 FANS GENERAL

Fans shall be capable of giving the specified performance when tested in accordance with BS.848 and as detailed on the drawings and / or in part F of the Specification Document.

Each fan is to be complete with a plate fixed to the casing showing the maker's name, fan duty serial number and electricity supply.

The specification requirements for motors and starters shall be as indicated under centrifugal fans.

Where guards for Drive and Couplings are to be provided with the fans as necessary to comply with Statutory Regulations, and where the fans are operated under open inlet or outlet conditions mesh guards are to be fitted.

Special requirements for fans used in a corrosive atmosphere e.g. fume cupboard extraction; will be indicated in part F of the Specification Document.

Connections to suction and delivery of all fans and elsewhere as required shall have best quality heavy air tight canvas/neoprene connections secured between angle iron flanges.

It is the Mechanical Services Installer's responsibility to check the available voltages before ordering any electrical equipment.

E.4.4 CENTRIFUGAL FANS

The Mechanical Services Installer shall supply and install where indicated on the drawings and or in part F of the Specification Document radial bladed centrifugal fans of the type, duty and manufacture specified.

Fan casings shall be constructed so that impellers can be easily withdrawn after installation. Outlets shall be flanged, and inlets flanged or spigotted as indicated. A drain and plug shall be fitted to the fan casing at its lowest point.

Impellers shall be keyed to a substantial mild steel shaft and both statically and dynamically balanced at maker's works.

Fan bearings shall be sleeve type oil lubricated, but ball or roller type will be acceptable if the noise level is satisfactory.

Each fan is to be complete with a motor rated for continuous running and have Class 'A' insulation throughout.

To control the motors push button starters shall be provided with overload protection on each phase and no-volt release.

This starter type to be used on motors up to 3hp. Motors of larger capacity will have special starter requirements

E.4.5 AXIAL FLOW FANS

The Mechanical Services Installer shall supply and install where indicated on the drawing(s) Axial flow fans of the type, duty and manufacture as indicated on the contract drawing and / or in part F of the Specification Document.

Generally axial flow fans shall have integral casings with the motors arranged for direct drive built into the unit.

The casings shall be constructed with flanges, to enable the unit to be easily removed without disturbing adjacent ductwork. Access doors shall be provided for motor inspection and external greasing and oiling points.

If guide vanes are fitted as part of an axial flow fan the vanes are to be of true aerofoil section as are the fan blades themselves.

External integrated louvre shutter grilles and internal protection wire guards are also to be provided as specified. All louvres to be complete with powder paint finish and Class A rated.

E.4.6 DUCTWORK GENERAL AND ERECTION

The contract drawings are general arrangement drawings only and the Mechanical Services Installer shall include for taking site dimensions for the preparation of his own detailed

fabrication and installation drawings. These drawings shall allow for full co-ordination of other services, ceiling layouts, lighting fittings etc., to ensure that no clash of interest occur during or after erection.

All ductwork dimensions given for rectangular ductwork are for width x depth on both plan and section and the dimensions given will be clear internal dimensions and due allowance must be made for internal acoustic lining and external insulation where applicable for both manufacturing and clearance purposes. For circular ductwork the diameter dimension given will be clear internal dimensions.

All the fabrication and installation drawings shall be submitted to the Contract Administrator in triplicate giving full details of the method of construction, overlaps, seam, stiffeners, rivets, flanges, bolts support etc., for approval before construction commences.

General arrangement drawings of filters, heater batteries, grilles, fans and louvres, etc., shall also to be submitted for approval.

All ducting systems shall be erected in a workmanlike manner by an approved specialist contractor and when completed shall be rigid, true to size, free from movement, accurately aligned and airtight.

During erection all open ends of ducting shall have a suitable covering securely tied in position to prevent entry of dust, dirt and other debris present during building operations.

Before final fixing of grilles, the ducting shall be blown through by running the fans for a period of at least one hour and the interior of all ducts, as far as accessible, thoroughly cleaned by means of an industrial type of vacuum cleaner.

E.4.7 MANUFACTURE OF SHEET STEEL DUCTWORK FOR AIR SYSTEMS

This ductwork shall be constructed of steel sheets hot galvanised to BS 2989, Grade Z2 Coating type C & comply with BS EN 10327:2004 and HVCA Specification DW/144 with latest amendment, and be constructed with mild steel angle, assembled with slip joints except for connections to fans, heater batteries, filter banks, diffusers, grilles etc.

Self-tapping screws shall not be used on any high velocity ductwork.

All ducts shall be adequately stiffened and braced to prevent drumming and/or vibration and all ducts shall be free from internal sharp edges or projections.

Cross-bracing" shall be permitted on sheet metal un-insulated ducts with one greater 475mm to give additional rigidity.

E.4.8 MANUFACTURE OF FLEXIBLE DUCTWORK

Flexible ductwork can be used to connect to grille diffuser boxes. The flexible ducts shall be good quality insulated type and maintain the integrity of the ductwork system to which it is connected with airtight seams. Joints to be fastened with bolted galvanised metal bands.

The length of flexible ducting connectors shall not without the Contract Administrator's approval, exceed 500mm run.

Flexible ducting shall comply with all the requirements of EN13180 BS 476 Part 7:1997(Class 1, Surface of very low flame spread) and shall be spring wire reinforced self-extinguishing grade rot-proof airtight material or spirally or machine formed interlocking self-extinguishing grade PVC, or alternatively consist of flexible corrugated metal tubing, such as aluminum or stainless steel.

Joints shall be by hose type galvanized or sheradised metal clamps with final sealing by 50mm adhesive tape of approved quality, or as indicated in part F of the Specification Document

E.4.9 FIRE RATED DUCTWORK

All fire-rated ductwork where indicated on the drawings shall be ducts will be Lindab Thor Duct classified BS EN 13501-3, and tested to EN 1366 1 vertically and horizontally for Type A (fire outside) and Type B (fire inside). Classification report must be provided. All fire rated ductwork will be tested in a flexible wall and be suitable for installation in stud partition, block wall and concrete floor. All Fire Rated Ductwork is to be installed under a third-party certifier program such as Firas. The ductwork must be classified minimum E120. Where the ductwork passes through a fire compartment wall, the rating of the fire compartment wall must be maintained by the ductwork, E & I to the same value as the wall being traversed.

The ductwork system shall be supplied, installed, and certified by a specialist fire ductwork specialist.

Under normal no fire operating conditions, the ductwork should confirm to the class C pressure / leakage classification of the current HVCA DW/144 specification for sheet metal ductwork.

Ductwork system to also be FIRAS accredited, and the specialist contractor shall issue a FIRAS certificate of conformity for the newly installed smoke extract ductwork system.

Note: any flexible ductwork supplied and installed on this system should also be suitably fire rated and certified.

All external smoke ventilation ductwork to be fully insulated and clad in aluminium and labeled.

E.4.10 DUCTWORK SUPPORTS FOR RECTANGULAR DUCTWORK

The ductwork shall be supported on mild steel angles beneath the ducts projecting about 76mm on each side of the duct. These angles are to be suspended on mild steel rods suitably threaded and located in the steel angles with nuts. All supports where site cut or modified are to be painted with galvafrond paint or equal and approved.

The dimensions of the angle iron supports and the flat steel clamping the duct to the support shall be as follows: -

Length of Bottom of Duct	Size of Angle Iron	Size of Flat Iron	Bolts
Up to 840mm	25 x 25 x 3.2mm	25 x 3.2mm	6.4mm
Over 840 to 1500mm	32 x 32 x 4.8mm	32 x 4.8mm	7.9mm
Over 1500mm	38 x 38 x 4.8mm	38 x 4.8mm	9.5mm

In general ductwork shall not rest directly on the building structure. Where approved however, builders work supports may be used together with vibration packing material.

Ducts shall be firmly and rigidly held in position and be free from vibration rattle or drumming. Approved anti-vibration material shall be inserted between the ducts and the supports

E.4.11 DUCTWORK SUPPORTS FOR CIRCULAR DUCTWORK

The ductwork shall be supported by means of Mild steel flat iron band clips formed in two half sections bolted together and hung from two mild steel rod hangers.

The dimensions of the flat iron supports for circular ducts shall be as follows: -

<u>Diameter of Duct</u>	<u>Size of Flat Iron</u>	<u>Bolts</u>
Up to 750mm	25mm x 3.2mm	6.4mm
Over 750 to 1500mm	32mm x 4.8mm	7.9mm
Over 1500mm	32mm x 4.8mm	9.5mm

All hangers shall have screwed sections incorporated for adjustment of ducting to ensure neat and true alignment.

All nuts shall be provided with washes and locknuts or alternatively be patent self-locking types.

Hangers used shall be made from mild steel rod to the sizes given below: -

<u>Circular Ducts</u>	<u>Rectangular Ducts</u>	
<u>Diameter</u>	<u>Longer Side</u>	<u>Hanger Rod</u>
Up to 400mm	Up to 300mm	9.5mm
Over 400mm to 850mm	Over 300mm to 700mm	12.7mm
Over 850mm to 1500mm	Over 700mm to 1500mm	15.8mm
Over 1500mm	Over 150mm	19.1mm

Supports shall be spaced at not more than 1.83m centres according to the size and rigidity of the duct. Supports shall be provided at all branches, take-offs, bends and at all main flanged joints.

Vertical runs of ductwork shall be supported by means of angle iron flanges to the duct and resting on channel irons securely fixed to the building structure. This support shall take the vertical loading. Material movement shall be prevented with flat bar straps clamped around the ductwork and bolted back to the channel iron.

In general ductwork shall not rest directly on the building structure. Where approved however, builders work supports may be used together with vibration packing material.

Ducts shall be firmly and rigidly held in position and be free from vibration rattle or drumming. Approved anti-vibration material shall be inserted between the ducts and the supports.

E.4.12 TEST POINTS

Air flow test points shall be provided in the air ducting at all branches and regulating damper, adjacent to each plant item and control item, at all fan inlet and discharges and elsewhere as required.

The test points shall consist of a 38mm dia. hole drilled through the ducting and covered with a removable spring clip fastened cover.

Generally, air flow test points shall be provided as recommend in CIBSE Guide.

E.4.13 DAMPERS

The Mechanical Services Installer shall supply and install dampers as indicated on contract drawings or in part F of the Specification Document and will be either of the multi-vane or butterfly type as specified.

All duct dampers, except fire dampers and self-locking dampers shall be fitted with locking devices and position indicators.

Each primary control damper shall be fitted with a non-corrosion label stating the actual air flow in m³/s and the cross sectional area.

After final regulation and balancing of the system, the position of the dampers as set shall be indelibly marked on each damper quadrant.

All dampers have an inspection door provided adjacent to them.

Multi-vane design dampers shall have blade widths not exceeding 127mm with felt insert at tips with each alternative blade contra-rotating. Blades shall be of stream lined section mounted on square spindles linked together to heavy duty cast quadrant, indelibly marked open and shut, with finger operated locking device and spanner locking device for permanent setting.

Butterfly design dampers shall have blades constructed of 3.2mm galvanized mild steel sheet with 9.5mm spindle mounted on stout galvanized mild steel bearings secured to duct walls. Quadrant to be indelibly marked open and shut and all materials shall be galvanized. Edges of damper shall be rolled.

When air ducts are greater than 450mm in either plane, then splitters shall be incorporated, with rolled edges and two or more dampers, not greater than 450mm in either plane shall be incorporated. Such dampers shall be linked to a single quadrant.

Dampers shall be galvanized throughout and mounted in flanged casings.

E.4.14 FIRE DAMPERS – FUSIBLE LINK CURTAIN TYPE (FD)

The fire dampers where indicated on the drawings, shall be provided under the contract. The dampers shall be Actionair Fireshield stainless steel curtain fire dampers series FS201 with blades outside the air stream (rectangular ducts) or series FS301 (circular ducts).

The damper shall be supplied complete with installation frame I/F for masonry floors/walls, or dry wall fix cleats DWFX-C.

Fire damper classification shall be in accordance with EN 13501-3. Fire dampers shall be tested in accordance with EN 1366-2, corrosion tested to EN 60068-2-52. Fire dampers must be CE marked and comply with product standard EN15660:2010 ventilation for buildings – fire dampers.

Fire Dampers shall be installed in accordance with the manufacturer's instructions. Fire Dampers shall be installed in accordance with BESA Good Practice Guide DW/145.

In all cases the contractor is to install a Break-Away duct joint between the fire damper spigot and the attached ductwork. A break-away duct joint is to be as defined in DW/145 which is a flexible joint incorporating materials, fixings or clamps manufactured from a non-fire resistant material with a low melting point.

A properly sealed but easily removable access door shall be provided in the ductwork such as to allow easy access to the fusible link assembly. Access doors shall be Actionair removable, hinged, insulated access doors.

All Fire Dampers shall be fitted with an external visual blade position indicator. All fire dampers shall be provided with double pole micro switches for future connection to a monitoring panel.

All fire dampers installed in vertical ducts shall be installed such that the access side is the underside of the damper, and the access doors shall be fitted within the ceiling void where one exists.

Provide and fix in all ducts where shown on the drawings and where ducts pass through a fire resisting floor, wall or partition, fusible link operated fire dampers arranged to close completely against the air flow in the event of air at a temperature in excess of 72 deg. C (+/- 4 deg C) melting the fusible link.

Unless otherwise indicated the fire rating of the damper shall be equal to the fire rating of the fire resisting floor, wall, or partition through which the duct is passing and will be constructed to meet the requirements of the Local Authority.

It is the responsibility of the Sub-Contractor to obtain all necessary approvals from the Local Authorities for the use of a proposed fire damper and also to obtain a waiver in respect of the use of shutter type, spring operated dampers mounted in the horizontal plane (where applicable).

E.4.15 FIRE & SMOKE DAMPERS – MOTORIZED TYPE (MSD)

The Mechanical Services Installer shall supply and install dampers as indicated and specified (supplier - Lindab) on the drawings, complete with motorized fire damper control panel as described.

Each damper is to be supplied complete with 24V actuator and local 240/24V transformer.

All ductwork which penetrates a fire barrier will be provided with suitably rated motorised fire and smoke damper.

As required by European and Irish Law through the Construction Products Regulation (EU)No305/2011, all fire dampers installed on or after 1st September 2012 must be CE marked.

The products must meet the requirements described in EN 15650:2010 to achieve CE certification in both directions. All fire dampers must comply with Technical Guidance Document B, Building Regulations of Ireland (2006).

A copy of the test certificate and physical samples of the product must be submitted to the engineer for inspection and approval.

As stated in BSEN1366-2:1999: "Fire dampers which are to be installed in both horizontal and vertical constructions shall be tested in both orientations" (Clause 6.3.2)

"A test result obtained for a fire damper installed within a structural opening is only applicable to other fire dampers installed in the same orientation as that tested" (Clause 13.2)

"A test result obtained for a fire damper installed on to the face of a wall or floor is only applicable to fire dampers installed on to the face of a separating element in the same orientation as that tested" (Clause 13.3)

"Determination of leakage at ambient temperature, Undertake this test prior to the fire test" (Clause 10.3)

"The leakage through the fire damper shall not exceed 200m³/hr/m² (corrected to 20°C)" @300Pa (Clause 11)

"If smoke leakage is required, an additional fire damper, representing the smallest size, shall satisfy the smoke leakage criteria when tested to the procedure Described in10.3" (Clause13.1).

The actuator damper connection shall be by means of a drive interface mechanism which is independent of the ductwork.

Fire and smoke dampers with appropriate control actuators shall have spring fail-safe control actuators with24V/230V supply and shall be activated by a local fire alarm detector.

All fire and smoke dampers shall be tested to EN 1366-1 and shall be in compliance with EN13501-3. Fire and smoke dampers shall be WH-25/WK-25/WH-45/WK-45 as supplied by Lindab (Irl) Ltd or equal and approved.

Fire dampers shall be of proprietary manufacture and constructed from a corrosion resistant material such as stainless steel or be galvanized or otherwise treated to minimize corrosion. The dampers shall be housed in a rigid frame of proprietary manufacture, corrosion resistant casing which shall not distort under fire conditions.

Each fire damper casing shall be clearly marked with a permanent indication of the correct fixing attitude of the damper, the direction of airflow and the side at which access or maintenance openings shall be located.

Fire dampers shall be located in such a position and be of a type that facilitates manual testing and re-setting.

Fire dampers which are supported only by the ductwork in which they are located, or by combustible battens, frames or other methods that do not provide the fire resistance required are not acceptable.

Fire dampers provided in fire resistant ceilings shall be adequately supported either by the ceiling or from the structural soffit. It is not acceptable to form an opening, install a diffuser or grille and fit a fire damper above if the gap between the ceiling opening and the fire damper does not achieve the fire resistance.

Fire dampers shall be fitted with a suitably sized access door to facilitate manual testing.

Fire dampers shall be provided complete with installation frames. The contractor shall provide details of fixing and supports to the Engineer for approval. No duct lining or flexible ductwork shall be installed within 1.0 metres of a fire damper.

All fire dampers will provide a level of protection to match that of the fire barrier in which it is to be installed. (Classification of the Dampers within CE)

30 minute fire barrier– FD to be EI (30ve,ho) S
60 minute fire barrier– FD to be EI (60ve,ho) S
90 minute fire barrier– FD to be EI (90ve,ho) S
120 minute fire barrier– FD to be EI (120ve,ho) S

The fire damper type should be able to: Test and result externally
All Dampers to be rated in both directions (i <-> o)
Installed in line with manufacturers recommendations

A 'Fire Damper Control & Monitoring System' shall be provided for all fire smoke dampers where These dampers are indicated as 'MFD' on the drawings.

The automatic fire damper control system shall utilize an industry standard open protocol platform and shall be a completely modular and flexible computerised system which operates and continuously monitors smoke/fire dampers. Each damper shall be graphically represented in the open, closed, travelling or fault state

Manual damper override shall be via touchscreen keyboard/mouse operation. Inputs and Outputs to/from the system are via the digital input/output devices, each providing 8 off inputs and 4 off outputs to/from the panel PC. Network shape and length shall be highly flexible and extendable utilizing the Network Router devices

Software based zoning and grouping of devices shall allow complex multiple 'cause and effect' schedules to be programmed. A Smoke Fire Damper Interface device shall be mounted at each damper in the field and shall be connected to a DISYS panel via a network cable. These field SFDI devices shall allow for full addressability and individual control of all dampers. Automated scheduled damper testing to be provided via in-built software programme. Remote access to the system shall be provided.

E.4.16 ACCESS DOORS

Access doors shall be provided to give access to all dampers and at fans, each side of heater batteries and filters for inspection cleaning and maintenance purposes.

Access door shall be provided on straight runs of ductwork every 10m & not greater than 1m from duct from duct bends.

Access for cleaning ducts and for internal inspection shall be provided on all ducts at intervals and at all bends, by means of approved type access doors mounted on the duct, as called for in DW144. The size of door shall normally be 610mm x 610mm, but the shape and size may vary in individual cases to suit the size and form of duct. The door shall be secured in the closed position against an airtight gasket by three non-ferrous swing-bolts and hand wheels, one to each side.

Small inspection doors or access covers secured with non-ferrous swing bolts shall be provided at dampers on branch ducts and at all internal duct fitments, i.e. thermostat and thermometer bulbs, etc.

E.4.17 GRILLES, REGISTERS AND DIFFUSERS

The Mechanical Services Installer shall supply and install grilles and registers as indicated and scheduled on the tender drawings. All grilles shall be complete with grille box as specified and opposed blade dampers.

E.4.18 TERMINAL UNITS

The Mechanical Services Installer shall supply and install where indicated on the contract drawings and / or in part F of the Specification Document terminal units of the type and manufacture specified.

The individual components of these terminal units shall comply with the appropriate sections of this specification, unless otherwise stated.

E.4.19 ANTI-VIBRATION MOUNTINGS

All fans shall be mounted on anti-vibration bases to isolate them from the main building structure.

E.4.20 TESTING, CLEANING AND COMMISSIONING

Fitting of sensors and test holes

Provide test holes in ductwork system to allow complete testing and balancing of system in accordance with CIBSE Commissioning Code Series A.

Site drill test holes on site in accordance with DW144 Part 7 Section 20.6.
Provide holes in metal ductwork, in accordance with DW144 Part 7, paragraph 20.7, to accommodate sensors.

Fill holes that are used only for test purposes with rubber sealing caps.

Balancing of the system

The contractor shall employ a commissioning Specialist to balance air systems in accordance with CIBSE Commissioning Code A, Section A2.

Provide written commissioning reports to the Employers Representative, demonstrating the air flow rates achieved in comparison to the design flow rates.

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

E.4.21 IDENTIFICATION

Within each compartment, identify ductwork with bands indicating the purpose of the ductwork and the direction of air flow within the duct.

E.4.22 TESTING AND COMMISSIONING

The Mechanical Services Installer shall engage the services of a specialist commissioning engineer to balance test and commission the ventilation systems in accordance with C.I.B.S.E. requirements. All test figures shall be submitted to the Contract Administrator for his perusal prior to the system tests being repeated in the presence of the Contract Administrator or his nominated representative at an agreed time

Following the aforementioned demonstrations all dampers shall be marked as earlier referred to and all readings shall be recorded for inclusion in the O. and M. Manuals both on individual sheets and on the record drawings.

Failure to comply with the above two paragraphs will result in with-holding the issue of the Practical Completion Certificate.

E.5 VRV AIRCONDITIONING SYSTEM

E.5.1 SCOPE OF WORKS

The air conditioning contractor shall disconnect one of the existing outdoor Air Conditioning currently servicing existing first floor offices and relocate it as indicated in drawings.

The Air Conditioning Contractor shall supply, deliver, install, set to work and commission the systems and equipment as detailed in this section of the specification, as shown on the Tender drawings and described herein.

The design and installation of refrigerant-based air-conditioning systems shall be carried out in accordance with Current EU F-Gas Regulations 2024/573 & EN378.

E.5.2 SYSTEM DESCRIPTION

- Heating and Cooling will be provided by utilising an inverter Heat Recovery system(s) to provide heating and cooling to the zones as required from the load schedule.
- The Heat Recovery system must utilise a dedicated discharge line in addition to the Liquid and suction pipes to the indoor units. The dedicated discharge line is required to maintain a higher degree of usable heat output in comparison to a two pipe Heat Recovery VRF system.
- The Heat Recovery system must be able to heat continuously during the defrost cycle to gain higher integrated heating capacities.
- The system must be able to vary evaporating and condensing temperatures based on ambient temperatures and/or load to ensure optimum seasonal efficiency and comfort. Or alternatively fix the evaporating temperature for continual very high off coil temperatures.
- Part load conditions must be met by a combination of change of compressor speed and change in refrigerant temperature at a suitable reaction speed which is set at the condenser on commissioning.
- The Heat Recovery systems will have a minimum of 50 step inverter fan control to allow the system to accurately respond to head pressure control requirements.
- The compressor shall respond to control frequencies from 60 to 402Hz to provide stepless capacity control.
- All condenser fans must be capable of at least 78 Pascals of external static pressure.
- The refrigerant must be distributed using a refrigerant networking system (Refnet) to ensure low pipe pressure losses as well as keeping the require pipe work installation space and material used to a minimum compared to other parallel pipe work systems.
- The system must be able to operate a continuous heating during defrost system on multi-unit installations resulting in no cold air dumping.
- Changeover of a fan coil from Heating to Cooling will not prevent any other fan coil on a different BS box port from providing continuous capacity by ensuring that pressure equalisation is performed within the BS box and not across the whole VRF system.
- Both single and Multi BS boxes should be utilised. The single port Branch Selector boxes must not exceed 210mm in height.

E.5.3 VRV SYSTEM FEATURES

System operation

The VRV system will control flow of refrigerant through the fan coil unit, by means of an electronic expansion valve fitted in each indoor unit and must be able to utilise single or multiple Branch Selector boxes for optimum flexibility. The Branch Selector Boxes (BSQ) would be fitted with electronic control valves to define heat/cool zones as demanded by the indoor operating condition or user choice.

Minimum operation range

The system has to smoothly operate at ambient temperatures ranging at least from -5°CDB to +43°CDB in cooling and down to -20°CWB and up to +15,5°CWB in heating. The system operation must be possible outside above mentioned limits, unless safety devices are activated.

Manufacture and testing

The equipment manufacturer shall be responsible for the manufacture of the compressor, refrigerant oil and refrigerant used within the system to maintain integrity of design and optimise efficiency and reliability of equipment.

All equipment shall be run tested in accordance with the following procedures prior to leaving place of manufacture.

- A choke test carried out on the refrigerant piping to detect obstacles
- The pipework shall be tested to 38bar.
- Electronic leak testing shall be carried out to ensure maximum system refrigerant containment.
- System vacuum test to 2 Torr
- Electrical tests shall include flash testing at 1440V AC to ensure that current leaks above 5mA are detected, megger test at 500V DC to ensure resistance levels are above 10 mega Ohm and earth continuity tests.

Piping Capabilities

The VRV system will have the ability to sustain refrigerant piping lengths of up to 165m (equivalent piping length has to be at least 190 meters) with a level difference of 90m between fan coil units and condensing unit, providing connection ratios are suitable.

The system shall be capable of having up to 1000m of refrigerant pipe work installed.

The system shall be capable of having up to 90m from the first refnet to the furthest indoor unit, providing manufacturers system design guidelines are used. The elevation between the highest and lowest indoor units must be able to be extended up to 15 meters.

Heat/Cool changeover operation

Pressure equalisation required to change from heating to cooling must be performed within the BS box without causing any other indoor unit attached to a separate BS box port to cease heating or cooling thus lowering the capacity and comfort of the system.

Comms Rooms

The VRV system must be able to operate in cooling down to -20 C and be capable of being used in comms room/switch room applications by a technical cooling setting. This setting will allow low ambient year round cooling.

Automatic refrigerant charging & F-Gas compliant refrigerant containment check

The system will have the capability to automatically charge the correct volume of refrigerant during commissioning and, if automatic charging has been utilised, the system must also have the ability to self-diagnose refrigerant containment for maintenance and service purposes.

The unit shall be capable of carrying out automatically the calculated required additional refrigerant charge necessary to operate the system within its optimum efficiency. This cycle shall be completely automatic and provide a warning to the service technician to indicate when charging has been completed or the charging cylinder is empty.

The refrigerant cycle shall not rely upon float valves, level switches or weighed input of the refrigerant. The calculated refrigerant charge shall be retained within the memory of the outdoor PCB as a reference for a refrigerant containment check which can be carried out as required to verify the correct refrigerant charge remains within the system. The automatic refrigerant charging and containment check facilities shall be capable of being used at any time during the life of the system for any alterations or service operations which may be required.

Emergency operation capability

In the event of compressor failure, the system will allow emergency operation of its other compressors in order to maintain 8 hours of interim capacity whilst spares are sourced.

Sequential start-up

For all systems it will be possible to activate and deactivate the automatic restart of the indoors after power shortage or failure through proper setting at the local control of indoor units. In addition, all systems should keep on operating even in case of a power failure at an indoor unit, either with the installation of optional accessories or by having it as a standard.

The outdoor units will incorporate a "Soft Start" technology, to achieve a very low starting current in order to lower consumption, reduce power requirements of the electrical board and minimise the stress of individual parts of the outdoor unit (e.g., compressor's motor) to extend operating life and reduce lifecycle cost.

Commissioning

The condensing units should have a 7 segment decimal display, displaying detailed error codes, stage of the start-up procedure as well as function and operating data of the system.

For the commissioning of a system and in order to properly set all necessary data and values for the optimum operation of it, it is recommended for the starting-up the use of special software provided by the manufacturer of the system. The establishing of the values and the programming should be possible even offline.

Maintenance

For Service and Maintenance of indoor units the system should allow up to 30% of the indoor units to be disconnected without causing a system fault for up to 24 hours to prevent unnecessary whole system downtime for occupants of the conditioned spaces.

Refrigerant

The VRV system must operate with Refrigerant R410A, the refrigerant shall be a zeotropic blend constituted of a maximum of two different refrigerants providing a maximum temperature glide of less than 0.17K to avoid fractionation problems.

The equipment manufacturer shall ensure that the equipment is compliant with current RoHS (Restriction of Hazardous substances in electrical and electronic equipment (2002/95/EC)) regulations.

Required certification

All outdoor and indoor units will have to be assembled and properly tested at the manufacturer's factory. They will have to be certified for their safety standards according to European legislation and CE marked. The manufacturer must be certified with the ISO 9001 standard concerning quality and with the ISO14001 for environmental protection and awareness. A Certificate of Conformity shall be supplied with each machine.

Efficiency

All system efficiencies should be calculated according to UK legislative examples as set out in in the latest Non Domestic Compliance guide and provided with the conditions at which they are calculated and based on a single evaporating and condensing temperature for both indoor and outdoor units.

Equipment Supplier

All equipment will be supplied as scheduled on the drawings

E.5.4 OUTDOOR UNITS

Electrical:

Outdoor units will have to be manufactured for operating with a three-phase power supply of 400 V / 50 Hz.

Noise

The noise level - sound pressure – of a single condenser should not exceed 66 dB(A) under laboratory conditions, measured in a semi-anechoic chamber, at a horizontal distance of 1 meter from the unit and at 1.5 meters height from the base of the unit.

Physical attributes

The outdoor unit must be suitable for outdoor installation. The shell/casing of the unit will have to be made of enamelled stainless steel sheet, with polyester thermal powder coating (minimum 70µ) for high protection in environments with locations with high air salt content such as adjacent to the sea. The units shall be air-cooled type incorporating heat exchanger coils manufactured from copper tubes and aluminium fins. The air-cooled heat exchanger of the outdoor unit will have to have undergone appropriate treatment for protection and long life efficient operation against atmospheric corrosion. Specifically, the aluminium fins will be coated with a layer of acrylic resin and on top covered with a hydrophilic film or any other material which will provide minimum 5 to 6 times greater resistance to acid rain and salt corrosion. The bottom of the unit will have a sheet of stainless steel for protection against oxidation. The outdoor unit must successfully have passed at least the following tests:

1. VDA Wechseltest
2. Kesternich test

Component parts

In the outdoor unit there will be either one or two compressors in separate shells, so in case one fails it will not be necessary to replace both. The outdoor units will have axial fan(s) DC inverter driven, air-cooled heat exchanger, piping, wiring and automation, factory-installed electronic expansion valves, oil separator, accumulator at the suction side of the compressor, high & low pressure sensors, protection thermostats, fuses, protection against overcurrent, protection for overloading of the inverter, liquid and gas stop valves and solenoid valves, timers and all the necessary sensors and protection equipment to ensure continuous, safe and smooth operation.

The outdoor unit - and consequently the whole system - will keep on operating even if one compressor is turned off (emergency operation). In case of a multi-outdoor unit system, it will be possible to isolate one module, while the rest of the system will continue to operate even if delivering reduced capacity. This ensures continuous air conditioning of the premises, until the cause of the issue ceases to exist.

System Control

All indoor units to be connected to a system must be independently controlled depending on the requirements of each room. The indoor units will be connected to the outdoor unit via the wiring and

refrigeration piping network. The wiring cables are not required to be shielded, but the installer is required to ensure power sources do not interfere with the communications signal in accordance with the manufacturer's instructions.

The system's operation must be based on pressure sensors and thermostats, which via a specially designed integrated circuit will control the frequency of the compressor motor (inverter) by varying the compressor's speed resulting in changes to the refrigerant's volume and temperature. The result, combined with ambient temperature and building's load requirements, will always deliver the necessary capacity while maintaining optimum efficiency.

The system will have the ability to perform capacity control from the minimum 9% and up to 100% of the nominal capacity. The capacity delivered by the system should match the building's load. This way the system will consume the minimum required energy, at the highest possible efficiency.

The room temperature for each room must be controlled by a microprocessor, where processing of the various parameters and the corrective settings are proportional and according to the integral - differential method of regulation.

- Parameters: set temperature and return air temperature for the differential control, gas and liquid refrigerant temperatures for controlling the superheat
- Corrective settings; opening of the expansion valve, fan speed

Variable Refrigerant Temperature

The system is required to automatically adjust the evaporating and the condensing temperature in order to always deliver the required capacity for the building's load, whilst maintaining the optimal efficiency. In addition, the facility will be available to provide a set a target refrigerant

temperature. This way the delivered capacity will be ambient temperature dependent thus having very high seasonal efficiency. In addition, it must be possible to operate the system with at least three different set refrigerant temperatures. Higher evaporating temperatures will result in less dehumidification indoors, while the system will deliver mostly or even only sensible capacity. The adjustment of the evaporating and the condensing temperature will have to be easily field set, without any optional accessories prior to or after the commissioning of the system.

Ambient temperature dependent variation of the refrigerant temperature – evaporating and/or condensing is required, and results in even greater energy savings and optimal seasonal efficiencies, as per latest directives of the European Union.

It should also be possible to fix the evaporating temperature at different values in order to have the system operate with different Sensible Heat Factors. This way and depending on the indoor relative humidity the supply air temperature can vary (e.g., higher), thus increasing comfort levels through less cold air supplied in the rooms. At the same time relative humidity levels can be maintained within the comfort zone according to international standards and guidelines.

Continuous Heating During defrost

Multiple condenser VRV systems should incorporate a function that guarantees continuous comfort during defrost cycles as defrost takes place regularly in order to increase efficiency of the system and protect the outdoor units from heat exchanger breaking down by minimising reduction in off coil temperatures.

Compressors

Outdoor units should have a specific function and appropriate devices to prevent refrigerant in liquid phase to return to the compressor. This ensures the specified density of the oil and therefore the adequate lubrication of the compressor. This function increases the efficiency of the system and extends the lifespan of the compressor.

Compressors will have to be hermetically closed scroll type with integrated motor and sound absorbing jacket. They will have a DC inverter driven motor and be able to continuously change the frequency, resulting in a change to the volumetric refrigerant flow from the compressor, in order to accurately and fast respond to the required load. The change in frequency should be done incrementally, but in enough steps so the change of delivered capacity can be approximated as linear. The minimum number of capacity steps will have to be no less than 100.

The motor windings will have to be specially constructed, in order to achieve the safe and smooth operation to avoid hazards due to the continuously changing of frequency and voltage. The compressors will be protected by an electrical crankcase heater to prevent oil condensation at low ambient temperatures.

The oil supply in the compressor will be on the high-pressure side, ensuring optimum lubrication of all moving parts. Therefore a separate lubrication system will not be required for the moving parts of the compressor since the oil in the centre of the crankshaft will be transported across the surface of the rotating parts from the centre to the perimeter. This optimizes the performance of the compressor and minimizes stress and wear, extending its lifetime. The compressors' motors will have a cooling system using compressed gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings.

Compressors will alter the rotation speed linearly and consume energy in accordance with cooling and heating loads, ensuring operational autonomy and independent temperature control in each room. The two DC inverter compressors will vary their speed separately controlling the volumetric flow more accurately, with lower power consumption, resulting in higher efficiencies at all loads and connection ratios.

For protecting the compressor from frequent start-stops, there will be an appropriate timer.

Oil recovery

The oil recovery from the piping network and the indoor units must be achieved by the use of a microprocessor. The oil will be recovered at least once every eight hours, via a special oil recovery function, ensuring smooth operation of compressors.

Fan

The fan motor(s) of the outdoor unit will have to be DC inverter to further increase energy savings, to more accurately adjust the fan speed and reduce noise. The setting of the fan speed will result in precise control of system's performance in accordance with the requirements of indoor and ambient conditions. The DC inverter fan motors will automatically adjust the rotation speed - thus the air flow - and have at least 120 different steps. Each fan will be separately controlled in order to further increase the accuracy of system control.

The impeller will be made of plastic and with a special configuration to achieve greater air flow with low noise level. Outdoor units will have a protective cover over the fan to guard against accidents and to avoid foreign objects entering the units. It will be special design and construction to minimize the external static pressure drop of the fan.

Fans will have a high external static pressure setting in order to reach at least 78 Pa. This will allow the installation / connection of duct(s) for greater flexibility during installation. In case of an outdoor unit with two fans, then each fan will have the ability to be separately ducted.

Local control

Each indoor unit will be controlled by a wall mounted symbol driven wired remote controllers. The length of the connecting wiring of the remote controller to the indoor unit should be able to reach 500 meters.

The controller will have a high-resolution LCD, which will indicate the various operating parameters of the controlled indoor unit(s), as well as possible error code. The user will be able to switch between simple and detailed mode, by means of displayed parameters.

From the remote controller it will be possible to independently control the louvers of the indoor unit(s), if present. Any energy saving function and / or sensor related to indoors for increasing either efficiency and / or comfort, must also be possible to control by the remote controller.

The local remote controller will have an internal memory to store at least the last 9 error codes. It will be possible to connect, monitor and control at least sixteen (16) indoor units on one remote controller.

For each system it should be evident and clearly indicated which indoor unit is the one determining the operating mode (cooling / heating). Setting and changing this should be possible by the user and without having to shut down the whole system or by cutting off the power supply indoors.

The controller will have a built-in room temperature sensor which in cooperation with the building room air temperature

Module combination

The Outdoor unit shall connectable to up to 64 indoor units, with a connection index ratio between 50% - 130% unless otherwise authorised by the manufacturers, capacity permitting, to one outdoor unit. Each system of outdoor units could eventually be connected to up to 64 indoor units of different types and sizes, in a single refrigerant circuit and controlled independently in order to take fully advantage of deferral phenomena, reducing the total installed capacity of outdoor units and consequently the power consumption.

The total connection ratio of a system will be up to 200%, while always taking into consideration the case of simultaneous operation of indoor units resulting in greater than 130% connection ratio, which will affect the integrated capacity of the system.

The outdoor units will be able to deliver cooling capacities ranging from 8HP (22,4kW) and up to 20HP (56,0kW) in a single shell/housing. A combination of two or three outdoor units will be possible in order to have systems with cooling capacity reaching 54 HP (150,0 kW). No limitations on possible combinations will be accepted while the most appropriate one will be decided primarily for operating at the best possible seasonal efficiency. Aforementioned cooling capacities will have to be clearly mentioned in the manufacturer's official technical documentation and literature and will have to be calculated, based on the following conditions:

Indoor room air temperature: 27oCDB / 19oCWB.

Ambient air temperature: 35oCDB.

Equivalent piping length: 5m

Height difference: 0m.

Additional features

The unit shall be capable of operating with reduced operational sound pressure levels which can be selected. This feature is provided via an optional adapter which can accept an external signal for a time clock or other external source.

All refrigerant connections both internal within the unit and the external connections to the indoor units shall be brazed. Flared or mechanical connections will not be acceptable on the outdoor unit.

E.5.5 INDOOR UNITS

Concealed Ceiling Medium ESP Ducted Units

- The unit casing shall be manufactured from galvanised steel plate and shall be fully insulated. The use of a polystyrene only construction for the outer casing will not be acceptable.
- The unit shall not be more than 245mm deep.
- Facility shall be provided for duct connection for introduction of the fresh air in the unit and branch ductwork from the unit.
- The return air to the unit shall be through the rear of the unit as standard. A facility shall be provided for alternative return air position through the underside of the unit.
- The fan shall be of the dual suction multi blade type, statically and dynamically balanced to ensure low noise and vibration free operation.
- External static pressure up to 150 Pa enables the use with flexible ducts of varying lengths
- Must be able to change External Static Pressure through wired remote control to allow optimisation of the supply air volume
- Must have multi-tenant capability to enable continuous operation in the event of a loss of local power via an optional PCB

- The heat exchanger coils will be manufactured from copper tubes and aluminium fins. It shall have electronic expansion valve to control refrigerant flow rate in response to the load variation in the conditioned space. The expansion valve shall be controlled by an integral computerised PID control system to maintain correct room temperature.
- A condensate lift pump shall be provided within the unit and shall be capable of discharging 625mm above the drain outlet.
- The condensate shall be drained from the unit using suitable tube and run directly to a main drainage point.

Roundflow discharge ceiling Cassette Units

- The unit casing shall be manufactured from galvanised steel plate and shall be fully insulated. The use of a polystyrene only construction for the outer casing will not be acceptable.
- Facility shall be provided for duct connection for introduction of fresh air to the unit via an optional accessory, up to 20% fresh can be accommodated by the optional kit.
- An option must be provided for a floor sensor that can detect the average floor temperature and adjust the air flow to ensure even temperature distribution between the ceiling and the floor.
- An option must also be provided that detects the presence of people within a room and adjusts the set point if no one is detected in the room. It must also direct the air flow away from individuals within the room based on a four-zone system.
- The unit to have a 360° Airflow pattern with reduced velocity and all-round air distribution pattern to avoid hot and cold spots and to ensure uniform airflow with a possible 23 airflow patterns
- The fan shall be DC for LOT 11 compliance of the dual suction multi blade type, statically and dynamically balanced to ensure low noise and vibration free operation.
- The heat exchanger coils will be manufactured from copper tubes and aluminium fins. It shall have electronic expansion valve to control refrigerant flow rate in response to the load variation in the conditioned space. The expansion valve shall be controlled by an integral computerised PID control system to maintain correct room temperature.
- The indoor unit shall contain temperature sensors, to control the unit's heating / cooling output.
- The heat exchange coil shall be manufactured to allow air discharge in up to eight directions to reduce the risk of draughts.
- Provision will be made to fit manufactured discharge blanking plates should air flow not be required in one direction.
- The low profile dedicated decoration panel shall be provided for each unit. The decoration panel shall incorporate the return air grille and supply air louvers. A facility shall be provided to automatically swing the supply air louvers or lock them at a desired angle between 300 and 600 to ensure even distribution of the airflow.
- The decoration panel should also be available in white with white louvers.
- The decoration panel shall be manufactured to allow free passage of tempered air in all eight directions.
- A condensate lift pump shall be provided within the unit and shall be capable of discharging at a height of at least 850 mm above the drain outlet.
- The unit must sit no deeper than 204 mm within the ceiling void for class 20-63, 246mm for class 80 & 100 and 288mm for class 125.
- The condensate shall be drained from the unit using suitable tube and run directly to a main drainage point.
- The air filters shall be incorporated within the unit and shall be mould resistant washable resin net type.

Fully Flat Cassette 4-way discharge 600 mm square

- The unit casing shall be manufactured from galvanised steel plate and shall be fully insulated. The use of a polystyrene only construction for the outer casing will not be acceptable. Facility shall be provided for duct connection for introduction of fresh air to the unit and branch ductwork from the unit.
- The unit must be full flat to the ceiling protruding no more than 8mm. The unit must also be able to fit and be installed within a standard ceiling tile. The surrounding ceiling tiles must be able to rest on a slight lip (5mm) to allow correct/ accurate ceiling alignment.
- An option must be provided for a floor sensor that can detect the average floor temperature and adjust the air flow to ensure even temperature distribution between the ceiling and the floor.
- An option (presence sensor) must also be provided that detects the presence of people within a room and adjusts the set point if no one is detected in the room. It must also direct the air flow away from individuals within the room based on a four-zone system.
- The fan shall be DC for LOT 11 compliance of the dual suction multi blade type, statically and dynamically balanced to ensure low noise and vibration free operation and give excellent low draught characteristics
- The heat exchanger coils will be manufactured from copper tubes and aluminium fins. It shall have electronic expansion valve to control refrigerant flow rate in response to the load variation in the conditioned space. The expansion valve shall be controlled by an integral computerised PID control system to maintain correct room temperature.
- The low profile dedicated 4-way air discharge decoration panel shall be provided for each unit. The decoration panel shall incorporate the return air grille and supply air louvers. A facility shall be provided to automatically swing the supply air louvers or lock them at five adjustable settings.
- A condensate lift pump must be provided within the unit and will be capable of discharging 750mm above bottom of the unit.
- The condensate shall be drained from the unit using suitable tube and run directly to a main drainage point.
- The air filters shall be incorporated within the unit and shall be mould resistant washable resin net type.

E.5.6 CENTRAL CONTROLS

Intelligent Touch Screen Controller

- Intelligent Touch Manager System will be provided with a true touch active screen with colour Liquid Crystal Display with Icon displays to provide simple user-friendly operation. The system:
- Must have no physical buttons, all commands via Touch Screen.
- Operate with easy to understand "Windows" operating system
- Have the capacity to control up to 512 Addressable Groups from a single device
- Proportional power consumption to make the controller capable of providing energy monitoring & client billing requests (option)

Controller Display

- On/Off selection
- Set Point adjustment (Range 16-32 degrees C)
- Fan speed adjustment
- Heat/cool/auto changeover mode selection
- Frost protection set point
- Timer settings
- Holiday period settings

- Priority settings for restriction of local access for start/stop, heat/cool mode and set point adjustment range limitation
- Reset ability for malfunction codes and filter maintenance warnings

Indoor Units Monitoring Display

- Room set point
- Room Temperature Display
- Operation mode; Heating or Cooling
- Display of number of devices operating within system
- Start/stop operation, set point control, cool/heat mode selection, air volume setting, air flow direction setting and enabling/disabling operation of the remote controllers by group, zone or collectively.

Other Features of central controller

- Monitoring of operation status of the indoor units, filter change indication and error code of the group or the zone.
- Comprehensive schedule set up to start/stop the air conditioning systems. This can be set for year, month, weekday, hour and minute. This will enable normal day-to-day time clock functions as well as yearly holiday set up. Up to 8 settings can be configured up to 13 months in advance and allocated to various groups/zones.
- Volt free forced stop input possible such as fire shut down.
- Flexible Group/ Zone selection Remote monitoring of common operation/fault
- Power proportional distribution with optional memory card and external kW hour meters.
- Running cost per indoor unit via optional software licence and external kWh meter(s) (option)
- To be connectable to the preventative maintenance system.
- Possibility to perform monitor operation/fault for 8 separate systems with optional control board.
- Possibility to perform on/off control and monitor operation/fault for 4 separate systems with optional control board.
- Password protection for zone, group and schedule set-up functions.
- The controller shall have wide touch screen control colour display and can be wired by a non-polar 2-wire transmission cable to a distance of 1 km away from the outdoor units.
- The controller shall contain an internal power supply system WITHOUT the need for any external power supply, the controller shall accept a direct connection of a 230V AC power supply.
- Modbus interfaces shall be provided to facilitate the connection and monitoring of the VRV systems from the BMS.

E.6 HEATING SERVICES INSTALLATION

E.6.1 GENERAL DESCRIPTION

Scope of Works

- Remove/modify existing heating services pipework as indicated on drawing 26.3142-MFC-ZZ-XX-DR-M5600
- Strip out and remove existing unit heaters and cut back and loop LPHW pipework to the attic space as shown in the drawings
- Modify and drop LPHW pipework to the ceiling void in ground floor to serve the radiator in the corridor on ground floor and another radiator in the equipment room on first floor.
- Test and commission and certify the new system

The contractor shall liaise with the client to agree time schedules for heating system and set point temperatures for the system temperature stats.

The contract shall include for a full demonstration of the system to the consultant and the client.

E.6.2 LPHW STEEL TUBES AND FITTINGS

All above ground pipework associated with the LPHW system on this project shall be carried out in black steel pipework class B medium Gauge Schedule 2 to BS 1387 with pipe fittings up to 65mm of malleable banded iron.

All tubes shall be mild steel medium class quality unless otherwise specified with pipe fittings up to 65mm of malleable banded iron.

All pipework and fittings are to be in accordance with BS 1387:1985, AMD 5830:1989, BS 21:1985, AMD 6653:1990, BS 1821:1982, BS 2633:1987, BS 2640:1982, BS 2971:1991, BS 4677:1984 and BS EN 12732:2000. Pipe fittings 80mm and above are to be cast iron flanged or mild steel welded type fitting with flanges fitted for easy disconnection.

Easy sweep fittings shall be used throughout with the exception of vent, draw-off and thermometer positions where square tees shall be used. In all cases connections shall be of the same size as the pipework connection them. Bushings and long screw connectors shall not be used.

On no account will joints be permitted within the thickness of walls or floors. In cases where the application of this rule is impracticable (e.g., with sweep fittings or bends) the Contract Administrator may permit the use of square tees or elbows by special permission, if necessary, on site.

All pipes shall be screwed in accordance with B.S.S. and shall have sufficient unions or flanges to allow for the disconnection of any pipe without disturbance of the fabric of the building.

Pipes up to and including 65mm diameter shall have malleable iron unions with brass to iron seats. No connectors will be allowed. Pipes 80mm diameter and above shall have flanged joints and be made with approved expanded jointing rings and jointing compound. Pipes shall be expanded into the flanges after screwing or before welding is required.

All surplus jointing materials shall be cleaned off at the time the joints are made. Non-compliance will involve the Mechanical Services Installer in redecorating costs.

It is essential that after cutting of pipes the full bore shall be restored by reamer and shall be free from rust, scale and free from other defects and shall be thoroughly cleaned before erection.

If further faulty workmanship is found, i.e., pipe burrs, etc., then the Mechanical Services Installer shall dismantle and remove part of whole of the installation and replace all at his own

expense. All pipes shall be laid with a rise toward the point of venting and fall towards the point of drain. All pipes shall follow the line of walls both vertically and horizontally and where covered shall be spaced sufficiently apart to allow each pipe to be lagged separately and/or to facilitate the fitting of floor or wall plates.

Where a pipe increases its size for the purpose of providing additional heating surface, the increase shall be made by means of an eccentric reducing socket so fitted to prevent an air lock, on the return side the socket shall be fitted to allow the larger pipe to drain.

In all cases pipes where pipes are exposed in rooms pipes shall be run with a minimum clearance of 100mm between the underside of pipe and finished floor and 40mm clearance between finished walls or piers and back side of pipes.

All open ends, i.e., for radiator connections, continuation of pipe runs etc., shall have plugs or screwed caps inserts until such time as all open ends are finally connected.

Every effort has been made to show the runs of pipework as accurately as possible on the Contract Drawings, yet, if any such runs require any special fittings, sets, fire-bends, pillar-bends, etc., to complete the work to the satisfaction of the Contract Administrator they shall be included whether herein specified and/or shown upon drawings or not.

All connections to cylinders, tanks, boilers and all other items of plant or equipment shall be made with unions of the appliance for repair or replacement.

All adaptations to existing services shall be carried out in a neat and approved manner.

Flanges on flanged pipework, malleable iron unions on steel pipes and straight connections on copper pipes shall be fitted where required for erection but must not exceed 6 metres and also where their presence would facilitate dismantling, maintenance, etc., also on all pipes immediately under the access covers of ducts or trenches and as directed by the Contract Administrator.

Where practicable all springs and off-sets shall be made in one piece without the use of fittings. Defective joints shall be taken down and re-made. The caulking of defective joints is not allowed.

E.6.3 EXPANSION

Full allowance shall be made for expansion and contraction.

Where expansion joints are indicated on the drawings, these shall be of the stainless steel bellows type having flanged or screwed ends. Care must be taken when installing these joints that pipework is erected in true alignment and bolt holes on counter flanges lined up correctly with joint flanges.

Suitable pipe guides must be installed to ensure correct function of these expansion joints. Anchor brackets shall be provided where indicated or required, specially fabricated to suit conditions and to the approval of the Contract Administrator.

E.6.4 AIR VENTS

All high points are to be vented adequately. Where automatic air vents are called for these are to be of Winn's manufacture or equal and approved, incorporating Lockshield shut-off valve and with copper drip pipe carried to discharge outside the building in each case. These drip pipes shall not be connected.

In all cases where air vents are taken off, an air bottle shall be formed of the full-bore of the main, surmounted by a cap suitably tapped to take the auto vent or air cock. Where air bottles are fitted at high level, a bleed pipe shall be brought down to a convenient level (generally 1800mm above F.F.L.) in 10mm copper tube, bracketed by means of copper saddle clips with brass screws at 250mm centres and terminating in a 15mm back-plate elbow with radiator type air vent.

All vents and release pipes installed in exposed positions shall be insulated to prevent freezing.

E.6.5 PIPE SUPPORTS

Pipes in Boiler Room/Plant Room areas shall be supported on purpose made wrought iron brackets made up to tee iron or flat bar fabricated to the pipe diameter and rigidly fixed to the fabric of the building.

Flamco (or equal and approved) brackets may be used.

Pipes in roof spaces / ceiling spaces shall generally be supported from 'Flamco' (or equal and approved) pipe clips.

Pipes, where they are exposed to view within the building shall be supported on split ring brackets with screw-on back plates or build-in tails as required and where installed at low level shall be bracketed alternatively off walls and floors at 1200mm centres.

In addition, pipe supports must also be provided on exposed low level pipework **within 150mm** either side of any change of direction.

Pipes in ducts shall be supported on split ring pattern brackets with screw-on back plates or build-in tails as required.

There are various types of proprietary brackets on the market similar in operation to the standard brackets and these generally are acceptable but prior approval must be obtained from the Consultant before use.

Where intermediate floors are constructed from precast hollow beams the 'support rail' shall be secured by means of galvanized / sheradized long steel screws taken through the centre of these precast hollow beams and attached to galvanized fishplates with locknuts. The fishplate assembly will be covered by the floor screed after the installation has been completed.

Where intermediate floors are constructed from reinforced concrete slabs, the 'support rail' shall be secured by means of 10mm wedge type anchor bolts fixed into the soffit of the slab with a minimum embedment of 75mm.

The 'support rail' together with the long screws, drop rods, clips, fixings, etc., shall be supplied and fixed by the Mechanical Services Installer.

Should any special support steelwork be required, in addition to the items mentioned above, this will be indicated on the relevant design drawing(s).

The spacing of pipe supports shall not exceed the centres given in the table below:

A - Mild Steel Pipework

Size	Uncovered	Insulated
15mm	2.400 m	2.400 m
20mm	2.400 m	2.400 m
25mm	2.500 m	2.400 m
32mm	3.600 m	3.000 m
40mm	3.600 m	3.000 m
50mm	4.800 m	4.200 m
65mm	4.800 m	4.200 m
80mm	4.800 m	4.200 m
100mm	4.800 m	4.400 m
Over 100mm	6.000 m	5.400 m

B - Copper Pipework

Size	Uncovered	Insulated
15mm	1.200 m	1.200 m

22mm	1.800 m	1.500 m
28mm	2.400 m	1.800 m
35mm	2.400 m	1.800 m
42mm	3.000 m	2.400 m
54mm	3.000 m	3.000 m
76mm and over	3.600 m	3.600 m

Where plastic pipelines incorporate metal valves or other heavy fittings it is essential to support and valves directly rather than allow their weight to be carried by the plastic pipe. For the same reason it is usually advisable to fix pipe supports on either side of flanged connections, especially where metal backing plates are used. Moulded plastic fittings should also be supported.

NOTE: Where normal ambient or working temperature exceeds 20°C the support distances should be reduced. Continuous support is required where temperatures approach 60°C.

Sketches of all-purpose made brackets not detailed on standard drawings must be submitted to the consultant and approval must be obtained for the type of supports to be used before the work is put in hand.

E.6.6 VALVES – ISOLATION VALVES

ISOLATION VALVES:

Isolation Valves up to 50mm:

Full flow 1/4 turn lever ball valves up to and including 50mm. DZR body, chrome plated full bore ball, PTFE seats and stem seal. BS EN 13828. BSP ended or Press ended OVENTROP REF: 107 90. (Or equal and prior approved)

OR

Bronze wedge gate valves up to and including 50mm. BS5154 / BS EN 12288 OVENTROP REF: 104 30. (Or equal and prior approved)

Isolation Valves 65mm to 100mm:

Cast iron butterfly valves with lever from 65mm up to and including 100mm. Above 100mm with gearwheel. Nodular iron body, stainless steel shaft, stainless steel disc, EPDM seals. BS 5150 / BS EN 593.

OVENTROP REFS: 104 62. (Semi lugged lever pattern), 104 69. (Semi lugged gearwheel pattern), 104 82. (Fully lugged lever pattern), 104 89. (Fully lugged gearwheel pattern) (or equal and prior approved)

OR

Cast iron wedge gate valves BS5150 / BS EN 1171, 65mm and above. Flanged PN16. OVENTROP REF: 104 52. (Or equal and prior approved)

OR

Cast iron wedge gate valves BS5150 / BS EN 1171, 65mm and above. Flanged PN10. OVENTROP REF: 104 51. (Or equal and prior approved)

E.6.7 VALVES – DOUBLE REGULATING/FLOW MEASUREMENT VALVES

FIXED ORIFICE FLOW MEASUREMENT VALVES

Up to 50mm:

Hydrocontrol MTR / MPR” Bronze fixed orifice commissioning valve comprising double regulating valve and integrated metering station with test points up to and including 50mm. BS 7350. BSP ended or Press ended. OVENTROP REF: 106 04. (Or equal and prior approved)

65mm and above:

“Hydrocontrol MFC” Cast Iron fixed orifice commissioning valve comprising cast iron double regulating valve and integrated stainless steel orifice plate with test points. 65mm and above. Repositionable handwheel with lead lock anti-tamper device. BS7350. Flanged PN16. OVENTROP REF: 106 58. (Or equal and prior approved)

DOUBLE REGULATING VALVES

Up to 50mm:

“Hydrocontrol VTR / VPR” Double regulating valves up to and including 50mm. Bronze body & bonnet, DZR stem & disc, PTFE disc seal. BS7350. BSP ended or Press ended OVENTROP REF: 106 01. (Or equal and prior approved)

65mm and above:

“Hydrocontrol VFC” Double regulating valves 65mm and above. Cast iron body, bronze bonnet & disc, DZR stem, EPDM seals. Repositionable handwheel with leadlock anti-tamper device. BS EN 13789. Flanged PN16. OVENTROP REF: 106 26. (Or equal and prior approved)

E.6.8 VALVES – NON RETURN VALVES

Up to 50mm:

Bronze swing check valve up to and including 50mm. Bronze body, brass bonnet and flap. BS EN 12288. BSP Ended OVENTROP REF:107 50. (Or equal and prior approved)

65mm and above:

Cast Iron swing check valve 65mm and above. Cast Iron body and bonnet. Seat rings of brass, asbestos free gasket. BS EN 1074. Flanged PN16. OVENTROP REF:107 30. (Or equal and prior approved)

E.6.9 VALVES – STRAINERS

Up to 50mm:

Bronze 'Y' type strainer up to and including 50mm. Bronze body, stainless steel mesh. BSP Ended. OVENTROP REF: 112 00. (Or equal and prior approved)

65mm and above:

Cast iron 'Y' type strainer 65 mm and above. Cast Iron body and cover, asbestos free gasket. Stainless steel basket. Flanged PN16.
OVENTROP REF: 112 20. (Or equal and prior approved)

E.6.10 VALVES – DRAIN COCKS

Draw off cocks shall be fixed in such positions as are necessary to drain the whole of the installation.

'Optiflex' Lever operated ball drain valve with hose union, self-seal thread & cap.

OVENTROP REF: 103 33. (Or equal and prior approved)

E.6.11 VALVES – AUTOMATIC AIR ELIMINATORS

Brass automatic air eliminator with automatic isolation on removal.

OVENTROP REF: 108 83. (Or equal and prior approved)

E.6.12 VALVES - DIFFERENTIAL PRESSURE CONTROL VALVES

Where differential pressure control valves are indicated on the drawings, the following specification applies:

The Contractor shall install in positions indicated on the drawings issued, a differential pressure control arrangement. The valve arrangement will comprise of a differential pressure control valve (DPCV), installed on the return pipe, connected via the capillary supplied to a commissioning valve positioned on the flow. The commissioning valve shall be selected to provide a measurement signal across the metering station for flow measurement of between 1.0 and 4.7kPa. The DPCV shall be selected to provide an optimum pressure drop across the unit of between 3 and 10kPa. The DPCV shall control the downstream sub circuit pressure as indicated in the valve selection schedule.

An "Optibal" or "Hydrostop" Isolating valve shall be provided downstream of the DPCV on the return pipe to enable system isolation and maintenance. A T-piece measuring adaptor shall be installed on to the commissioning valve to allow simultaneous flow measurement and differential pressure control.

Manufacturer: - Oventrop GmbH & Co. KG

Model Ref's: -

Hycocn DTZ differential pressure control valve (DPCV) (5-60kPa Low flow)

Hydromat DTR differential pressure control valve (DPCV) (5-70kPa)

Hydromat DFC differential pressure control valve (DPCV) (20-180kPa)

Hydrocontrol MTR commissioning valve

Hydrocontrol MFC commissioning valve (65mm and above)

T-piece measuring adaptor

Optibal ball isolating valve (up to 50mm)

Hydrostop butterfly isolating valve (65mm and above)

E.6.13 VALVES - PRESSURE INDEPENDENT CONTROL VALVES (2-PORT)

Where pressure independent control valves are indicated on the drawings, the following specification applies:

The Contractor shall install in positions indicated on the drawings issued, a pressure independent 2 port control valve set. The valve set will comprise of a "Cocon Q" pressure independent control valve and an associated actuator. The valve shall be installed with the flow direction arrow positioned to ensure correct water flow through the valve. To ensure successful commissioning of the system the pressure independent control valve shall be selected to provide a minimum pressure drop across the unit as indicated in the valve selection schedule.

The valve shall have the following functions: -

- 2 Port Control with actuator (please refer to control strategy for particular actuator specification)
- Automatic (lockable) flow regulator with external, visible flow indicator markings for hydronic balancing
- Internal differential pressure control arrangement to maintain flow control and valve authority
- Pressure measurement test points

Manufacturer: Oventrop GmbH & Co. KG.

Flow Rates up to 4800l/h: Cocon QTZ pressure independent 2 port control valve (PN25)

Flow Rates 1.5 to 14m³/h: Cocon QTR pressure independent 2 port control valve (PN25)

Flow Rates 5 to 190m³/h: Cocon QFC pressure independent 2 port control valve (PN25)

The Contractor shall install in positions indicated on the drawings issued, a fixed orifice metering station to enable the flow rate to be witnessed.

The metering station shall be selected to provide a flow measurement signal of between 1.0 and 4.7 kPa, Manufacturer: Oventrop GmbH & Co. KG.

E.6.14 VALVE LABELLING

All valves in Boiler House and each main circuit control valve shall have black on white 'Traffolyte' labels 25mm in diameter securely wired on, stating valve number, also all pumps, fans, boilers, cylinders, etc., shall be numbered.

The Mechanical Services Installer shall provide and fix a circuit control diagram in accordance with the labeling. This shall be hung in a suitable position in the boiler house and provided with frame and glass protection.

E.6.15 SLEEVES

Where pipes pass through walls, floors, partitions, duct walls, etc., metal sleeve pipes shall be provided of Class 'A' Quality tube 2 no. Min. 'A' size larger, with ends neatly finished off to protrude 6mm beyond the finished face of the wall, etc., so that the pipes may be withdrawn from the sleeve if required.

These sleeves must be finished off either with an approved plastic or heavy metal floor plate of the set-screw type that can be fixed securely in position. (Sheet metal sleeves will not be acceptable).

Where pipes pass through suspended ceiling tiles floor/ceiling plates of an approved pattern must be fitted.

Where pipes pass through Fire Compartment Walls, fire stop precautions shall be required as denoted in Building Regulation B3 Section 11 and BS 476 Part 20

E.6.16 MAINTENANCE TOOLS

In addition to the special tools provided by the manufacturer, tools provided by the manufacturer, tools and lubricants as indicated in Part F of the Specification Document shall be supplied.

E.6.17 RETURN HEADERS

Where multiple returns are connected into a common return header each separate return shall be provided with isolating valve, thermometer and drain cock.

E.6.18 SYSTEM FLUSHING

The complete installation is to be treated by the application of 'Ferrox' chemical agents or equal and approved as advised by the Boiler manufacturer and the Mechanical Services Installer shall submit a schedule of such agents for approval by the Contract Administrator. The complete installation is to be flushed out with cold water and a commercial application of cleaning/flushing agent.

After the application of the flushing agent and the subsequent draining and refilling of the system, in accordance with the manufacturers recommendations, the installation is then to be dosed with protective agent.

The final PH reading for the system water should be between 7.0 and 8.0. Evidence of this reading shall be submitted to the Engineer upon completion of these works.

E.6.19 TESTING AND COMMISSIONING

The Mechanical Services Installer is required to supply, install, and set to work all the previously specified equipment. All pressure testing and thermal testing techniques shall be carried out in accordance with the C.I.B.S.E. Commissioning Guides. Fuel for this purpose shall be provided by the Mechanical Services Installer.

The attention of the Installer is specifically drawn to the 'Training of Operator' clause in Commissioning and Testing Part of the Specification Document.

NOTE: Where alterations and extensions are carried out to existing installations the Installer shall allow in his tender for the filling, dosing, and balancing of the new and existing systems after the installation work has been completed.

E.7 INSULATION

E.7.1 GENERAL DESCRIPTION

The Insulation services installation scope of works for this project involves the following:

Supply and install pipework insulation to new hot & cold water pipework systems
Supply and install pipework insulation to new LPHW pipework systems
Supply and install refrigeration pipework insulation (see air-conditioning section)

On completion of the hydraulic tests, to the satisfaction of the Contract Administrator, all pipework in the roof spaces, false ceilings, wall chases, etc., including the cold water services and all pipework not required as heating surface shall be thermally insulated in accordance with the following specification.

All pipes and ironwork to be thoroughly wire brushed and cleaned to ensure complete removal of all rust and grease prior to the application of insulation and treated with two coats of red oxide or equal paint.

In all cases where rigid sectional or flexible insulation is used, all care must be taken that its density is not impaired by compression when tie wires or bands are secured in position, or when further layers of materials or enclosures are applied.

The whole of the work is to be carried out in accordance with the manufacturer's installation procedures and in a neat and approved manner to conform with BS 874:1973:1986 (and all amendments), BS 5422:2009, EN 14303:2009+A1:2013 BS EN 12664:2001, BS EN 13467:2001 and all associated standards and codes of practice

E.7.2 PIPE AND DUCTWORK INSULATION SPECIFICATION

All pipework and ductwork shall be insulated as detailed.

All pipework and ductwork insulation shall be Thermobreak foil backed insulation. The physical characteristics of the insulating material together with adhesive, fixing, vapour barrier and finishing materials, whether pre-applied or applied on site, shall conform to the following.

Technical Data:

Material:	Irradiation (physically) crosslinked polyolefin foam with factory applied reinforced foil.
Density:	25kg/ m ³ (foam core only)
Thermal Conductivity: (ISO 8302-1991)	0.032 W/mk (@ 23° mean temperature)
Water Vapour Permeability: (ASTM E96)	8.19 x 10 ⁻¹⁵ kg / Pa.sm (0.29 mg.m/Nh)
Water Vapour Permeance:	3.3 x 10 ⁻¹⁴ g/M.N.S

Permeability Resistance Factor:	$\mu > 20,000$
Water Absorption by Volume:	0.8% (after 28 days)
Resistance to Fungi: (ASTM G21)	Zero Growth
Operating Temperature:	-80°C to 100°C
Fire and Smoke Behavior:	
BS 476 Part 6 and 7	Class 0
AS 1530.3 (1999)	
Spread Flam Index:	0
Heat Evolved Index:	0
Ignitability Index:	0
Smoke Develop Index:	0-1
UL94:	HF-1
ASTME 84:	Complies to: Flame Speed Index <25 Smoke Index <50
NFPA 90A & NFPA 90B:	Complies with Requirements
ISO 5659-2 (1994)	

All insulation shall be generally as follows:

Pipe Size:	Insulation Thickness
15-22	19mm
28 and above	25mm
Ductwork	25mm
Where frost protection is required:	38mm

All insulation joints both butt joints and horizontal joints shall be neatly finished with all joints being sealed with approved manufacturers adhesive. Insulation shall be neatly mitred at bends, tees, valves etc. end caps shall be installed at all valves, tees, etc.

All insulation work shall be carried out by an approved specialist. all materials delivered to site shall be new and dry, and so maintained throughout the progress of the works.

The engineer will not accept poor quality or badly finished work neither will he accept irregularities in the thickness of insulating materials or in the material covering. All work shall be left smooth, clean, and properly finished.

Pipework shall be insulated separately, and adjacent parallel pipes shall not be married together in one insulation covering.

Where allowance must be made for pipe – duct expansion, and / or contraction, insulation shall be finished in a neat and approve manner permitting easy access and disconnection of removable items without disturbing the surrounding insulation.

Insulation materials and their finishes shall be free from asbestos.

The Engineer will not accept poor quality or badly finished work, neither will he accept irregularities in the thickness of insulating materials or in the material covering. All work shall be left smooth, clean, and properly finished.

All insulating material and associated products shall be applied strictly in accordance with the manufacturer's recommendations and instructions and work failing to comply with these will not be accepted by the Engineer.

All joints, surfaces, edges, and overlaps shall be neatly finished and where possible, overlaps shall be arranged to be on the 'blind' side.

Where allowance must be made for pipe / duct expansion and / or contraction, insulation shall be finished in a neat and approved manner permitting easy access and disconnection of removable items without disturbing the surrounding insulation.

Unless otherwise indicated, all thermal insulating materials used within any building shall, when tested in accordance with B.S. 476, Part 4, be classified non-combustible. Alternatively, all thermal insulating materials used within any building shall be non-combustible with a facing of combustible material providing that the facing is not more than 0.8 mm thick, and it has a Class 0 surface spread of flame when tested in accordance with B.S. 476, Part 7. Thermal insulating materials used within any building shall be free from substances which in the event of a fire would generate appreciable quantities of smoke, noxious or toxic fumes. When requested by the Engineers, evidence of fire classification, obtained from an approved testing laboratory, shall be provided by this Specialist to certify that materials comply with this Clause.

Insulation materials and their finishes shall be free from asbestos.

E.7.3 PIPEWORK IN CEILING VOIDS, VERTICAL DUCTS, FLOOR VOIDS AND ALL OTHER CONCEALED LOCATIONS

All LPHW & water pipework systems to be insulated with "Isover" pre formed mineral wool snap on pipe insulation sections.

Insulation shall be manufactured under quality management standard EN ISO: 9001:2000 and shall comply with the performance requirements and application standards of BS5422:2001 & BS5970:2001.

The base mineral wool of the insulation shall be totally non combustible achieving a Euroclass A2 fire rating.

The aluminium foil face shall comply with the requirements of BS476: Part 6 “Fire propagation” and BS476: Part 7 “Surface spread of Flame” and rated to Class “O” to the building regulations.

The insulation shall be odourless and fully compatible with all standard pipework services and components and shall not accelerate corrosion with steel copper or aluminium.

The water vapour permeance of the applied foil covering the pipe insulation as be 0.00024g/(s.MN) and be suitable for use on pipework operating at temperatures below ambient.

Sections held in position by 3 bands per section are to be close butted and all longitudinal overlaps are to be sealed with a suitable adhesive to the manufacturer's recommendations.

Butt joints are to be sealed with 100mm wide self-adhesive white lacquered dead soft aluminum foil tape, applied over a clean surface and firmly pressed down.

Bends shall be insulated mitred and cut to fit, with joints sealed with adhesive and matching self-adhesive tape.

The installer must be careful not to damage the decorative facing.

Insulation thickness to be as follows:

Pipe Diameter (mm)	Insulation thickness (mm)
15mm-40mm	32mm
50mm-100mm	38mm
150mm-300mm	50mm

E.7.4 PIPEWORK EXTERNALLY (OUTDOOR)

The external pipework installations on this project shall be insulated in Isover Climpipe Section Alu2

Standards & Approvals:

Fire Performance: Classified A2 Euroclass , Class 0 Fire Rating for Aluminium Foil

CE marked in accordance with EN 14303

Compliant with BS 5422 2009

Conductivity at 10°C: 0.033W/mK or less

Pipe Diameter (mm)	Insulation thickness (mm)
15mm-28mm	40mm
35mm or greater	50mm

External Weather Protection:

Final Surface Treatment to be: Aluminium Sheet Protection.

Apply embossed aluminium cladding (stucco cladding) directly to insulating material – 0.71mm thick on ductwork. Aluminium Sheeting to be fixed and installed in accordance with BS 5970

All insulation joints are to be securely taped with 100 mm wide plain soft aluminum foil self-adhesive tape. Any exposed edges of the insulation and any other points where the covering is penetrated, are to be sealed with a suitable sealant.

The insulation shall be manufactured under quality management standard EN ISO: 9001.

The insulation shall be wrapped around the ductwork and bonded with a recommended fire-resistant adhesive, applied in accordance with the manufacturer's instructions.

E.7.5 VALVE LAGGING JACKETS

Contractor to include for the supply and installation of valve insulation blankets on all new LPHW pipework in the plantroom

The valve lagging jackets shall meet the following specification.

Outer & Inner Face Materials

Satin weave glass coated with specially formulated silicone rubber.

Weight of Cloth: 490 g per sq. m.

Coating: 80 g per sq. m. Silver grey silicone rubber.

Temperature Resistance

Continuous use 36 - 260 degrees C.

Flame Resistance: Complies with BS 476, Part 7, 1971, and Part 6, 1989: Class 'A' and Class 'O'.

Fastenings

Flaps: Velcro sewn onto face material cloth.

Draw Strings: Polyester cord.

Infill Material

Needle and mineral wool.

Sewing Methods: Lock stitch on all seams using glass thread.

Temperature Limit: 480 degrees C

E.7.6 RECTANGULAR / CIRCULAR AIR DUCTWORK IN ROOF SPACE, VOIDS AND CONCEALED LOCATIONS

The ductwork installations on this project shall be insulated in 25mm thick “Isover” Multi-purpose duct slab ductwork insulation which is suitable for standard rectangular and circular ductwork.

The insulation shall be manufactured under quality management standard EN ISO: 9001:2000 and shall comply with the performance requirements and application standards of BS3958: Part 5: 1986 “Specification for bonded man made mineral fibre slabs”

The insulation shall be mineral wool type and shall have a Euro-class A1 fire rating when classified in accordance with BS EN 13501-1.

Additionally, the aluminium foil face shall comply with the requirements of BS476: Part 6 “Fire propagation” and BS476: Part 7 “Surface spread of Flame” and rated to Class “O” to the building regulations.

The insulation shall be odourless and fully compatible with all standard HVAC materials and components and shall not accelerate corrosion with steel copper or aluminium. The insulation shall not sustain vermin, nor breed or promote fungi or bacteria.

The insulation shall have a thermal conductivity value of 0.032 W/m.k and water vapour permeance of 0.0037g/(s.MN) (foil facing).

The insulation shall be wrapped around the ductwork and bonded with a recommended fire resistant adhesive, applied in accordance with the manufacturer's instructions.

All insulation joints shall be sealed by means of a matching self-adhesive tape, 100mm wide. Any exposed edges of the insulation and any other points, where the covering is penetrated, are to be sealed with a suitable sealant.

Large ductwork sections greater than 600mm wide to include wire netting wrapped around insulation.

The Installer must ensure that the vapour barrier is not punctured when applying the wire netting.

E.7.7 RECTANGULAR / CIRCULAR AIR DUCTWORK EXTERNALLY (OUTDOOR)

The external ductwork installations on this project shall be insulated in 25mm thick Isover Climcover Roll Alu2 (Circular) or Isover Climcover Slab Alu2 (Rectangular)

Standards & Approvals:

Fire Performance: Classified A2 Euroclass

CE marked in accordance with EN 14303

Compliant with BS 5422 2009

Conductivity at 10°C: 0.032W/mK or less

External Weather Protection:

Final Surface Treatment to be: Aluminium Sheet Protection.

Apply embossed aluminium cladding (stucco cladding) directly to insulating material – 0.71mm thick on ductwork. Aluminium Sheeting to be fixed and installed in accordance with BS 5970

All insulation joints are to be securely taped with 100mm wide plain soft aluminium foil self-adhesive tape. Any exposed edges of the insulation and any other points where the covering is penetrated, are to be sealed with a suitable sealant.

The insulation shall be manufactured under quality management standard EN ISO: 9001.

The insulation shall be wrapped around the ductwork and bonded with a recommended fire resistant adhesive, applied in accordance with the manufacturer's instructions.

E.7.8 GENERAL PAINTING AND IDENTIFICATION BANDS

Where insulation is enclosed in aluminum cladding it is to be left thoroughly clean and in natural finish. Under no circumstances should the aluminum be painted. PVC identification colour bands shall be provided at 2m intervals in accordance with BS 1710 and applicable to colour chart code. PVC flow direction arrows shall be fitted at 3m intervals.

All pipework, whatever the finish, which is not immediately identifiable must have identity colour bands fitted at 2m intervals in accordance with BS 1710 colour code indicated on chart.

In order to standardize on colour bands for engineering pipework, the following colour chart will be used. This chart is in accordance with the latest B.S.1710:1984 (See also table 15:8 - Part 15 Symbols and Notations).

<u>Pipe Contents</u>	<u>Basic Colour</u>	<u>Colour Code Indication</u>
Drinking Water	Green	Blue
Cooling Water	Green	White
Boiler Feed Water	Green	Crimson/White/Crimson
Condensate Water	Green	Crimson/White/Crimson
Central Heating <100°C	Green	Blue/Crimson/Blue
Central Heating >100°C	Green	Crimson/Blue/Crimson
Cold, down Service	Green	White/Blue/White
Hot Water Supply	Green	White/Crimson/White
Fire Extinguisher	Green	Safety Red
Compressed Air Light	Blue	Light Blue
Steam	Silver Grey	Silver Grey
Natural Gas	Yellow Ochre	Yellow Ochre
Oil (Furnace Fuel)	Brown	Brown

All pipework above duct level and within the building, which is not included elsewhere in this specification will be finished by others.

On repair work, or where alterations to existing plant are involved, all covering which is disturbed must be made good and repainted as called for in this specification. Where this work is in an existing boiler house the whole of the equipment, new and existing, is to be repainted in accordance with this specification.

E.7.9 DUCTWORK PAINTING AND IDENTIFICATION

In accordance with BS 1710 identification tags are to be placed at 3m intervals, or as appropriate, on all ductwork outside the plant room for easy identification, indicating 'Warm Air Supply', 'Conditioned Air Supply' 'Recirculation Air', 'Fresh Air', 'Extract', or as appropriate.

E.7.10 LIAISON

Insulation work must be programmed in such a way as to ensure that no part of the work causes inconvenience or delay, either to other trades or the client, particularly in respect of services situated in ducts or trenches, which if left open for protracted periods of time, whilst awaiting the insulation works, can seriously impede the progress of the Contractor's program of works.

It is the Installer's responsibility to ensure against any such delays or holdups and to arrange the program of his specialist works to comply in full with the requirements of the Contract. Boiler house and plant room insulation and painting are to be completed in its entirety within a reasonable time of the completion of the plant and pipework installation therein.

F MECHANICAL SCHEDULES

F.1 SCHEDULE OF DOCUMENTS

Drawings

26.3142 Refer to Drawing Register for list of drawings

Drawing Registers

26.3142 Drawing Register

Technical Specifications

26.3142 Mechanical Specification

G SUMMARY OF PRICES

ELEMENT 1 – CONTRACT PRELIMINARIES

1. Amount for General Preliminaries	€
2. Amount for compliance with Conditions of Contract:	€
3. Amount for compliance with requirements of Building Regulations:	€
4. Amount for compliance with Health, Safety, Welfare at Work Regulations	€
5. Amount for compliance with Work Safety Protocol (Covid 19)	€
6. Amount for coordinated drawings:	€
7. Amount for “as-installed” drawings:	€
8. Amount for marking out builders works requirements:	€
9. Amount for labeling and charts	€
10. Amount for all attendances:	€
11. Amount for attendance at site meetings:	€
12. Amount for O&M Manuals:	€
13. Amount for client instruction:	€

TOTAL: (carried forward to Summary of Tender): €

ELEMENT 2 - HEATING INSTALLATION:

1. Amount for modifications to existing heating installation in the attic space	€
2. Amount for new LPHW pipework	€
3. Amount for flushing out entire system and refilling and dosing the system	€
4. Amount for identification of existing services	€
5. Amount for testing and commissioning	€
6. Amount for any item not listed (Give details)	€

TOTAL: (carried forward to Summary of Tender): €

ELEMENT 3 – WATER SERVICES

1. Amount for draining down existing systems and isolating same	€
2. Amount for connection of new water services pipework into existing systems	€
3. Amount for new MWS pipe work (non-metallic) and valve installation	€
4. Amount for new CWS pipe work and valve installation	€
5. Amount for new HWS pipe work and valve installation	€
6. Amount for new water services fixtures and fittings	€
7. Amount for thermostatic mixing valves at wash hand basins	€
8. Amount for installation of sanitary ware & connecting services to same	€
9. Amount for flushing out, disinfection and chlorination of water services system	€
10. Amount for pipe work insulation	€
11. Amount for labeling and tagging	€
12. Amount for testing and commissioning	€
13. Amount for any item not listed (give details)	€

TOTAL: (carried forward to Summary of Tender): €

ELEMENT 4 - SOILS & WASTES:

- | | |
|--|---|
| 1. Amount for new waste pipe work installation. | € |
| 2. Amount for fire collar installation. | € |
| 3. Amount for fittings, traps & final connections etc. | € |
| 4. Amount for labeling. | € |
| 5. Amount for identification of services. | € |
| 6. Amount for testing and commissioning. | € |
| 7. Amount for any item not listed (give details) | € |

TOTAL: (carried forward to Summary of Tender): €

ELEMENT 5 – PROTECTIVE SERVICES:

- | | |
|--|---|
| 1. Amount for new fire extinguisher installation | € |
| 2. Amount for new fire blanket | € |
| 3. Amount for any item not listed (give details) | € |

TOTAL: (carried forward to Summary of Tender): €

ELEMENT 6 – VENTILATION & AIR CONDITIONING SERVICES:

- | | |
|---|---|
| 1. Amount for relocation of existing outdoor Air Conditioning system complete | € |
| 2. Amount for new VRF AC system complete | € |
| 3. Amount for new refrigeration containment system on external façade of Building | € |
| 4. Amount for new Heat Recovery Ventilation units complete | € |
| 5. Amount for electric duct heaters complete | € |
| 6. Amount for Supply air Ventilation ductwork complete | € |
| 7. Amount for Return air Ventilation ductwork complete | € |
| 8. Amount for Supply grilles complete | € |
| 9. Amount for Return air grilles complete | € |
| 10. Amount for Ventilation Attenuators complete | € |
| 11. Amount for volume control dampers complete | € |
| 12. Amount for ductwork insulation | € |
| 13. Amount for new fire dampers complete | € |
| 14. Amount for external Roof Cows complete | € |
| 15. Amount testing and commissioning | € |
| 16. Amount for any item not listed (give details) | € |

TOTAL: (carried forward to Summary of Tender): €

ELEMENT 7 – CONTINGENCY:

- | | |
|---------------------------|------------|
| 1. Amount for contingency | € 5,000.00 |
|---------------------------|------------|

TOTAL: (carried forward to Summary of Tender): € 5,000.00

SUMMARY OF TENDER

1. Amount for element 1	€
2. Amount for element 2	€
3. Amount for element 3	€
4. Amount for element 4	€
5. Amount for element 5	€
6. Amount for element 6	€
7. Amount for element 7	€5000.00

TOTAL MECHANICAL TENDER Ex VAT €

Contractors Signature

.....

Contractor's Address

.....

Date

.....

H FORM OF TENDER

Tender for the:
Corlann Ireland
Proposed extension to Offices
Gort Road

I/We

.....

Hereby tender and undertake to execute and complete all the Service required to be performed in accordance with the Form of Contract, Contract Conditions, Specifications, instructions for tendering and Instructions to Tenderers, and contained in therein and any other documents listed in the Specific Conditions of Contract for the following prices:

Tender Figure exclusive of VAT
(In words)

.....

Tender Figure inclusive of VAT
(In words)

.....

Contractors Signature

.....

Contractor's Address

.....

.....

Date

.....

I DECLARATION OF COMPLIANCE

Tender for the:
Corlann Ireland
Proposed extension to Offices
Gort Road

I/We

.....

Hereby tender and undertake to execute and complete all the Service required to be performed in accordance with the Form of Contract, Contract Conditions and Specifications, instructions for tendering and Instructions to Tenderers.

In addition to this, we hereby confirm that our tender submission is in accordance and in full compliance with tender documents, including all associated specification and drawings.

Contractors Signature

.....

Contractor's Address

.....

.....

Date

.....