

LevelUp Whitehaven Mechanical Services Specification

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PART1 PREAMBLE

1.1 Introduction

1.1.1 This specification is divided into three sections:

Section A	-	Contract Particulars
Section B	-	Particular Specification
Section C	-	Standard Specification

- 1.1.2 Section A describes the specific contract requirements for the applicable to all projects.
- 1.1.3 Section B describes the specific requirements for each single particular project.
- 1.1.4 Section C describes standard methods of installation and minimum requirements applicable to all projects. This section is broadly divided into the constituent elements, which form the complete mechanical installation.

Specification

- 1.1.5 Design, supply, install, set to work, test and commission the complete mechanical services installation as described in this specification and as shown on the tender drawings.
- 1.1.6 Read the specification in conjunction with the Preliminaries of the Main Contract.

Standards and Codes of Practice

1.1.7 References to British Standards, Codes of Practice, Regulations and the like do not give the year of issue or amendment. The published versions that apply will be those current ten days before the date set for return of tenders.

Engineer

1.1.8 References to the Engineer shall mean the person nominated in the contract as Contract Administrator or his authorised representative.

Approvals

1.1.9 References to "approval of the Engineer" or similar terms shall mean the written acceptance in principle of the Engineer.

Tender Drawings

- 1.1.10 The specification lists all tender drawings for the mechanical engineering services.
- 1.1.11 If required inspect the Architect and Structural Engineer's drawings at their respective offices.

Read Together

1.1.12 Read the specification and tender drawings together. Include work shown on tender drawings but not described in the specification, and vice-versa. If it is considered there is a discrepancy between the specification and drawings or ambiguity in either of them clarify



the difference before Tendering.

1.1.13 If all the information required cannot be obtained from the specification, tender drawings or visiting the site, apply to the Engineer for the information.

Preferred Standard Equipment

- 1.1.14 The specification and tender drawings contain references to products and equipment, and all such references quote by name, type, figure number or by detailed specification, particular products of specified manufacturers. The tender drawings have been prepared using the dimensions and salient features of such preferred standard equipment.
- 1.1.15 Base the tender on the equipment specified.
- 1.1.16 If the Contractor desires to submit alternative equipment for the approval of the Engineer, do so after the Contract is let.

1.2 Information to be Provided

- 1.2.1 Provide design, installation, builders work information and drawings and other information as detailed in the specification.
- 1.2.2 Thoroughly check all Suppliers and Specialists drawings etc to ensure that the various works, installations and services do not conflict with each other or with other Sub-Contractors drawings or with the building structure, fabric or finishes, either during construction or in the finished building.
- 1.2.3 Submit drawings in sufficient time to comply with the contract programme. Allow not less than two working weeks for the Engineer's comments. Make due allowance for resubmission of drawings, if necessary, in accordance with the Engineers comments.
- 1.2.4 Do not proceed with ordering, fabrication, erection or installation until the Engineer has confirmed in writing he has no further comments.
- 1.2.5 Supply three copies of all drawings for comment and seven copies of the final version for use by the Employer.
- 1.2.6 The Engineer's comments on working or manufacturing drawings submitted by the Contractor shall not in any way relieve the Contractor of his responsibility in respect to the accuracy of all such drawings nor from his responsibility for providing equipment suitable in dimension, construction and finish for the location in which it is to be installed, provided that any discrepancies, errors or omissions are not due to inaccurate information or particulars furnished in writing to the Contractor by the Engineer. The Engineer will draw attention to any divergence from the specified requirements or errors, which occur to him but his comment, shall not imply approval in terms of dimensional accuracy or completeness of detail.



Equipment Manufacturer's and Shop Drawings

1.2.7 Obtain manufacturers shop drawings etc for all items of plant, equipment, control panels etc for the purpose of explaining how components of the design are to be assembled, fabricated, connected and installed.

Builders Work Information

- 1.2.8 Prepare drawings and schedules to show the architectural and structural requirements for all builders' works and allow their integration into the project. Include on these drawings and schedules requirements for foundations, bases and supporting structures for plant and equipment.
- 1.2.9 Mark out all builders' work and carry out minor builder's work (e.g. fixing of brackets to grounds and drilling of holes for screws).

Installation Drawings

- 1.2.10 Prepare drawings, based on the tender drawings and/or co-ordination drawings showing proposals for the execution of the works. Prepare the drawings in such detail as to enable the works to be installed. Agree the precise route of all pipelines and air ductwork with the Engineer.
- 1.2.11 Allow for attending co-ordination meetings with the Main Contractor, other sub-Contractors and Engineer as required to enable the installation drawings to be co-ordinated with those of other trades. Subsequently set out work involved and take all measurements and dimensions required for the installation on site.
- 1.2.12 Ascertain on site that the installation will not foul other permanent services or equipment. Notify the Engineer if it is necessary to make changes to take account of site conditions.
- 1.2.13 Obtain uniform and tidy arrangements of wall and ceiling mounted equipment. Determine the precise position of equipment as follows:
 - (a) Mount single items of equipment, which are visually remote from other items of electrical or mechanical equipment at the mounting heights stated in later sections.
 - (b) Arrange two or more items of equipment, whether electrical or mechanical or both, which are to be erected on the same wall or ceiling, or which will be otherwise visually close to each other, in a neat and symmetrical group. Obtain symmetry of arrangement by horizontal and vertical alignment through the centre lines and not the edges of the equipment, for this purpose vary the mounting heights slightly from those specified in later sections.
 - (c) Co-ordinate with all other services and disciplines in the planning of grouped arrangements.



Working Drawings

- 1.2.14 Keep on site a complete set of prints of installation drawings. Mark all variations, deviations and amendments on these drawings as the installation work proceeds. Use these 'marked-up' drawings as the basis for the record drawings referred to later.
- 1.2.15 Keep working drawings on site and available at all times for inspection by the Engineer.

1.3 Statutory and General Obligations

- 1.3.1 In respect of the installation, materials, components, equipment and workmanship comply with statutory and other obligations and the regulations of any Local Authority, Public Services or Statutory Undertaking relating to the execution of the works. In particular comply with the requirements of:
 - (a) The CIBSE Codes and Guides.
 - (b) Water Supply Bylaws.
 - (c) British Gas Regulations.
 - (d) The HVCA Codes and Guides.
 - (e) BS 7671 Regulations for Electrical Installations.
 - (f) Regulations under the Electricity Acts.
 - (g) The Health & Safety at Work, etc Act.
 - (h) Construction Design & Management Regulations (CDM) 2015.
 - (i) The Electricity at Work Regulations.
 - (j) The National Inspection Council for Electrical Installation Contracting.
 - (k) The Building Regulations.
 - (I) All other relevant British Standard Specifications and Codes of Practice, whether mentioned in this Specification, or not.

Existing Services

1.3.2 Do not interfere with or disrupt in any way the operation of any existing services (including process services) without the written permission of the Engineer; and in the case of Statutory Authorities or Private Owners, without the permission, in writing, of such Authorities or Owners.

1.4 Management and Administration Procedures

Schedule of Rates

1.4.1 Within two working weeks of being awarded the contract submit for approval of the Engineer three copies of the Schedule of Rates upon which the tender has been based. Schedule detailed quantities and rates for all works, and fully price and total the schedule to equal the original tender figure.



Valuation of Instructions and Variations

- 1.4.2 Oral instructions have no effect unless confirmed in writing.
- 1.4.3 Submit to the Engineer, within fourteen days of the receipt of the written instruction, the price of each variation showing the quantities and rates applicable for all materials etc employed in accordance with the schedule of rates. No work will be certified for payment until this information is provided.

Programme

- 1.4.4 Prepare a programme for the works and submit it for approval within two weeks of commencement of the contract. Take into account the Main Contractors programme, materials procurement and the needs for liaison with other services. Include all such relevant dates and supply three copies to the Engineer.
- 1.4.5 Review the programme at least on a monthly basis and update the programme if any circumstances arise which affect the progress of the works. Submit three copies of all revisions to the Engineer.

Specialist Activities

- 1.4.6 Employ specialists to undertake installations, including:
 - (a) Air ductwork
 - (b) Thermal insulation
 - (c) Controls and electrics
- **1.4.7** Employ specialists conversant with such work and ensure their attendance and advice on all aspects of installation, testing and commissioning.

Service Agreements

1.4.8 Obtain details and costs of all service agreements available and hand these to the Engineer four weeks prior to Practical Completion.

Site Procedures

- 1.4.9 Provide all necessary superintendence during the execution of the works and employ full time, on the site, a suitably qualified supervisor to be in charge of the site works from commencement of first fix activities to completion.
- 1.4.10 Do not remove or transfer key members of staff unless they prove unsatisfactory or cease to be employed by you. In such circumstances introduce their replacement in sufficient time for them to fully understand the status of the works prior to the original persons replacement.
- 1.4.11 Maintain on site during all such times as work is proceeding at least one copy of the under noted documents:
 - (a) All contract documents other than priced tender documents.



(b) All working drawings and additional details and instructions issued to operatives in connection with the Contract.

Protection and Cleaning

- **1.4.12** Ensure that all materials held on site, whether installed or awaiting installation, are protected against site deterioration.
- 1.4.13 Inspect all equipment immediately on delivery to site and rectify any deficiencies without delay. Subsequently maintain them free from corrosion or deterioration.
- 1.4.14 Paint purpose made mild steel supports fabricated from unpainted stock with a suitable primer and two coats of approved protective paint immediately after fabrication but before erection.
- 1.4.15 Mild steel heating and natural gas pipelines in boiler rooms and plant rooms, welds and all mild steel chilled water pipelines to be wire brushed clean and given one coat of red oxide paint.
- **1.4.16** Properly protect non-ferrous, highly finished, and speciality items at all times by approved coverings and packings to prevent deterioration.
- 1.4.17 Leave the installation of electrical components, motors, switchgear and instrumentation as late as possible and not before the area of installation is watertight so as to limit the possibility of damage.
- 1.4.18 Replace any defective, damaged or deteriorating equipment.
- **1.4.19** Maintain the site in a clean and sanitary condition and remove surplus materials, packings, etc., as they accumulate.
- 1.4.20 Protect all equipment against ingress of dust, water and foreign bodies, and seal off all openings at each interruption of work; so as to eliminate all possibility of contamination.

Steelwork and Fixings

- 1.4.21 Provide all necessary supporting steelwork, brackets, clamps and fixings necessary for the complete installation.
- 1.4.22 Obtain the Engineer's permission before welding to structural steelwork.
- 1.4.23 Make fixings generally as follows to:
 - (a) Concrete brickwork, etc., by suitably sized plugs or expansion bolts in correctly drilled holes.
 - (b) Structural steelwork by means of beam clamps.
 - (c) Steelwork specially provided for the purpose of supporting services and by means of suitably sized bolts, nuts and washers or clamps as required.



1.5 Work at Completion

Notices, Charts and Labels

- 1.5.1 Provide all necessary statutory and warning notices.
- 1.5.2 Submit sample copies of all notices, charts and the wording for all labels to the Engineer for approval before ordering them.
- 1.5.3 Identification tapes for pipelines and air ducts to be provided at 3 metre intervals, changes of direction, both sides of each isolation/regulation device and each side of wall and floor penetrations. Tapes to include service description and direction of flow and to comply fully with BS 1710.
- 1.5.4 40mm diameter white traffolite identification discs complete with tie wires to be attached to all valves located in plant room areas and at main isolation points. A schedule to read in conjunction with the discs is to be prepared and hung in the plant room in a glazed frame. When the record drawings are prepared add the identification numbers to the drawings and a schedule on each drawing to describe the purpose of each valve.
- 1.5.5 White traffolite, or other approved laminate type labels engraved with 6mm high black characters to be securely fixed by means of nuts, bolts and washers to all main items of plant and equipment indicating the following:
 - (a) Name of unit or equipment.
 - (b) Reference number.

Inspection, Testing and Commissioning of the Works

- **1.5.6** Provide attendance during the testing and commissioning of all mechanical and electrical plant, equipment and apparatus connected under this contract.
- 1.5.7 On completion of the works carry out tests on all pipeline and air ductwork systems in accordance with the requirements of the documents listed in the Statutory and General Obligations clause of this specification.
- 1.5.8 Tabulate the results of all tests in an approved format. Note and record on the tabulated forms the date such tests were carried out. Hand these forms to the Engineer on completion of the works.
- 1.5.9 For specialist installations, complete the test certificates as prescribed in the relevant BS Specification and hand to the Engineer on completion of the works.
- **1.5.10** Provide all necessary instruments and tools for the tests. Supply the Engineer with copies of recent test certificates confirming the accuracy of all test instruments.
- 1.5.11 On completion of the works forward to the Engineer duplicate copies of all test certificates and the completion certificate and inspection certificate as prescribed in the IEE Regulations.



Commissioning

- 1.5.12 Commission the individual parts of the works in accordance with manufacturers' instructions and the requirements of the documents listed in The Statutory and General Obligations Clause and the Commissioning Section of this specification.
- 1.5.13 Prepare in consultation with the Main Contractor a short-term programme for the Commissioning of the works. Include dates for pre-commissioning checks and actual commissioning tests and supply three copies to the Engineer in sufficient time for him to arrange to witness individual tests at random.
- 1.5.14 Give 5 days notice to the Engineer of the intention to carry out testing and commissioning. Where required by the Engineer repeat specific checks and tests in the presence of the Engineer.

Instruction

1.5.15 Following satisfactory commissioning of the works and prior to the completion of the works explain and demonstrate to the Employer's representative(s) the purpose, function and operation of all the works covered in this Specification including all items and procedures listed in the operating and maintenance manual. Include in this undertaking instruction from manufacturers' service engineers. Allow a minimum of 3 working days for this exercise which is to be carried out during normal working hours.

Record Drawings

- 1.5.16 Use 'marked-up' working drawings as the basis of the record drawings.
- 1.5.17 Incorporate plans, sections, elevations and other views as necessary to provide a complete record of the services as installed.
- 1.5.18 Include on the drawings the following items in sufficient detail to enable the building occupier to operate, maintain and adjust the plant and equipment:
 - (a) The location, level and sizes of all below ground services.
 - (b) The location and size of all isolation, regulation and control devices for each pipeline system.
 - (c) The location and size of all isolation, regulation, fire and control devices for each ventilation system.
 - (d) Isometric of each pipeline and ventilation system.
 - (e) The location of all electrical equipment associated with the mechanical services installation.
 - (f) The identification references of all plant and equipment.



1.5.19 Not later than two weeks prior to the completion of the works provide two copies of each record drawing to the Engineer for approval. Following approval, issue to the Engineer one copy of each drawing in AutoCAD version 2019 format on CD-ROM and insert two print copies in the operating and maintenance manual.

Operating and Maintenance Instructions

- 1.5.20 No later than two weeks prior to the commencement of commissioning provide two draft copies of the manual for comment.
- 1.5.21 Issue the final version of the manuals on completion of the works.
- 1.5.22 Each Manual to be A4 size, in plastic covered loose-leaf four ring binders with hard covers, indexed, divided and appropriately titled.
- 1.5.23 Ensure each manual contains the following information:
 - (a) An index.
 - (b) A full technical description of each system written to ensure that the Employer's staff fully understand the scope and facilities provided.
 - (c) A description of the mode of operation of each system.
 - (d) A list of record drawings with a brief description of each.
 - (e) A legend for all colour coded service.
 - (f) Schedules system by system, of plant and equipment stating their locations, duties and performance figures.
 - (g) The manufacturers name, address and telephone number for each item of plant and equipment together with catalogue list numbers.
 - (h) Manufacturers technical literature for all items of plant and equipment.
 - (i) A copy of all test certificates.
 - (j) A copy of all manufacturers guarantees and warranties.
 - (k) A schedule of all equipment settings established during commissioning.
 - (I) Procedures for seasonal changeovers.
 - (m) Recommendations as to the preventative maintenance frequency and procedures to be carried out to ensure efficient operation.
 - (n) Recommended lubricants.
 - (o) A list of normal consumables.
 - (p) A list of recommended spares.
 - (q) A guide to fault finding.
 - (r) Starting up, operating and shutting down procedures for all equipment and systems.



- (s) A copy of each record drawing.
- (t) A list of emergency telephone numbers.
- **1.5.24** Edit manufacturers standard operating and maintenance instructions to ensure only that information relevant and pertaining to the works is used.

Building Log Book

- 1.5.25 Refer to the Main Contract preliminaries for details of which member of the design or construction team is responsible for producing the Building Log Book in accordance with current Building Regulations. The log book is for the use of the building owner or occupier and shall include details of the installed building services plant and controls, their method of operation and maintenance, and other details that collectively enable energy consumption to be monitored and controlled. The information shall be provided in summary form suitable for day-to-day use.
- 1.5.26 The format will generally comply with the requirements of CIBSE TM31: Building Log Books – a guide and template for preparing building log books.
- 1.5.27 Include for liaising with the Building Log Book author and providing duplicate copies of the following information:
 - Description and purpose of each individual building services system.
 - A schedule of floor areas of each of the building zones categorised by environmental servicing type (e.g. air conditioned, naturally ventilated).
 - The location of the relevant plant and equipment including simplified schematic diagrams.
 - The installed capacities (input power and output rating) of the services plant.
 - Simple descriptions of the operational and control strategies of the energy consuming services in the building.
 - A copy of the report confirming that the building services equipment has been satisfactorily commissioned.
 - Operating and maintenance instructions that include provisions enabling the specified performance to be sustained during operation.
 - A schedule of the building's energy supply meters and sub-meters, indicating for each meter, the fuel type, its location, identification and description and instructions on their use.
 - A design assessment of the building services systems carbon emissions and the comparable performance benchmark (information provided by designer).



Keys Tools and Spares

1.5.28 Requirements:

Make an inventory of keys, tools and spares and hand them over in a lockable container.

- 1.5.29 Keys and tools:
 - (a) Two keys for drain cocks and air cocks.
 - (b) One length of reinforced plastic hose pipe, drain cock connector and storage rack.
- 1.5.30 Spares:
 - (a) One set of air filter media for each air filter.

Hand Over Procedure

1.5.31 On completion of commissioning the Engineer will make a preliminary hand over inspection and list all outstanding works and defects. Rectify these defects and subsequently offer the works for final hand-over. The Engineer will only recommend handover following receipt of the record drawings, operating and maintenance instructions, commissioning manual, written confirmation of the completion of outstanding works and satisfactory instruction of the Client's representative.

Defects Liability Period

- 1.5.32 During the defects period attend to further/additional items that need attention.
- 1.5.33 Approximately three weeks before the end of the defects period the Engineer will produce a final defects lists. Ensure that any items noted thereon are rectified prior to the end of the defects period. Write to the Engineer confirming such defects have been rectified and the work is complete.

Maintenance Contract

1.5.34 The Contractor is to include in his Tender a separate price for maintaining (not operating) the mechanical services installation for the duration of the defects liability period. Allow for three service visits and the cost of all consumables for carrying out the procedures listed in the operating and maintenance manual. This may be accepted or deleted by the Employer.

Section B Particular Specification **Mechanical Services Specification**



SECTION B – PARTICULAR SPECIFICATION

PART 1 PROJECT SPECIFIC REQUIREMENTS

1.1 Introduction

1.1.1 This part of the Specification describes the scope of the mechanical services installation and should be read in conjunction with the remainder of the Specification and the Tender Drawings. Together they cover the design, manufacture, supply, delivery to site, offloading and positioning, co-ordination, erection, testing, setting to work and commissioning of the mechanical services installation.

1.2 The Building

- 1.2.1 The existing furniture store located in Duke Street, Whitehaven will be redeveloped into a modern Digital and Gaming Hub.
- 1.2.2 This three-floor project is designed to align with its new purpose, featuring a café, gaming and IT areas, a servery, as well as a motion/capture area and relaxation spaces.
- 1.2.3 The building's current footprint will be maintained, with all existing mechanical services being fully stripped out and replaced to meet the new facility's requirements. Once completed, this hub will offer a dynamic environment tailored to digital and gaming activities.

1.3 Scope of Works

- 1.3.1 The mechanical services installation shall comprise the following elements:
 - a) Provision of new primary services
 - b) Mechanical ventilation installations
 - c) Space heating and cooling
 - d) Domestic hot and cold water
 - e) Automatic controls & wiring
 - f) Above ground drainage
- 1.3.2 The installation shall take due account of all relevant British Standards, The Building Regulations, recommendations of the Chartered Institution of Building Services Engineers and The Institute of Plumbing. Also, the recommendations in so far as they apply to this project concerning legionella contained in document CIBSE TM13 and Health and Safety Executive guide note EH48.

1.4 Design Philosophy

1.4.1 The design philosophy for the mechanical services systems shall incorporate the following primary aims:



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- a) Ensure compliance with statutory regulations and health and safety requirements (both during construction and the life of the new building).
- b) Provide spatial flexibility to be able to alter accommodation provisions at a later date with minimum disruption.
- c) To be suitable for the intended functions and use of the accommodation and integrated with the architectural/structural elements as much as possible.
- d) Provide comfortable and user-friendly accommodation.
- e) Simplicity of design for systems and their controls to reduce as much as possible the technical sophistication necessary to run the building satisfactorily.
- f) The use of standardised equipment throughout the project.
- g) The provision of easily and safely maintained plant for which spare parts and manufacturers support is readily available or obtainable without undue convenience or delay.
- h) Co-ordination of the engineering systems with the building fabric to ensure that major maintenance is where practical not carried out from within occupied areas.
- i) Particular emphasis to be placed on minimising the maintenance requirements together with minimising the range of spares needed to be held on site.
- j) Incorporate all features necessary to achieve the aim of low running cost and minimal energy use.
- k) Safety in use for occupants and maintenance staff.
- I) Be flexible for future modification and expansion.
- m) Be inherently reliable in use with acceptable levels of resiliency.

1.5 Design Life

1.5.1 The design life of the mechanical services plant and equipment shall be 20 years. The pipework and ductwork installation life shall be 25 years.

1.6 Ambient Conditions

- 1.6.1 All plant, equipment and systems shall be capable of withstanding the following ambient conditions:
 - a) External plant and equipment: Air temperature -20°C to +40°C, 90% RH
 - b) Internal plant and equipment: Air temperature -5°C to +40°C, 90% RH
- 1.6.2 These figures are not design values for the sizing of HVAC plant.

1.7 Plantrooms

1.7.1 External plant space will be provided at roof level to accommodate mechanical services plant and equipment as follows:



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• VRF external condensers

• <u>Ventilation Heat Recovery Units (serving Level 01,02 & Level 03)</u>

The mechanical services will be distributed vertically through the building via dedicated service risers. On each floor plate the services will be distributed horizontally within dedicated ceiling service voids or exposed as required by the building aesthetic.

1.8 Design Criteria

The Mechanical Services installation shall be designed upon the following design criteria:

1.8.1 External Design Conditions

Winter:	-5°C fully saturated
Summer:	27°C db, 19°C wb for heat gain calculations
	32°C db, 23°C wb for air-cooled condenser selection

1.8.2 Internal Design Conditions

•	
Circulation Spaces (Corridors):	18°C +/- 2°C, winter, summer uncontrolled
Circulation Spaces (Staircases):	18°C +/- 2°C, winter, summer uncontrolled
Gaming Spaces:	20°C +/- 2°C, winter, 23°C +/- 2°C summer
Toilets and Changing Rooms	18°C +/- 2°C, winter, summer uncontrolled
Café	20°C +/- 2°C, winter, 23°C +/- 2°C summer
Recording Studio	20°C +/- 2°C, winter, 23°C +/- 2°C summer
Editing Room	20°C +/- 2°C, winter, 23°C +/- 2°C summer
Consultation Room	20°C +/- 2°C, winter, summer uncontrolled
IT Learning/ Motion Capture	20°C +/- 2°C, winter, 23°C +/- 2°C summer
Internal Plant Areas:	5°C minimum

Internal temperatures are dry resultant and measured 1.5 metres above finished floor level.

Noise Criteria

Noise levels generated by the building services to the external environment shall be in accordance with the requirements of the Local Building Control/Environmental Health Officer.

Occupancy

The occupancy details and numbers of room users utilised to calculate the building services loadings have been developed from the information incorporated within the architectural layout drawings.

Mechanical Services Specification



SECTION B – PARTICULAR SPECIFICATION

For the purpose of mechanical ventilation design the following occupancies have been used:

E Sports	12
Café	20
VR Gaming open Area	49
IT Learning/ Motion/Capture	33
Recording Studio	3
Editing Room	3
Consultation	3
Relaxation	15

1.9 Incoming Services

- 1.9.1 A new mains water supply will be extended from the statutory authority main to serve the new building. A new pulsed type water meter will be provided on the incoming supply to allow monitoring of water usage.
- 1.9.2 The mains water supply to the building will be distributed from the meter outlet into the building to serve all potable cold water draw offs and primary supply to the hot water generation equipment.

1.10 Space Heating and Cooling

- 1.10.1 Heating and cooling shall be provided to all of the spaces through a refrigerant based 3 pipe variable refrigerant flow (VRF) and multi split type systems.
- 1.10.2 A centralised VRF system will be provided to <u>floors o to 2 consisting of wall mounted</u> <u>indoor units</u> located as indicated on the drawings connected to three outdoor condensers located at roof level.
- 1.10.3 The refrigeration pipework shall distribute from the roof top condensers through the mechanical service riser before entering each floor and connecting to the new system of VRF indoor units.
- 1.10.4 The entire VRF system will be controlled by the manufacturer based central controller which will allow the building operator to manage time schedule and temperature set point control to each zone.
- 1.10.5 The VRF <u>wall mounted units</u> in open plan areas will be controlled under the dictates of space temperature detectors connected to the central controller, where temperature and time scheduling can be adjusted and monitored.
- 1.10.6 The Editing Suite and Recording Studio will have the ability to be independently controlled via wall mounted controllers which will be zoned according to the indoor unit within each space.



SECTION B – PARTICULAR SPECIFICATION

- 1.10.7 A multi split type system will be provided to floor 3 consisting of <u>**2No wall mounted indoor**</u> <u>**units**</u> located as indicated on the drawings connected to an outdoor condenser located at roof level.
- 1.10.8 The refrigeration pipework shall distribute from the roof top condenser at high level before connecting to the new system of indoor units.
- 1.10.9 The system will be controlled by the manufacturer based central controller which will allow the building operator to manage time schedule and temperature set point control to each zone.
- 1.10.10 The <u>VRF units</u> will be controlled under the dictates of space temperature detectors connected to the central controller, where temperature and time scheduling can be adjusted and monitored.
- 1.10.11 An electric door curtain will be provided above the main entrance doors.
- 1.10.12 Electric panel heaters will provide heating within the circulation cores and Consultation room.

1.11 Ventilation

- 1.11.1 The building will be provided with mechanical ventilation.
- 1.11.2 Mechanical supply and extract ventilation will be provided to all floors through a number of ventilation heat recovery units as indicated on the drawings.
- 1.11.3 <u>1No. mechanical heat recovery unit will be ceiling mounted to serve Level oo with 3No.</u> <u>heat recovery units serving Level 01, 02 and 03 situated externally on the roof.</u>
- 1.11.4 The heat recovery units and will consist of filter sections, plate heat exchanger heat recovery section and supply and extract fans.
- 1.11.5 The units will provide tempered fresh air to the spaces for respiratory purposes only.
- 1.11.6 The units will be scheduled to turn on and off based on time and will operate in response to CO₂ detectors, providing an occupancy-based mechanical ventilation system that aligns with the building's occupancy patterns.
- 1.11.7 The units located on the roof top shall be complete with environmental treatment suitable for a coastal environment.
- 1.11.8 Dirty extract systems shall extract vitiated air from the WC's, Cleaner stores, Servery and Pot Wash/ Storage areas.
- 1.11.9 The WC's will be provided with local extract fans operating under presence detection and also incorporate run on timers to allow for a minimum of 20 minute duration run on facility.
- 1.11.10 Cleaners cupboards shall be provided to operate continuously via local extract fans.
- **1.11.11** Ductwork shall be accessible for maintenance and cleaning at the periodic intervals and to allow regular inspection of fire and fire/smoke dampers.



SECTION B – PARTICULAR SPECIFICATION

- 1.11.12 Where air ducts pass through fire compartment walls and floors a fusible link type fire damper arrangement shall be provided, designed to rupture at 72°C.
- 1.11.13 Opposed blade volume control dampers shall be provided throughout the ductwork distribution systems to enable commissioning.
- 1.11.14 To comply with Part L2A of the Building Regulations the specific fan power (SFP) of each heat recovery unit shall be no greater than 1.6 W/litre/second.

1.12 Hot and Cold Water Services

- 1.12.1 A new incoming mains water supply will be extended from the statutory authority main to serve the new building. A new pulsed type water meter will be provided on the incoming supply to allow monitoring of water usage.
- 1.12.2 The water supply will be distributed from the meter into the building to serve all potable cold water draw offs and serve as the supply to hot water heaters and cylinders.
- 1.12.3 Unvented type electric water heaters will be installed to generate hot water to serve the necessary appliances. The heaters will be located either below the appliance or wall mounted as indicated on the drawings.
- 1.12.4 An unvented electric water cylinder will be installed to serve Level oo WCs and the Pot Wash/ Storage as indicated on the drawings.
- 1.12.5 The heaters will be provided with all manufacturers recommended safety devices and drains.
- 1.12.6 The outlets to all wash hand basins will be fitted with TMV₃ mixing valves designed to provided blended water at a temperature of 43°C, excluding cleaners sinks.
- 1.12.7 Quarter turn isolation valves will be fitted at each hot and cold draw point to safely isolate each appliance without the need to isolate ranges of sanitaryware and drain points will be provide at all low points of the system to allow the system to be drained of water.

1.13 Above Ground Drainage

- 1.13.1 A new above ground drainage system will serve the new sanitary appliances and connect into the below ground drainage as indicated on the layouts.
- 1.13.2 The Contractor shall supply, install and test and commission the above ground drainage installation as described below and as shown on the tender drawings.
- 1.13.3 The Contractor shall supply all materials, unless otherwise specified.
- 1.13.4 The above ground foul drainage pipework shall be designed to BS EN 12056 and Building Regulations Approved Document H.
- 1.13.5 Pipework, fittings and accessories shall be installed to ensure that appliances drain quickly, quietly and completely at all times, without nuisance or risk to health.
- 1.13.6 Discharge shall be conveyed without crossflow, back-fall, leakage or blockage.

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- 1.13.7 All concealed pipework shall be easily accessible.
- 1.13.8 The system will connect to co-ordinated below ground drainage connection points within the building to discharge soil and waste from the appliances.
- 1.13.9 All sanitary appliance to be fitted with sealed traps with diameters and depth as follows:
 - Wash Basin 32mm dia, depth 75mm
 - WC 110mm dia, depth 50mm
 - Sink/Washing Machine/Dishwasher dia 40mm, depth 75mm or 50mm when horizontal run is between 3-4m
- 1.13.10 Anti syphon traps to be fitted 32mm pipelines over 1.7m long and 38mm pipelines 3m long.

1.14 Automatic Controls and Wiring

- 1.14.1 The automatic controls system will be to set up to suit the new mechanical services installation.
- 1.14.2 The central VRF system will operate under the dictates of the manufacturer central controller located at a location to be finalised on Ground Floor with local temperature detectors located within each space.
- 1.14.3 All power, controls, and communication wiring from the controller to the VRF indoor and outdoor units will be provided by the refrigeration sub-contractor.
- 1.14.4 The controls system will control all the HVAC systems and incorporate the following basic functions:
 - Accurate control of space conditions.
 - Status monitoring of plant and equipment.
 - Monitoring of system and plant failure and alarm conditions.
 - Safety interlocking of plant and equipment.
 - Time scheduling
- 1.14.5 The heat recovery units will initiate under the dictates of an agreed time schedule. The schedule will be agreed with the users to allow the system to work during operating hours only.
- 1.14.6 Individual time clocks will be provided to each floor to allow independent time scheduling for each heat recovery unit.
- 1.14.7 The heat recovery units will control to allow a variable air volume to be provided within each floor plate to allow each heat recovery unit to be switched off for periods when the floor is unoccupied or if CO₂ levels within the floor space are below 1000ppm.
- 1.14.8 The heat recovery units will initiate to meet the design supply and extract air volume requirement within each floor level should the CO₂ levels within the floor space exceed 1000ppm.
- 1.14.9 Control of the units will be through dedicated local CO₂ detectors at each floor level.



SECTION B – PARTICULAR SPECIFICATION

1.15 Thermal Insulation

1.15.1 Thermal insulation shall be applied to pipelines and ductwork as described in the specification.

1.16 Interface Works

The Electrical Contractor shall provide the following:

- 1.16.1 Wiring to all mechanical services plant and control panel
- 1.16.2 All works to be carried out to the BS 7671:2018 IET Wiring Regulations.

Section B2 Technical Schedules



SCHEDULE NO. 01 – AIR GRILLES AND DIFFUSERS

Manufacturer: Gilberts or equal and approved (Angus@angus-air.co.uk)

Ref	Floor	Location	Quantity	Type / Size (mm)	Plenum Box / Spigot Size (mm)	Throw (m)	Flow Rate (m³/s)	Max. Pres sure Drop (Pa)	NR	
	SUPPLY DIFFUSERS									
			L	EVEL oo						
SG/00/01	Level oo	E Sports	3	CVH/ 1225x85 /DO	In duct, duct size Ø200	3	0.144	20	35	
SG/00/02	Level oo	Cafe	1	L/o/6/75 ox3oo/D O	N/A Grille Only	9	0.240	20	35	
	1		L	EVEL 01						
SG/01/01	Level 01	VR Gaming	3	CVH/ 1225x85 /DO	In duct, duct size Ø250	3	0.183	20	35	
SG/01/02	Level 01	VR Gaming	2	CVH/ 1225x85 /DO	In duct, duct size Ø200	3	0.183	20	35	
SG/01/03	Level 01	VR Gaming	3	CVH/ 1225x85 /DO	In duct, duct size Ø250	6	0.122	20	35	
			-	Level 02						
SG/02/01	Level 02	Motion Capture/ IT Learning	2	LN/0/6/1 350x100 /DO	In duct, duct size 250x125	6	0.132	20	35	
SG/02/02	Level 02	Motion Capture/ IT Learning	2	LN/0/6/1 350x100 /DO	In duct, duct size 200x150	3	0.132	20	35	
SG/02/03	Level 02	Consultation Room	1	LN/o/6/ 400x75/ DO	200X150	N/A	0.036	20	35	
SG/02/04	Level 02	Editing Room	1	LN/o/6/ 400x75/ DO	200X150	N/A	0.036	20	35	

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Mechanical Services Specification



Ref	Floor	Location	Quantity	Type / Size (mm)	Plenum Box / Spigot Size (mm)	Throw (m)	Flow Rate (m ³ /s)	Max. Pres sure Drop (Pa)	NR
SG/02/05	Level 02	Recording Studio	1	LN/o/6/ 400x75/ DO	200X100	N/A	0.036	20	35
	Level o3								
SG/03/01	Level 03	Relaxation	2	CVH/ 1225x85 /DO	In duct, duct size Ø250	6	0.180	15	35
			EXTR	ACT GRILL	.ES				
				Level 02					
EG/02/01	Level 02	Consultation Room	1	LN/o/6/ 400x75/ DO	200X100	N/A	0.036	20	45
EG/02/02	Level 02	Editing Room	1	LN/o/6/ 400x75/ DO	200X100	N/A	0.036	20	45
EG/02/03	Level 02	Recording Studio	1	LN/o/6/ 400x75/ DO	200X100	N/A	0.036	20	45
			TOILET E	XTRACT G	RILLES				
TEG/oo/o 1	Level oo	Acc.WC	1	GX-200	Ø200	N/A	0.043	20	45
TEG/00/0 2	Level oo	Servery	1	PE/550x 550/DO	Ø250	N/A	0.103	20	45
TEG/oo/o 3	Level oo	Pot Wash and storage	1	PE/300x 300/DO	Ø150	N/A	0.042	20	45
TEG/oo/o 4	Level oo	Unisex WC	1	GX-200	Ø200	N/A	0.047	20	45
TEG/oo/o 5	Level oo	Acc.WC	1	GX-200	Ø200	N/A	0.048	20	45
				Level 01					
TEG/01/0 1	Level 01	Acc. WC	1	GX-200	Ø200	N/A	0.043	20	45

Issue No/Date: Co2/Feb 25

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Mechanical Services Specification

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Ref	Floor	Location	Quantity	Type / Size (mm)	Plenum Box / Spigot Size (mm)	Throw (m)	Flow Rate (m³/s)	Max. Pres sure Drop (Pa)	NR
TEG/01/0 2	Level 01	Unisex WC	1	GX-150	Ø150	N/A	0.028	20	45
TEG/01/0 3	Level 01	Unisex WC	1	GX-150	Ø150	N/A	0.026	20	45
TEG/01/0 4	Level 01	Store	1	GX-150	Ø150	N/A	0.021	20	45
				Level 02					
TEG/02/0 1	Level 02	Cleaners Store	1	GX-200	Ø200	N/A	0.036	20	45
TEG/02/0 2	Level 02	Acc. WC	1	GX-200	Ø200	N/A	0.038	20	45
TEG/02/0 3	Level 02	Unisex WC	1	GX-150	Ø150	N/A	0.022	20	45
TEG/02/0 4	Level 02	Unisex WC	1	GX-150	Ø150	N/A	0.022	20	45

Notes:

1. Information for tender purposes only, all design information shall be verified by the contractor.

LevelUp Whitehaven

Mechanical Services Specification



SCHEDULE NO. 02 – HEAT RECOVERY UNITS

Manufacturer: Nuaire or equal and approved

Ref	Serving	Supply Air flow rate (m3/s)	Supply Fan External Resistance (Pa)	Extract Air flow rate (m3/s)	Extract Fan External Resistance (Pa)	Accessories/controls
HRU/01	Level oo	0.384	225	0.384	90	Occupancy controlled via CO₂ sensor
HRU/02	Level 01	0.490	280	0.490	90	Occupancy controlled via CO₂ sensor
HRU/o3	Level 02	0.408	200	0.408	90	Occupancy controlled via CO₂ sensor
HRU/04	Level o3	0.180	90	0.180	40	Occupancy controlled via CO₂ sensor

Description:	Packaged heat recovery unit with variable speed supply and extract fans, integral heat exchange unit (plate heat exchanger with summer bypass, minimum 75% heat recovery) and supply and extract filters.				
Controls:	All units to come complete with EcoSmart Connect controller with BMS compatibility				
Location:	Units to be internally mounted within the roof void.				
Specific Fan Power:	SFP for each unit not to exceed 1.6 W/I/s				
Supply filter:	G4 grade intake filter				
Extract filter:	G4 grade prior to heat exchanger				
Electrical Requirements:	230V / 50Hz - TBC by manufacturer				

Notes:

Each Heat Recovery Unit (HRU) to be equipped with 600mm long attenuators for the intake, exhaust, supply, and extract ductwork.



SCHEDULE NO. $o_3 - EXTRACT FANS$

Manufacturer: Nuaire or equal and approved

Reference	Area	Туре	Volume (mȝ/s)	Pressure (Pa)	Controls
EF/01	Unisex WC's & Acc. WC	Single in- line Fan	0.138	80	Trickle and Boost operate via PIRs with in the WC areas
EF/02	Servery & Pot Wash and Storage	Single in- line Fan	0.146	30	Run continuously
EF/o3	Unisex WC's & Acc. WC	Single in- line Fan	0.097	60	Trickle and Boost operate via PIRs with in the WC areas
EF/04	Unisex WC's, Acc. WC & Cleaners Store	Single in- line Fan	0.118	60	Trickle and Boost operate via PIRs with in the WC areas

Notes:

1. SFPs shall not exceed 0.5 W/l/s



SCHEDULE NO. 04 - REFRIGERANT BASED HEATING AND COOLING

Manufacturer – Toshiba by CDL ref TQN58760 (phil@cooldesignsltd.co.uk)

General Areas

Comfort cooling equipment will be of the DX split systems arranged in either 'Single' Split Systems, 'Twin' Split Systems, 'Triple' Split Systems or 'Quad' Split Systems. <u>A series of indoor wall</u> <u>mounted units</u> shall be matched to externally mounted condensing units on a system-by-system basis. The comfort cooling equipment shall meet both the cooling and heating requirements of each space. The units shall be of the Twin Rotary Inverter type to reduce system-starting currents.

The outdoor units, interconnecting pipework and controls shall be supplied and installed by the air conditioning specialist. The air conditioning specialist shall also allow for liaising with the automatic controls specialist to ensure the system is commissioned correctly to the manufacturer's recommendations.

The design, supply, installation, setting to work and commissioning of the new comfort heating and cooling systems, as scheduled and shown on the drawings, shall be carried out by a registered and accredited specialist installer of the selected manufacturer.

The refrigerant systems shall be installed by a recognised associated installer of the named manufacturer, having undertaken all relevant training applicable to the types of systems being installed.

Equipment Requirements

Indoor Units

The room units shall be positioned where indicated on the drawings and, where applicable, shall be selected to give an even distribution of air throughout the space.

The indoor units shall be complete with a directional throw capability and accessible washable filters shall be fitted. The whole external surface of the units shall be wipe clean.

Automatic condensate pumps shall be included as necessary. The pumps shall be of the sump type and shall be complete with a fail-safe device, which shall, in the case of pump failure, switch off the applicable unit. Alternatively, trapped gravity condensate shall be run to a convenient drain. Due consideration shall be taken of the need to avoid traps drying out by using waterless traps – where required (for example at downstand beams) supplementary peristatic condensate pumps shall be installed. Rodding eyes are to be installed where condensate runs change direction.

All indoor units shall be sized on medium fan speed whilst meeting the room/space heating and cooling requirements and they must not exceed the room noise criteria specified.

All systems shall be selected for 'standard UK' supply conditions.

Outdoor Units



External units shall be sized based on the following conditions:

Summer:	29°C db / 19°C wb
Winter:	-4°C db / fully sat

Matched condensers shall be provided and, for reduction of noise, may be oversized. The air-cooled condensing units shall be located to ensure adequate unrestricted air flow.

Due consideration shall be given to maintaining existing ambient noise levels, and reference to the Environmental Pollution Act 1990 should be sought.

The external units shall be complete with fan speed/pressure head control for low ambient operation.

The units shall be mounted on anti-vibration mounts or pads as recommended by the manufacturer.

Where the condensers are to be supported by secondary steel from either roof on wall mounted brackets, these shall be galvanised.

Refrigerant Pipework Installation

Interconnecting refrigeration pipework lines shall be run between the indoor and outdoor units.

Refrigeration pipework shall be refrigeration quality copper tube to BS 2871 Part 2 with brazed fittings and joints. Pipework shall be installed and tested in accordance with BS 4434. Pipework shall be adequately supported using insulated hydrosorb clips and rail. The recommended distance between supports shall be as follows:

Copper tube up to 22mm dia.	Max 1m
Copper tube 22mm to 54mm dia.	Max 2m

For the purpose of support 'hydrazorb' clips will be used for the fixing of refrigeration quality copper tubing. The pipework shall be suspended from the soffit above using cadmium threaded rod, washers and nuts.

All pipework not installed within ceiling voids or risers, i.e. in areas which are visible to the occupants, shall be on 'solid' mild steel trays, painted to an agreed RAL colour finish to compliment adjacent services/systems and/or to satisfy the requirements of the Architect/Conservation Officer.

All pipework shall be insulated using 20mm thick flexible foam Class o Armaflex, fixed in accordance with the Manufacturer's recommendations. All joints shall be glued, and vapour sealed. External and exposed insulation shall be finally finished with two coats of Armaflex paint. Externally the insulation shall be provided with protection from birds via the installation of aluminium cladding. All condensate drains shall be installed using white plastic pipe.

During the pipework installation brazing operation, oxygen free nitrogen shall be introduced into the pipework to prevent internal oxidisation. The nitrogen shall be introduced in such a way as to ensure

that no pressurisation occurs. Under no circumstances shall hacksaws be used to cut copper pipe. All unfinished pipework shall be capped and sealed to prevent the ingress of dirt and moisture.

The pipework pressure test shall not be conducted until the leak test is satisfactorily completed and the tests shall be carried out with oxygen free nitrogen. The test pressure shall be held for at least one hour and any fall in pressure after due allowance for ambient temperature change indicates a leak which should be traced. If any leaks are present, the fault shall be corrected, and the system shall be re-tested.

In the interests of Health and Safety, refrigerant pipework pressure testing shall only be carried out during periods when the building is unoccupied by other trades.

Repairs, particularly involving brazing shall not be carried out on any part of the system or component whilst under pressure.

The system shall be triple evacuated to 2mm Hg to eliminate any moisture which may be present in the system. The final vacuum shall be held for four hours. Any rise indicates the presence of moisture, and the procedure will require repeating until the vacuum holds. After completion, the system will be ready for the correct charge of refrigerant.

Where existing refrigeration/air conditioning plant is to be disconnected, relocated or removed and disposed of, Section 3.3 of the Environmental Protection Act 1990 and the F-Gas Regulations shall be strictly adhered to for the recovery and disposal of the refrigerant and the relevant disposal certification provided.

Electrics and Controls

The comfort cooling unit's controls shall incorporate individual remote setting of temperature, heat/cool/auto, fan speed, recirculation, and time clock facilities.

Units serving large open plan spaces may be grouped to a single controller.

All units serving one space shall have their own individual, hard wired, simplified wall mounted controller that will allow the occupant to turn on/off, choose heating or cooling, set temperature, and adjust fan speed only – any additional settings will be locked off.

The Specialist shall carry out all necessary interconnecting control wiring, between the indoor and outdoor units, and between the indoor unit's remote controls and condensate fail safe contacts all in accordance with the latest edition of the BS 7671.

Power supplies shall be provided to each indoor unit and outdoor unit by the electrical contractor. The air conditioning specialist shall extend the supplies from the isolators into each item of equipment.

Builders Work

It shall be the Specialist's responsibility to identify all necessary builder's work (which is not to be



undertaken by the Specialist) to the Services Contractor, who should identify all works to the Main Contractor.

Commissioning

The Specialist shall commission the comfort cooling installation strictly in accordance with the manufacturers recommendations and shall submit all commissioning data and results together with three sets of operating and maintenance instructions. They shall also allow 1 day to demonstrate the full operational capabilities of the system to the Client and end users.

Equipment Detail

System 1

Unit Ref	Location	Type / Model	Min Heating (kW)	Min Corrected Sensible Cooling (kW)	Fan Speed Setting
		Indoor Unit			
IU/0/01	E Sports	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0151HP-E</u>	1.5	<u>3.1</u>	<u>Medium</u>
IU/0/02	E Sports	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0151HP-E</u>	1.5	<u>3.1</u>	<u>Medium</u>
IU/o/o3	E Sports	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0151HP-E</u>	1.5	<u>3.1</u>	<u>Medium</u>
IU/o/o4	Cafe	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UPo181HP-E</u>	1.8	4.5	<u>Medium</u>
IU/o/o5	Cafe	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UPo181HP-E</u>	1.8	<u>4·5</u>	<u>Medium</u>

Ref	Location	Туре	Min. Duty Cooling (kW)	Dimensions (WxDxH mm)	Noise (dBA)	Air Flow Rate (l/s)		
Outdoor Unit								
OU/01	Externally on roof (Level 03)	MMY- AP4216FT8P- UK	40	1210x780x1830 (3No)	64	3389		


System 2					
Unit Ref	Location	Type / Model	Min Heating (kW)	Min Corrected Sensible Cooling (kW)	Fan Speed Setting
		Indoor Unit			
IU/1/01	VR Gaming	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0181HP-E</u>	0.5	<u>4.2</u>	<u>Medium</u>
IU/1/02	VR Gaming	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0181HP-E</u>	0.5	<u>4.2</u>	<u>Medium</u>
IU/1/03	VR Gaming	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0181HP-E</u>	0.5	<u>4.2</u>	<u>Medium</u>
IU/1/04	VR Gaming	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0181HP-E</u>	0.5	<u>4.2</u>	<u>Medium</u>
IU/1/05	VR Gaming	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0181HP-E</u>	0.5	<u>4.2</u>	<u>Medium</u>
IU/1/06	VR Gaming	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UPo181HP-E</u>	0.5	<u>4.2</u>	<u>Medium</u>
IU/1/07	VR Gaming	VRF Wall Mounted/ MMU-UP0181HP-E	0.5	4.2	Medium

Ref	Location	Туре	Min. Duty Cooling (kW)	Dimensions (WxDxH mm)	Noise (dBA)	Air Flow Rate (l/s)					
	Outdoor Unit										
OU/01	Externally on roof (Level 03)	MMY- AP4216FT8P- UK	40	1210x780x1830 (3No)	64	3389					

System 3

Unit Ref	Location	Type / Model	Min Heating (kW)	Min Corrected Sensible Cooling (kW)	Fan Speed Setting	
Indoor Unit						



IU/2/01	Recording Studio	<u>VRF Wall</u> <u>Mounted/MMK-</u> <u>UP0121HP-E</u>	0.6	2.2	<u>Medium</u>
IU/2/02	Editing Room	<u>VRF Wall</u> <u>Mounted/MMK-</u> <u>UP0121HP-E</u>	0.3	<u>1.9</u>	<u>Medium</u>
IU/2/03	IT Learning	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0181HP-E</u>	0.6	4-3	<u>Medium</u>
IU/2/04	IT Learning	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0181HP-E</u>	0.6	4-3	<u>Medium</u>
IU/2/05	IT Learning	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UPo181HP-E</u>	0.6	4-3	<u>Medium</u>

Ref	Location	Type Min. Duty Cooling (kW)		Dimensions (WxDxH mm)	Noise (dBA)	Air Flow Rate (l/s)					
	Outdoor Unit										
OU/01	Externally on roof (Level 03)	MMY- AP4216FT8P- UK	40	1210x780x1830 (3No)	64	3389					

System 4

Unit Ref	Location	Type / Model	Min Heating (kW)	Min Corrected Sensible Cooling (kW)	Fan Speed Setting			
Indoor Unit								
IU/3/01	Relaxation	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0121HP-E</u>	0.7	2.9	<u>Medium</u>			
IU/3/02	Relaxation	<u>VRF Wall</u> <u>Mounted/ MMK-</u> <u>UP0121HP-E</u>	0.7	2.9	<u>Medium</u>			

Ref	Location	Туре	Min. Duty Cooling (kW)	Dimensions (WxDxH mm)	Noise (dBA)	Air Flow Rate (l/s)
		(Outdoor Unit			
OU/02	Externally on roof (Level 03)	RAV- GM1102ATW-E	5.8	900x320x890	57	1133



Notes:

- 1. All power wiring to the outdoor units by the electrical contractor (as detailed on Link MEP drawings).
- 2. All remote controllers (Model RBC-AMSU52-E) and controls wiring supplied and installed by heat pump specialist.
- 3. All heating duties quoted at UK conditions as -4°C db winter design external conditions.
- 4. All outdoor units shall have a frost protection facility and automatic defrost cycle.
- 5. External units shall be provided with 'Soft start' facility by employing inverter compressors.
- 6. Where the condensers are to be supported by secondary steel from wall mounted brackets, these shall be galvanised. Any cut ends shall be treated with Galvafroid type paint and proprietary plastic end caps fitted.
- 7. External units to be of the high efficiency type achieve the following minimum Seasonal Coefficient of Performance (SCoP) to meet Part L 2022 requirements.
- 8. All information is for tender purposes only. Contractor shall verify all design information.



SCHEDULE NO. 05 – ELECTRIC WATER HEATERS

Manufacturer: Heatrae Sadia or equal and approved

EWH Ref	Quantity	Туре	Input	Serves
EWH/01	7	Multipoint Eco 10	3 kW	Wash Hand Basins- First and Second Floor
EWH/02	2	Multipoint Eco 30	3 kW	Cleaner Store Sinks- First and Second Floor
EWC/01	1	Megaflow Eco Direct- Unvented Cylinder- 125dd	-	Ground Floor WHB and Pot Wash and Storage

Notes:

- 1. Electric Water Heater to be installed in accordance with manufacturers recommendations and guidelines.
- 2. Electric water heaters shall be supplied complete with factory fitted temperature & pressure relief valve, manually resettable thermal cut-out, tundish, non-return valve and suitably expansion vessel as standard.



SCHEDULE NO. 06 - ELECTRIC PANEL HEATERS

Manufacturer – Dimplex

Model –Low Surface Temperature

Grille Ref.	Room Served	Model	Output (kW)	Dimensions (HxWxD mm)	Elec Supply (V)	Thermostat Type	Timer	Controls
EPH/01	Stair (1-08)	LST100E	1	430x690x108	240	Electronic thermostat (±0.2°C) Overheat detection	Integral 7- day time and temperature adjustment	Digitally controlled, Electronic Timer modes: •7 Day Programmable User Timer, Out All Day, Home All Day, Holiday Continuous heat modes: •Timer, Eco, Manual, Frost Protect, Runback, Off
EPH/02	Consultation Room	LST100E	1	430x690x108	240	Electronic thermostat (±0.2°C) Overheat detection	Integral 7- day time and temperature adjustment	Digitally controlled, Electronic Timer modes: •7 Day Programmable User Timer, Out All Day, Home All Day, Holiday Continuous heat modes: •Timer, Eco, Manual, Frost Protect, Runback, Off



SCHEDULE NO. 07 – ELECTRIC OVERDOOR HEATERS

Manufacturer – Thermoscreens

Grille Ref.	Room Served	Model	Output (kW)	Dimensions (HxWxD mm)	Elec Supply (V)	Thermostat Type	Timer	Controls
ODH/01	Main Entrance Doors	C1000E	1	1137x275x198	240	Touch Remote Controller	N/A	Manufacturers Controller



3 COST ALLOCATION SCHEDULE

3.1 Mechanical and Electrical Services Cost Allocation Schedule

The Tenderer shall enter in this schedule, prices for the following constituent parts of the works. Items indicated on the drawings and/or requested in the Specification and not covered in this Schedule shall be included by the Tenderer to form part of the tender figure.

ltem	Description	Cost £
1	Preambles	
2	Hot and Cold Water Services Installation	
3	Refrigerant Based Heating and Cooling	
4	Electric Space Heating	
5	Mechanical Ventilation Installation	
6	Automatic Controls Installation	
7	Below Ground Drainage Installation	
8	Buildersworks in connection with Mechanical Installations_	
9	Electrical Services Works in Connection	
10	As Fitted / Record Drawings, O&M Manuals	
11	Testing and Commissioning	
	Total Cost	

DAYWORK (in accordance with the definitions of prime costs of DAYWORK published by RICS and Trade Association):

The Contractor shall indicate the percentage addition to Prime Cost of Labour, Materials and Plant where work is to be valued at Daywork rates.

Labour	%
Materials	%
Plant	%

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SECTION B – PARTICULAR SPECIFICATION

3 CONTINGENCIES AND PROVISIONAL SUMS



SECTION B – PARTICULAR SPECIFICATION

4 DESIGN DRAWING SCHEDULE

4.1 The following drawings are to be read in conjunction with this specification:

Drawing No.

Description

LUWH-LNK-XX-XX-DR-M-52001	All Floor Levels Above Ground Drainage Layouts
LUWH-LNK-XX-XX-DR-M-53001	All Floor Levels Domestic Layouts
LUWH-LNK-XX-00-DR-M-55001	Level oo Heating and Cooling Layout
LUWH-LNK-XX-01-DR-M-55001	Level o1 Heating and Cooling Layout
LUWH-LNK-XX-02-DR-M-55001	Level o2 Heating and Cooling Layout
LUWH-LNK-XX-03-DR-M-55001	Level 03 Heating and Cooling Layout
LUWH-LNK-XX-00-DR-M-57001	Level oo Ventilation Layout
LUWH-LNK-XX-01-DR-M-57001	Level 01 Ventilation Layout
LUWH-LNK-XX-02-DR-M-57001	Level o2 Ventilation Layout
LUWH-LNK-XX-03-DR-M-57001	Level o3 Ventilation Layout

Section C Standard Specification



PART 1 GENERAL TECHNICAL CLAUSES

1.1 Definition of Terms

The word "shall" is mandatory.

The word "will" is informative.

The word "should" is advisory.

The word "provide" means supply and fix or install.

- 1.1.1 The words Contract and Contractor shall read as meaning Sub-Contract and Sub- Contractor when this Specification relates to a Sub-Contract.
- 1.1.2 This section of the Specification specifies the general quality of the Mechanical Services Installation. Section 3 and the accompanying drawings specify in detail the installation to be provided. All clauses in this section may not apply to this project and only those relevant to the works are applicable.
- 1.1.3 All work shown upon the drawings but not described in the Specification, or vice versa, shall be provided. The Contractor shall seek clarification of such matters prior to submitting a Tender.

1.2 Standards and Regulations

- 1.2.1 The installation shall conform to all relevant and generally accepted Standards and Regulations which in all cases shall be the edition in current use including all amendments. The Contractors attention is particularly drawn to the following:
 - a) The Health and Safety at Work Act 1974.
 - b) Construction Design and Management Regulations (CDM) 2015
 - c) British Standards.
 - d) British Standards Codes of Practice.
 - e) The Clean Air Act.
 - f) Control of Pollution Act.
 - g) Energy Conservation Act.
 - h) Regulations Under the Factories Act.
 - j) The Building Regulations
 - k) The Gas Safety Regulations
 - I) British Gas Corporation Codes of Practice.
 - m) The 18th Edition IEE Regulations (BS 7671: 2018).
 - n) The Electricity Supply Regulations1988.



- o) The Electricity at Wwork Regulations 1989.
- p) Any special requirements of the local Electricity, Gas or Water Undertakings and Fire Fighting Authority.
- q) The Control of Asbestos at Work Regulations 1987.
- r) The Pressure Systems and Transportable Gas Containers Regulations 1989.
- s) Environmental Protection Act1990.

1.3 Handover Procedure

- 1.3.1 The installation will not be considered as complete and will not UNDER ANY CIRCUMSTANCES be accepted for handover until the following criteria are met.
 - The installation in fully tested, inspected, commissioned and regulated as detailed in this Specification.
 - Approved "As Installed" documentation has been provided to the Client's Representatives.

Inspection, Testing, Commissioning and Regulation

- 1.3.2 During the installation period the Contractor shall continuously check the whole of the works to ensure complete safety and compliance with the Specification. The works will from time to time be inspected by the Engineer and it should be noted such inspections will be of a general nature and therefore not be comprehensive. The responsibility for ensuring the works comply with the Specification is that of the Contractor.
- 1.3.3 All tests shall be carried out in accordance with the appropriate British Standard or as otherwise specified in this document.
- 1.3.4 Seven days' notice shall be given to the Engineer of all tests and the Engineer shall confirm whether the test will be witnessed.
- 1.3.5 The Contractor shall include for the cost of all energy consumed for all tests and shall provide all necessary instruments, plant and equipment, supervision, skilled and unskilled labour required for the site tests. The accuracy of the Contractor's instruments shall be demonstrated if deemed necessary.
- 1.3.6 The Contractor shall include for all fees charged by the Nominated Insurance Companies for supervision and examination at Works during construction of all pressure vessels and similar equipment.
- 1.3.7 Three copies of all Test Certificates shall be handed to the Engineer. The Contractor shall note that storage cylinders, indirect cylinders, calorifiers, pneumatic control systems, three-way valves etc. shall not be subject to hydraulic tests greater than the manufacturer's test pressure and if necessary, such special items shall be disconnected from the pipework system when this is being tested.
- 1.3.8 The installation may have to be tested in sections to suit building progress and the Contractor



shall include for any number of these tests as may be required by the Engineer.

- During the installation all liquid carrying pipework and upon completion of each section as 1.3.9 determined by the Engineer, the installation shall be hydraulically tested to a pressure of 6.8 bar or twice the normal working pressure, whichever is the greater. The test shall be maintained for a period of sufficient time to enable the installation to be inspected, the minimum period being ONE HOUR. If the test fails during the above mentioned period, the defective joint shall be located, repaired and the system re-tested as described above.
- The Contractor shall test the mains cold water installation in sections in accordance with the 1.3.10 details previously described and in addition shall conform to any further tests which may be required by the Local Water Authority.
- The whole of the gas installation shall be pressure tested by authorised personnel in accordance 1.3.11 with IGE/UP/1 'Soundness Testing and Purging of Industrial and Commercial Gas Installation.
- Underground pipework shall be tested prior to any backfilling of the trench takes place. 1.3.12
- Tests shall be carried out by applying a test pressure of at least 1.5 x working pressure or 50mbar 1.3.13 whichever is the greater.
- If the installation fails, the pressure test remedial works shall be carried out and the whole of 1.3.14 the installation retested. In the case of polyethylene pipework leaking joints shall be replaced with new sections of pipework and fittings.
- The installation shall Regulated and Commissioned using the methods and procedures set out 1.3.15 in the CIBSE Commissioning Codes:

CCA	-	Air distribution systems
ССВ	-	Boiler plant
ссс	-	Automatic controls
CCR	-	Refrigeration systems
CCW	-	Water distribution systems.

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- Upon completion of the installation all valves shall be set to ensure the correct amount of fluid 1.3.16 is circulating through all circuits.
- The Contractor shall include in the tender for instruction of the persons appointed to run and 1.3.17 maintain the plant. The instructions shall be carried out over a period of TWO WEEKS and during this time the Contractor shall advise the person appointed, the location and function of all items of plant and ancillary equipment throughout the building.
- The Contractor shall ensure all pressure testing points are installed as the installation 1.3.18 progresses.
- Where routine tests are applied to plant before delivery to site, two copies of the relevant test 1.3.19 certificates shall be forwarded to the Engineer.



- 1.3.20 On certain occasions the Engineer may wish to witness tests carried out on plant before delivery to site. These instances will be detailed when required and the Contractor shall give at least seven days' notice in writing, of the date of these tests.
- **1.3.21** Two copies of all test certificates subsequently supplied to the Contractor by the manufacturer shall be supplied to the Engineer.

Spares

1.3.22 The Contractor will be required to provide a number of spare parts and consumable items upon completion. A specific list of these items is contained in Section 3 of this Specification.

"As Installed" Documentation

- 1.3.23 One copy of the "As Installed" documentation shall be submitted for approval at least 10 days prior to the anticipated handover date for comment and approval. The final documentation incorporating the Engineers comments shall be made available at handover.
- 1.3.24 Should the Contractor fail to produce the "As Installed" documentation to the Engineers approval at the date of practical completion the Client may instruct the Engineer to provide the drawings with whatever assistance the Engineer deems necessary and the cost of preparing the drawings will be deducted from the outstanding payments due to the Contractor.

Maintenance Manual

- 1.3.25 The Contractor shall furnish to the Engineer upon practical completion of the complete installation, three copies of a Maintenance Manual.
- 1.3.26 The Manual shall be of the loose leaf type, A4 size having stiff covers, with sub-division for each section, a ready means of reference and a detailed index. The Manual shall contain full operating and maintenance instructions for each item of equipment and shall deal systematically with each system including the following:
 - General description of installation
 - Control panel wiring diagrams
 - Wiring diagrams for each item of plant
 - Plant
 - Valve operating
 - Description of controls operation includingsettings for control variables
 - Procedure to adopt in an emergency
 - Setting up and operating instructions for all installed equipment
 - Procedure fault finding
 - Maintenance requirements including frequency and details of routine maintenance including schedule of consumables
 - Legend of colour coding for all services
 - Schedule of manufacturersincluding address and telephone number
 - List of recommended spares



- Copies and schedules of the "As Installed" drawings and valvechecks
- Copy of test sheets, inspection, completion and commissioning certificates

Note:

Manufacturers' standard "hand out" cards and leaflets will be accepted in the Manual, but only as supporting information additional to the instructions detailed above.

"As Installed" Drawings and Charts

- 1.3.27 During the progress of the works the Contractor shall record on drawings in an approved manner, the information necessary for preparing the "As Installed" drawings.
- 1.3.28 The marked-up drawings shall be made available to the Engineer for inspection and checking at any time during the Contract.
- 1.3.29 The "As Installed" drawings shall indicate:
 - a) The exact positions of all plant and apparatus.
 - b) The size, type and routes of all pipework, conduits, trunking ductwork etc.
 - c) The size, type and date of laying of all underground services and ducts.
 - d) Schematic diagrams of distribution systems and control systems.
 - e) Position of all valves valve reference numbers shall correspond to the reference numbers on valve labels.
 - f) A list of symbols, notation and nomenclature used.
 - g) General arrangement drawings shall be to a minimum scale of 1.50.
 - h) Plant Rooms and section 1.20.
 - In addition to the "As Installed" drawings, valve and instruction charts reproduced on suitable plastic materials shall be supplied and fixed in the Boiler House, Calorifier Rooms, and/ or Plant Rooms. All charts must be approved by the Engineer prior to final printing.
- 1.3.30 The Contractor shall provide printed instructions and "As Installed" drawings of plant control systems and equipment in sufficient detail to enable the Employer to operate, maintain, dismantle, re-assemble and adjust such plant and equipment.
- 1.3.31 The final "As Installed" drawings of the installation, together with any required Drawings or Instructions relating to the plant and equipment, shall be provided at Practical Completion.
- 1.3.32 "As Installed" drawings shall be in approved CAD format as specified.
- 1.3.33 The Contractor shall provide "As Installed" drawings in CAD format AutoCad, .DWG format on CD(s) or DVD(s). Drawings shall be produced at a scale of one drawing unit to 1mm. Each engineering service shall constitute one layer and text shall be on a separate layer.
- 1.3.34 The Engineers design drawings may be available to the Contractor either in hard copy or AutoCad, DWG format as appropriate. An appropriate charge may be made for the provision of this service.



1.4 Position and Neatness of Installation

- 1.4.1 The positions of all plant shown on the drawings will be used for the purposes of tendering, but the Contractor shall not scale the drawings for actual site installation.
- 1.4.2 The Contractor shall set out the works involved and take all measurements and dimensions required for the erection of plant on site, making any modification in detail as found necessary during the progress of the works.
- 1.4.3 The Contractor shall ascertain on site that the installation will not conflict with other services or furniture and any work requiring alteration due to negligence by the Contractor in this respect shall be at the Contractor's expense. Particular care shall be taken to obtain uniform and tidy arrangements of wall and ceiling mounted equipment.
- 1.4.4 Two or more items of equipment whether electrical or mechanical or both which are to be erected on the same wall or ceiling or which will be otherwise visually close to each other, shall be arranged in a neat and symmetrical group. Symmetry shall be obtained by horizontal and vertical alignment through the centre lines of the equipment.
- 1.4.5 In the planning of arrangements, the Contractor shall co-operate with the Main Contractor and any other Contractor involved. Exact positions of plant and equipment shall be marked out on site and agreed with the Engineer prior to installation and before any holes or chases are cut.
- 1.4.6 Failure to comply with this requirement may result in disruptions to other disciplines and the Contractor shall be held responsible for any additional expenditure involved in resolving the issue.

1.5 Contractors Working Drawings

- 1.5.1 The Contractor shall prepare his own working drawings. If any further instructions, details or drawings are required to enable these working drawings to be prepared or any work to be done, the Contractor shall apply in writing to the Engineer for such information.
- 1.5.2 The Contractor shall ensure that the working drawings are co-ordinated with other trades during their preparation.
- 1.5.3 Generally working drawings shall follow the guidance given in BSRIA Technical Note TN/22/97. The Contractor shall submit to the Engineer for comment, the following:
 - 1. on or before the dates named in the Specification such drawings as may be called for therein,
 - 2. during the progress of the "Services" and within such reasonable times as the Engineer may require, such drawings of the general arrangement and details of the "Services" or any part thereof as the Engineer may reasonably require.
- 1.5.4 Within a reasonable period after receiving such drawings, the Engineer shall identify his comments if appropriate.



- 1.5.5 Two copies of all drawings which require comment by the Engineer shall be provided by the Contractor.
- 1.5.6 The Engineer shall appraise the drawings on a technical nature only in terms of the drawings being compatible with the intent of the design and comment by the Engineer shall not relieve in any way the Contractor from his responsibilities under this Contract, in respect of the accuracy of drawings or the relationship of the drawing content in terms of co-ordination of other trades.
- 1.5.7 Drawings signed as above described shall not be departed from except as provided by an Official Instruction.
- 1.5.8 The Engineer shall have the right at all reasonable times to inspect at the Premises of the Contractor, all drawings of any portion of the "Services".
- 1.5.9 In the event of any discrepancies in the scale approved to any plan or drawing and the figured dimensions thereon, the figured dimensions shall be taken and held to be correct.
- 1.5.10 The Contractor shall be responsible for and shall pay the extra cost, if any, occasioned by any discrepancy, error or omissions in the drawings and other particulars supplied by him, whether "commented on" the Engineer or not, provided that such discrepancies, errors or omissions are not due to inaccurate information or particulars furnished in writing to the Contractor by the Employer or Engineer.

1.6 British Standards

1.6.1 All British Standards referred to in this Specification shall include all the latest amendments.

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Mechanical Services Specification



SECTION C – STANDARD SPECIFICATION

PART 2 LTHW HEATING INSTALLATIONS

NOT USED



PART 3 HOT AND COLD WATER SERVICES INSTALLATION

3.1 General

- 3.1.1 The installation shall conform to all relevant British Standards and Codes of Practice which are current at the time of installation. The Contractors attention is particularly drawn to BS 6700 - Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.
- 3.1.2 All materials used in Hot and Cold Water Services Installation shall be approved by the Water Research Centre.

3.2 Pipework and Fittings

- 3.2.1 All water supply pipework shall be carried out in accordance with BS EN 1057: 1996. All fittings shall be Yorkshire potable capillary type. Bends and elbows on copper pipework size 15mm and 22mm shall be kept to a minimum and the Contractor shall allow for the bending and setting of pipework wherever possible. On pipework 28mm and over bends shall be used in preference to setting of pipework and the use of elbows.
- 3.2.2 The Contractor shall provide and fix on the connection to each wash hand basin, sink, WC, urinal cistern a Ballofix valve as manufactured by Yorkshire Imperial Metals Limited.
- 3.2.3 All pipes shall be reamed to the full bore of the pipe. The Contractor shall ensure pipework levels are correct.
- 3.2.4 No joints shall be allowed within the thickness of walls, floors, partitions etc. except where such arrangements would prevent the pipe from maintaining the specified projection from the wall.
- 3.2.5 All pipes in plant rooms, under floors, in roof spaces, in false ceilings and a high level are to be supported on swinging type hangers, fixed to the floor slab or steelwork.
- 3.2.6 All pipes in room shall be supported by cast brass screw fixed clips.
- 3.2.7 All metal supports, screws, bolts etc. and the drilling to angle iron bearers are to be provided by the Contractor who shall be responsible for the accurate setting out of these.
- 3.2.8 All pipes shall be supported at the following intervals:

15 and 22mm	:	1.2M
28mm	:	2.0M
32mm to 54mm and over	:	2.4M

- 3.2.9 The Contractor shall note that all exposed pipework, fittings and brackets shall be chromium plated.
- 3.2.10 The installation requirements for this pipework shall be in all respects in accordance with the requirements for the LTHW Heating Installation.



- 3.2.11 Provide and fix where pipes pass through walls, floors, ceilings etc. a loose fitting pipe sleeve flush with the wall, floor or ceiling and complete with a chromium plated wall or floor plate.
- 3.2.12 The space between pipe and sleeve shall be fire stopped using an approved fire retardant material.
- 3.2.13 The Contractor shall, if deemed necessary during the progress of the installation, be prepared to employ registered plumbers for the installation of copper pipework.
- 3.2.14 The final connections to all sinks, basins and fittings shall be provided by the Contractor who will provide suitable BSPT copper adaptors and the Contractor shall note that all taps shall be supplied under a separate contract.
- 3.2.15 The Contractor shall also note that the use of Hemp and Paste for jointing in hot and cold water systems will not be allowed under any circumstances. Any screwed joints can be made using PTFE tape, however he must obtain written approval to do so from the Engineer.
- 3.2.16 The Contractor shall ensure that where dissimilar metals are used within the pipework installation they do not result in chemical reaction or electrolytic action.
- 3.2.17 All pipework and fittings shall be in accordance with the following Schedule of Technical Requirements Table 1.

COPPER PIPES. CAPILLARY OR FLANGED JOINTS				
WORKIN	WORKING PRESSURE 6 bar. g max TEMPERATURE - NOMINAL 65°C			
ITEM	NOMINAL SIZE	DESCRIPTION	BRITISH STANDARD	NOTES
Pipe	All sizes mm	Copper tube. Half hard	BS EN: 1057:1996	Material to BS
	O.D. 15 to 159	tube.	Table X	6017 non-
				arsenical and de-
				oxidised grade.
Fittings	15 to 108	Copper or non-	BS 864: 1982 Part 2	Fittings to be
		dezincifiable copper alloy.		marked by
		Capillary type with integral		manufacturer to
		"lead free" solder rings.		identify as having
				"lead free" solder.
				IMI Yorkshire
				Fittings Limited
Fittings	15 to 108	Brass compression fittings.	BS 864: 1982 Part 2	

Table 1 Schedule of Technical Requirements



Mechanical Services Specification

SECTION C – STANDARD SPECIFICATION

COPPER	PIPES. CAPILLA	RY OR FLANGED JOINTS		
WORKING PRESSURE 6 bar. g maxTEMPERATURE - NOMINAL 65°C				
ІТЕМ	NOMINAL	DESCRIPTION	BRITISH	NOTES
	SIZE		STANDARD	
Unions	15 to 54	Non-dezincifiable copper alloy. Capillary type with integral "lead free" solder rings.	864 Part 2	Fittings to be marked by manufacturer to identify as having "lead free" solder.
Gaskets at flanges	All sizes metric	Ethylene propylene synthetic rubber.	4865 Part 1	To the approval of WRC tests.

Notes:

Flux shall be as recommended by the fitting manufacturer and be approved by the Water Authorities Association as suitable for hot "potable" water services to Water Research Centre tests. Flux shall be applied sparingly, be water miscible and flushed away as soon as possible in accordance with the manufacturer's recommendations.

3.3 Valves and Stopcocks

- 3.3.1 Isolating valves shall be installed on the pipework connections to all heat exchanged, pressurisation equipment, tanks, strainers, mixing valves, pressure reducing valves and where shown upon the drawing.
- 3.3.2 Check valves shall be installed on the delivering side of circulating pumps, inlet side of mixing and pressure reducing valves and where shown upon the drawing.
- 3.3.3 Drain cocks shall be installed at all low points to enable the whole system to be completely drained and where shown upon the drawing.
- 3.3.4 A means of isolation using a stopcock shall also be provided to all draw off points and final connection point of all appliances which consume water.

Isolating Valves

3.3.5 Crane D171A or D171ALS DZR copper alloy ball type threaded to BS 21 PN25. Valve to be quarter turn lever operation or lockshield as required for system balancing.

Check Valves

3.3.6 Crane D140 bronze swing type with renewable nitrile rubber disk and screwed in cap, threaded to BS 21 PN25.



Strainers

3.3.7 Crane D297 bronze Y type strainer screwed BS 21 with copper screen and screwed cap.

Drain cocks

3.3.8 Drain taps shall be DZR Crane D171HULS of the ball valve pattern to BS 2879, with inlet end screwed to BS 21 taper thread, ribbed outlet suitable for hose attachment complete with lockshield type head. Three lockshield keys to be provided for each size of draincock installed.

Stopcocks

- 3.3.9 Standard Ballofix valves sized 15 and 22mm with compression ends brass finish where concealed and chrome finish when exposed.
- 3.3.10 Yorkshire YP514GM double union stopcock on sizes 28mm and over.

Pressure Reducing Valves

- 3.3.11 IMI Bailey Birkett type, of bronze construction.
- 3.3.12 The Contractor may substitute the manufacturers named in this section of the Specification with Messrs. Hattersley Newman Hender.
- 3.3.13 The Contractor shall note an approximately sized anti-vacuum valve shall be fitted to all pressure vessels installed within the HWS system.

Flexible Hoses

3.3.14 Flexible connections shall be used to connect portable equipment such as vending machines. Flexible hoses shall be braided chromium finish complete with suitable connections.

3.4 Water Storage Tank (Sectional)

- 3.4.1 The Contractor shall provide and fix in the position shown water storage tank as detailed in Section 3 and on the drawings. The storage tank shall be complete with screened overflow and warning pipe which shall be taken to discharge in an external visible position.
- 3.4.2 The inlet cold water feed connections to the cold water storage tank shall be complete with an isolating valve and float valve. The float valve shall be fitted above the overflow outlet connection and shall be adjusted to ensure the water line is at the specified distance from the top of the tank.
- 3.4.3 The tank shall be fitted with a delayed action float valves.
- 3.4.4 Each float valve shall be complete with line size 'Filterball' spherical isolating valve with integral strainer. Float valves shall be suitable for the pressure of the installation.
- 3.4.5 The tank shall have a fully self-draining base, bolted lid, man way and inspection hatch. The tank shall be mounted on supports to the manufacturer's requirements.



- 3.4.6 All connections shall be of sufficient length so as to project clear of the finished face of the storage tank to facilitate ease of disconnection.
- 3.4.7 The sectional tank shall have external flanged joints suitably sealed during erection with a sealing compound recommended by the manufacturer. The flanges of each tank shall be jointed using mild steel nuts, bolts and washers, galvanised in accordance with BS 729.
- 3.4.8 The tank shall be complete with internal 304 quality stainless steel stays to prevent distortion as recommended by the manufacturer. Internal ties shall be utilised as necessary to structurally stabilise the tank.
- 3.4.9 Sectional tanks shall be constructed from non-toxic glass reinforced polyester material (GRP). The panels shall be manufactured with a raised centre and shall be hot press moulded at 140EC. The panel shall have flanges 80mm deep, precision drilled to suit M12 bolts. The panels shall be complete with mitred corners to reduce the possibility of localised areas of high internal stress. The loads in the tank shall be taken by stiffened flanges and supports. All panels shall be factory drilled.
- 3.4.10 The material shall be medium pale blue/grey colour including 25% polyester resin and UV stabilisers to BS 5734 Part 5.
- 3.4.11 Tank panels shall be pre-insulated with 25mm cfc free foam insulation, truncated pyramid shaped with smooth internal and external surfaces. The panels shall have 100% panel surface insulation.
- 3.4.12 The tank panels shall have a thermal conductivity of 0.87 W/m2K
- 3.4.13 The tank shall be externally braced with galvanised steel supports using the manufacturers recommended method in accordance with BS 4994.
- 3.4.14 Assembly of tank panels shall be means of 12mm galvanised mild steel finished bolts to BS 729 with internally bolted heavy duty cover. Sides shall be externally bolted, and the base shall be externally bolted. Internal fasteners shall be stainless steel 304 quality.
- 3.4.15 Aqualite sealant used in the assembly of the tank shall be butyl rubber compound minimum 3mm thick 75mm wide with minimum 25% recovery from compression.
- 3.4.16 The testing of the tank shall be undertaken on completion of the installation. There shall be no visible sign of water leakage for minimum period of 24 hours.
- 3.4.17 The tank shall have a 300mm raised ball valve chamber of sufficient size to house both float valves. The drain connection shall be taken from the bottom of the tank.
- 3.4.18 The design, manufacture and installation of the tank and connecting pipework shall comply with the Water Supply Byelaws Guide and the latest British Standard.



3.5 Water Storage Tank (One Piece)

- 3.5.1 The Contractor shall provide and fix in the position shown one piece glass reinforced plastic water storage tank as detailed in Section 3 and on the drawings. The storage tank shall be complete with screened overflow and warning pipe which shall be taken to discharge in an external visible position.
- 3.5.2 The cold water feed connection to the tank shall be complete with a line size 'Filterball' spherical service valve and a delayed action float valve which shall be suitable for the existing water pressure.
- 3.5.3 The tank shall be complete with a close fitting mechanically fixed rigid cover with built in screened breather (0.65mm mesh). Both tank and lid shall be insulated in integral encapsulated insulation at 0.87W/m2K minimum.
- 3.5.4 The design, manufacture and installation of the tank and connecting pipework shall comply with the Water Supply Byelaws Guide and the latest British Standard.

3.6 Valve Labels and Wall Chart

3.6.1 All major valves shall be labelled and included in the wall chart as specified in Clause 2.2.19 of this Specification.

3.7 Chlorination

- 3.7.1 The hot and cold water pipework shall be sterilised in accordance with BS 6700, 1987 and the following notes:
 - a) The following sterilisation procedure shall be applied when serving complete domestic hot water and cold water installation.
 - 1. Ensure that all equipment is shut off and disconnected from system at mains/branch pipework connections prior to sterilisation.
 - 2. Preparation of the sterilisation solution shall be carried out in the following manner and in accordance with the system capacities given in the Specification and dosage datahereunder.
 - b) Hatacide C.R. (Chlorine) tablets to be inserted into the cold water storage tanks.

Note: 1 No. Hatacide C tablet to every 800 gallon system capacity.

- 1. Allow time for tablets to dissolve (normally 30 minutes). Leave the whole system charged for a period of not less than three hours.
- 2. Open all taps and allow sterilising solution to flush through the system and carry out a residual chlorine test to determine when solution is apparent at all outlets.
- 3. When solution is detected at outlets, shut down all taps installed on system.



- 4. Leave system in a shutdown situation fully charged, until final commissioning is carried out.
- 5. After sterilisation period, open all outlets and drain through, carry out residual chlorine tests until negative chlorine test is proved at all outlets.
- 6. Operate all domestic hot water plant and repeat chlorine test when system is up to temperature. Further draining may be necessary if chlorine is detected.
- 7. When system is working with fresh (chlorine free) water, reconnect any appliances disconnected under item 1.

3.8 Water Authority Regulations

3.8.1 The Contractor shall liaise fully with the Local Water Authority and be fully conversant with the Local Water Authority Bye-Laws and Regulations before commencing any work and must make allowances for all things necessary to carry out the whole of the work covered under this Specification and the accompanying drawings, in accordance with these regulations whether specifically detailed herein or not. Allow for all testing and stamping charges involved.

3.9 Expansion

- 3.9.1 Thermal expansion of pipework shall be absorbed by expansion loops sets or bellow units as necessary and as indicated on the drawings.
 - 1. Expansion Loops
 - a. Expansion of pipework to be taken up by the natural offset and change of direction of pipe runs where this is not possible expansion devices to be adopted.
 - 2. Expansion Bellows
 - a. Expansion bellows shall be Powerflex RFA or RWA stainless steel Axial Compensator type as detailed on the drawings. They shall have suitable connections for copper pipe and shall be complete with outer protection sleeve.
 - b. Expansion bellows shall be designed to withstand the test pressure of the system.
 - c. Expansion bellows shall be installed in accordance with the manufacturer's recommendations complete with all necessary pipe guides and anchor points. Bellows shall be line size.

3.10 External Water Mains

3.10.1 The Contractor shall connect to the new metered water supply at the boundary of the site and run new pipework into the building as indicated upon the drawing. Buried potable blue



medium density polyethylene for buried potable water distribution system. Pipes and fittings to be manufactured and tested in accordance with the Water Research Council Specification No. 4.32.03 for mains pipe (90mm and above) and 4.32.04 for fusion joints and fittings. Service pipe (20mm - 63mm) to be manufactured in accordance with BS 6572 by Wavin Industrial Products Limited or equal and approved.

3.10.2 For fusion welding the Engineer reserves the right to consult Wavin to ensure that installers are competent to handle PE pipework and fittings.

Frost Protection

3.10.3 All underground pipework and fittings shall be laid with a minimum cover of 750mm below finished ground level, and where entering buildings shall not rise above that level until they have reached a point not less than 750mm away from the internal face of any external wall.

Pipe Laying

- 3.10.4 The Contractor shall lay all underground pipework with a minimum cover of 750mm below finished ground level and to a maximum depth of 1250mm.
- 3.10.5 Where practical the gradient shall not be less than 1:250.
- 3.10.6 No water service or distribution mains shall be made along a trench in which is laid any drain or sewer. Pipes shall not be laid in avoidable foul or injurious soil or other materials. Where laying of pipes in such materials is unavoidable, the pipes shall be protected.
- 3.10.7 No pipes shall be laid on their collars or bricks tiles or other temporary supports. If the bottom of the trench has been taken too low, it shall be made up with well rammed fill of ballast. Joint holes shall be formed in the bottom of the trench ahead of the work in order that joints may be properly made. The joint holes shall be as short as practical.
- 3.10.8 Where MDPE pipes are laid underground care shall be taken to ensure that the bed on which the pipes are laid and the backfilling immediately adjacent to the pipes does not contain any sharp edged stones. Backfilling of trenches shall be carried out carefully to avoid damage to pipework.
- 3.10.9 Pipes shall be kept free from mud, debris, superfluous jointing material or other obstructions during laying and until completion of the contract. Open pipe ends shall be temporarily sealed using purpose made metal or wooden plugs or blank counter flanges. Where necessary, pipework shall be weighted to prevent floatation. All pipes and fittings shall be thoroughly cleaned internally and maintained in a clean condition during pipe laying.
- 3.10.10 Trenching work concerned in the laying of underground pipework shall comply with the requirements of BS 8010. Constructions of trenches, their depth, line and gradient shall comply with the requirements of this Specification and the British Standards Codes of Practice before pipe laying commences. Thrust blocks complying with BS Codes of Practice shall also be provided at all bends, branches, changes in direction and dead ends, before



filling and testing the installation. Thrust blocks shall be constructed out of concrete to British Standards.

3.11 Valves

- 3.11.1 Stop valves shall be of brass construction with ends screwed or suitable for copper connections where specified. Stop valves shall conform to BS 1010 with crutch head.
- 3.11.2 Sluice or mains isolating valves shall conform to BS 5163 and be of the class suitable for the pressure in the main. The valves shall be double flanged pattern and where necessary shall be complete with cast iron spigot and socket adapters for either cast iron or uPVC or ABS pipework. Sluice valves fixed inside buildings shall be fitted with square cap suitable for normal turnkey operation.

Testing

3.11.3 The pressure test shall not be commenced until a period of at least 24 hours has elapsed from the time of making the last pipe joint and all thrust blocks are complete.

Chlorination

3.11.4 The external water main shall be chlorinated in accordance with Clause 2.3.8.

3.12 Painting and Finishing Off the Works

- 3.12.1 As the installation progresses all ferrous components shall be thoroughly wire brushed and cleaned of all dirt, rust, paper labels and grease etc. All welded joints shall be cleaned and be free surplus slag. All surplus jointing materials shall be removed, and all edges and corners made safe to the entire satisfaction of the Engineer.
- 3.12.2 The foregoing work shall be carried out prior to the progression of any further work either by the Contractor or any other Contractor which shall conceal the materials in question.
- 3.12.3 After cleaning, one coat of anti-corrosive primer of an approved manufacture shall be applied.
- 3.12.4 The Contractor shall note that this applies to all MS pipes, fittings, steel supports and unpainted plant.
- 3.12.5 All exposed MS pipework, metalwork, brackets etc. with the exception of aluminium or galvanised items shall be given one coat of undercoat and one coat of heat resistant paint of an approved colour.
- 3.12.6 Upon final completion the whole of the works shall be thoroughly cleaned to remove all building debris, insulation and paint splashes. After cleaning, if damage is apparent it shall be repaired to the satisfaction of the Engineer.
- 3.12.7 The Contractor shall ensure that all exposed copper pipework in plant rooms shall be cleaned of all jointing compound, flux, excess solder, polished and given two coats of clear lacquer.

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SECTION C – STANDARD SPECIFICATION

PART 4 NATURAL GAS INSTALLATION

NOT USED

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Mechanical Services Specification



SECTION C – STANDARD SPECIFICATION

PART 5 CHILLED WATER INSTALLATIONS

NOT USED





PART 6 AIR CONDITIONING AND VENTILATION SYSTEMS

6.1 General

6.1.1 The installation shall conform to all relevant British Standards and Codes of Practice which are current at the time of installation. The Contractors attention is particularly drawn to the following:

BS 2852	-	Testing for rating of room air conditioners.
BS 4718	-	Methods of testing for silencers for air distribution systems.
BS 4856	-	Methods for testing and rating fan coil units, unit heater and unit cooler
BS 4857	-	Methods for testing and rating terminal reheat unit distribution systems
BS 4954	-	Methods for testing and rating induction units for air distribution-
BS ***	-	Specification for rating and testing unit air conditioners of above 7 kW cooling capacity
BS 5588	-	Code of Practice for ventilation and air conditioning ductwork
BS 6583	-	Methods for volumetric testing for rating of fan sections in central station air handling units
BS 6821.	-	Methods for aerodynamic testing of dampers and valves
BS 6901.	-	Specification for rating and performance of air source heap pumps with electrically driven compressors
BS EN 60335-2-40	-	Electric heat pumps air conditioners and dehumidifiers
BS EN 60335-2-65	-	Air cleaning appliances

6.2 Ductwork

- 6.2.1 The Contractor shall provide and fix a complete range of supply, recirculation and extract ductwork together with all necessary fittings and accessories as described below.
- 6.2.2 All ductwork, fittings and accessories shall be manufactured from hot-dip zinc coated and iron zinc ally coated mild steel sheet and plate in accordance with BS EN 10143:1993.
- 6.2.3 All ductwork fittings and accessories shall be manufactured and installed in accordance with HVCA Specification for sheet Metal Ductwork DW/144. The pressure and leakage classification for the ductwork system shall be identified elsewhere in this Specification.
- 6.2.4 Where kitchen ventilation systems are required ductwork, fittings and accessories shall be manufactured and installed in accordance with DW/171 guide to good practice for kitchen ventilation systems.



- 6.2.5 The ductwork system shall be maintained throughout the installation period in a clean condition and shall finally be cleaned prior to testing in accordance with DW/TM2 guide to good practice internal cleanliness of new ductwork installations.
- 6.2.6 Efficient protection shall be given to all duct ends left disconnected during the progress of the works.
- 6.2.7 Protection shall be carried out by using heavy grade polythene taped in position or other approved method. The Contractor shall ensure that all necessary test holes and holes required for thermostat and thermometer bulbs are provided in the ducts and shall ensure that any defects in the galvanised coating are painted with galvafroid paint.
- 6.2.8 The ductwork shall be complete with dampers, bends, tees, tapers, transformation and special pieces. Lobster back type bends or mitred type elbows will NOT be permitted under any circumstances.
- 6.2.9 All positions for plant and ductwork shall be checked on site and detailed installation drawings shall be submitted to the Engineers before manufacture is commenced.
- 6.2.10 Transformation or taper pieces shall be constructed so that the angle on any side does not exceed 20 degrees to the axis of the duct. Sharp corners or edges on ductwork, associated equipment, supports and angle supports, shall not be allowed.
- 6.2.11 All flanged joints shall be provided with a 3mm thick full faced rubber gasket, where slip joints occur, they shall be telescoped to ensure a tight taper fit, have an overlap of not less than 75mm and sealed over the full lap not greater than 50mm.
- 6.2.12 The Contractor shall ensure that all bends have a throat radius of at least half the width of the duct, bends fitted with guide vanes shall be used where indicated upon the drawings.
- 6.2.13 Control dampers shall be provided where indicated upon the drawings and these shall be of the streamlined multi-leaf type, the spindles of which shall be fixed to quadrants. The damper blades shall be fixed in line with the operating arm of the quadrant and 'open' and 'closed' plates.
- 6.2.14 Control dampers not exceeding 300mm wide and 300mm deep shall be of the single leaf pattern.
- 6.2.15 Control dampers above this size shall be of the double skin multi-louvred pattern with a maximum blade width of 250mm.
- 6.2.16 The connections to all items of plant shall be made with acoustic type flexible connectors.
- 6.2.17 All supports and brackets shall be felt lined and painted ONE COAT of red oxide before and after erecting. All nuts and bolts shall be sheradised. The fastening of electrical cables to ductwork will NOT be permitted.
- 6.2.18 Ductwork where passing through floors, walls, roofs, etc. shall be provided with galvanised steel sleeves packed with manual fibre or similar non-flammable fire resisting material form a



fire/smoke stop of adequate rating and to eliminate movement of air between the duct and the sleeve and the transmission of noise from one area to another.

- 6.2.19 Ducts shall not come into contact with the fabric of the building except where fire/smoke dampers are fitted in the building fabric.
- 6.2.20 Expansion joints shall be provided on all straight runs of ductwork exceeding 21m. Hangers and brackets for ductwork shall be spaced to ensure adequate support and where practicable shall be fitted at each joint of the ductwork.
- 6.2.21 The whole of the ductwork shall be cleaned by means of a high vacuum plant supplied by the Contractor immediately prior to the operation of each installation.
- 6.2.22 Test points shall be included at each side of items of equipment, upstream of dampers and as required to measure the system performance.
- 6.2.23 Upon completion of the ductwork installation, the Contractor shall be required to demonstrate to the Engineer that the system is air tight by carrying out air leakage test in accordance with DW/143 where appropriate.
- 6.2.24 The ductwork shall be manufactured by a Specialist Ductwork Contractor approved by the Engineer and the Contractor shall demonstrate the quality of workmanship to the Engineer if required before approval is given.

6.3 Fire Dampers

- 6.3.1 The Contractor shall provide and fix in the positions indicated upon the drawings and as detailed in Section 3 fire/smoke dampers.
- 6.3.2 Fire dampers shall be mounted within the ducts shown and the shutter shall be located such that it is positioned within the extremities of the fire wall, floor, blanket etc.
- 6.3.3 All fire dampers shall be designed to give a fire resistance of two hours when tested, in accordance with BS 476: Part 24 and shall comply with DW/TM3 guide to good practice for the design and installation of fire and smoke dampers.
- 6.3.4 Fire dampers shall be located horizontally, or vertically, as required and the Contractor shall ensure they are installed in accordance with the local Fire Officer's requirements.

6.4 Duct Access Doors

- 6.4.1 The Contractor shall supply and fix duct access doors to ductwork at intervals not exceeding 3m for cleaning and at the following positions:
 - 1. At each side of all heating and cooling coils for the purpose of inspecting and cleaning the coils.
 - 2. At each side of all filters.
 - 3. At each side of all attenuators.
 - 4. At one side of all dampers.



- 5. At one side of all fire dampers.
- 6. As required by Table 25 of DW/144.
- 6.4.2 Access doors shall be rectangular double skin sandwich construction lift-off doors.

6.5 Flexible Ductwork

- 6.5.1 The Contractor shall provide and fix ranges of flexible ductwork as shown upon the drawings. The size of ductwork shall be shown upon the drawings or detailed in the Schedule of Grilles and Diffusers. Flexible ductwork shall be used to connect trunk ducts to grilles using the shortest length possible commensurate with providing the required degree of tolerance required for the system installation. Flexible ductwork shall not be installed with a tight radius bend thus preventing puckering occurring and shall be independently bracketed to prevent undue sagging.
- 6.5.2 Connections shall be made to all items of equipment using a good quality jubilee clip. All joints shall be air tight and shall be finally taped with heat resisting 50mm wide PVC adhesive tape which shall also be used to seal the insulation to the ends of each length of ductwork.
- 6.5.3 Flexible ductwork shall be as follows:

Supply (Conditioned) Air -Type M-KC pre-insulated

Recirculation/Extract -Type ST

6.5.4 All flexible ductwork shall be Thermaflex as manufactured Flexible Ducting Limited, Milngavie, Glasgow, G62 7LW or equal and approved.

6.6 Grilles and Diffusers

- 6.6.1 The Contractor shall provide and fix in the positions indicated upon the drawings, diffusers and transfer grilles.
- 6.6.2 The grilles and diffusers shall be constructed from polished extruded aluminium complete with standard fixings, as recommended by the manufacturers, or of the type detailed later and finished with a stone enamel finish to our approved BS colour.
- 6.6.3 All grilles and diffusers shall be in accordance with the details described in the Schedule of Grilles and Diffusers.
- 6.6.4 The frame and fixing details shall be selected to ensure compatibility with the suspended ceiling, they shall be complete with plenum boxes as required and shall be supported from the structure with mild steel drop rods. All drop rods shall be cut back and fitted with plastic end caps.

6.7 Air Handling Units

6.7.1 Supply, provide and fix air handling units as described below, in the schedules and as shown on the drawings.



- a) <u>General Requirements</u>
 - External noise (maximum) NC50 at 3.0m Internal noise (maximum) NC40.
 - Units shall be suitable for an internal or external (weatherproof) location as detailed in Section 3 of the Specification.
 - Unit sections shall be designed and constructed to prevent drumming or distortion of panels up to a pressure differential of 2500 Pa.
 - Each unit shall be of modular construction for ease of handling and replacement or addition of sections.
 - Each section shall have matching cross sectional dimensions, be of the same construction type and present a clean internal appearance to ensure even airflow through the components.
 - Steel channel bases shall be provided under all units. These shall be 150mm high or 200mm as specified.
 - Prior to dispatch, each section shall be shrink wrapped, using heavy gauge polythene sheeting to provide protection during shipment and installation.
 - The Contractor shall ensure that the units are adequately protected throughout the contract. Access doors shall be provided to ensure case of access for maintenance cleaning and repair. The acoustic performance of the air handling unit shall be as specified in Section 3.
 - The Engineer reserves the right to have any panels which are scratched or otherwise damaged, replaced at the Contractor's expense.
- b) Basic Construction
 - The unit shall be of framed construction. The frame shall be built from Modar composite material providing high thermal, high strength, corrosion free and fire resistant properties.
 - Frame members shall be bonded/mechanically fixed together to provide strength equal to welding and to prevent air leakage.
 - Panels shall be flush mounted into the unit framework. They shall be 50mm thick double-skinned insulated construction, with a Colorcoat Plastisol pre- coated steel outer skin to provide a tough surface finish. The panel inner skin shall be formed from pre-galvanised steel.
 - Panels shall have a CFC free rigid foam insulation infill with a thermal conductivity no greater than 0.02 W/m°C. Insertion loss through the panels shall be sufficient to achieve 25dB and 27dB reductions at 63 and 125 Hz octave bands respectively.



- All panels shall be removable, being retained by flush headed screws which do not penetrate through the framework. Access doors shall be provided with heavy duty hinges and cam handles.
- The floor of the unit shall be flush, with no lips at doors or access panels, so that sections can be sluiced out.
- The design of the unit shall be free from cold bridges. There shall be no direct metallic contact between the inside and the outside of the cabinets due to the non-conducting properties of the frame, the design of the panels and the design of the fixings and fasteners.
- Air leakage of the assembled units shall be to DW/144 Class B.
- Frames shall be self-coloured to BS 4800. Panels externally shall be from the BSC Colorcoat standard range.
- c) <u>Fan Section</u>
 - Fans shall be double inlet, double width, centrifugal construction pedestal bearing type with forward or backward curved impellers with a total efficiency of not less than 75%.
 - Vibration isolation shall be by springs. Rubber mountings shall not be used. Scrolls shall be fabricated from galvanised steel, seam jointed to give strength and eliminate leakage. The inlets shall be fitted with aerodynamically designed volutes.
 - Shafts shall be manufactured from accurately turned and ground steel, keywayed at both ends. The bearings shall be sealed for life ball bearings in rubber anti-vibration housing or split plummer blocks with self-aligning ball bearings as applicable. A flexible connection shall isolate the fan casing from the unit casing, this shall also be fire resistant.
 - Impellers shall be dynamically balanced at their rated speed to BS 6861: Part 1 1987.
 - The fans shall be driven by Totally Enclosed Fan Ventilated Motors. All motors shall be suitable for 415V, 3 phase/240, 1 phase 50 Hertz electrical supply as required and shall have Class F insulation rated for Class B temperature rise.
 - The motor frame size shall be 110% of the rated duty.
 - Fan drives shall be multi-vee pulleys fixed to the fan and motor shafts by means of taper lock bushes. Matched sets of Vee belts shall be supplied to provide the required fan speed. Drive guards shall be removable to provide access for maintenance.
 - Where top discharge is required fans shall be positioned so that the throw of the



air follows the ductwork bend immediately after the discharge to reduce friction losses.

- d) <u>Heating and Cooling Coils</u>
 - Coils shall be manufactured from solid drawn seamless copper tubes staggered in the direction of airflow. Tube return bends shall be copper, brazed to the tube ends. Tubes shall be expanded to permanently bond them to the fins.
 - Fins shall be manufactured from pre-tinned copper, having extended collars for spacing and shall be bonded mechanically to the tube. Headers shall be heavy gauge seamless copper tube. The casing shall be galvanised mild steel on the heating coils and brass on all cooling coils and extract run around coils.
 - Coils shall be air pressure tested under water to 21 bar after manufacture.
 - Coil sections shall be arranged to provide removal of coils from the access side of the section. Coils shall be horizontally split where necessary, with same side pipework connections.
 - Drain pans shall be incorporated inside all cooling coil sections and shall extend underneath the headers and beyond the fin block to ensure adequate collection of condensate. They shall be of sloping design. On stacked coils, intermediate drain troughs shall be fitted. Drain pans shall be manufactured from galvanised steel which shall be coated with an epoxy paint system for added protection.
 - Plastic eliminators shall be utilised only at the discretion of the manufacturer. Traps on cooling coils shall be clear borosilicate glass to prove the integrity of the water seal. The trap depth shall be not less than 1.5 times the fan static pressure.
 - Each trap shall incorporate quick release couplings to enable easy removal of the traps, and a water fill point. Condensate pipework shall be routed in copper to BS 1387 to the plant room drain.
- e) <u>Mixing Box</u>
 - The mixing box shall be fitted with opposed blade aerofoil section dampers and shall be selected and sized with authority to give near linear performance.
 - The blades shall be roll formed from two aluminium strips to form torsionally rigid hollow profile sections with lock seams for high strength.
 - The aerofoil section shall provide low air resistance and low noise generation. Standard bearings shall be low friction nylon which require no maintenance in operation. Each shaft shall be fitted with an external cover to prevent air leakage.
 - Coupling of the blades shall be by means of internally mounted, high precision aluminium gears to ensure positive accurate movement with minimum actuating force.


- f) <u>Filters</u>
 - The filters shall be mounted within a 'Polyseal' side access arrangement enabling filter replacement to be from the side. The side access arrangement shall consist of extruded aluminium tracks which shall be fitted with a lipped, moulded gasket which inflates under the air pressure to provide an effective seal. The ends of the filter mounting tracks shall be sealed with gasketed metal inserts to prevent air bypass. All filters shall be flame resistant.
 - Filters performance shall be as detailed in Section 3.
 - The Contractor shall demonstrate to the Engineers that suitable access is provided to remove and install filter panels.
 - The tracking shall incorporate channels for fitting pre-filters, so forming a compact assembly. Only standard sized filters shall be used.
- g) <u>Notes</u>

An allowance shall be included for the changing of pulleys and belts (once only) at commissioning stage.

1. Each unit shall have an inclined manometer fitted across each filter with indicators showing clean and dirty conditions.

The sections of the air handling unit shall be bolted to the channel base by the manufacturer. Each unit shall be assembled on site in the plant room and the Contractor shall include for the manufacturer's representative to visit the site (1 visit per unit) to check that the unit is correctly assembled.

The unit shall be complete with holes cut through the double skinned sections by the manufacturer to accept the various thermostats, thermometers, sensors and controls shown on the drawings as listed in the Automatic Controls Specification.

The holes shall be suitably sealed to prevent migration of the insulation in the panels. All coils shall be easily removable for maintenance purposes.

All materials incorporated in the construction of the unit shall not support micro biological growth; this applies particularly to mastics, gaskets, insulation etc.

2. Each unit shall come complete with an initial fill of bag filter media, along with a complete set of spare drive belts and pulleys.

Each unit shall be delivered in two or more sections to facilitate

3. Each unit shall be delivered in two or more sections to facilitate installation and shall be assembled on site within the plant room.



The Contractor shall be responsible for determining the number of sections required prior to ordering. Claims arising from failure to do so shall not be considered.

- 4. The air handling unit motorised dampers shall be set to work so that upon commencement of operation the damper shall open to a pre- set/commissioned point and upon unit shut down (after the pre-set fan run on time) the dampers shall close fully to outside air to avoid back draughts.
- 5. Air handling unit sections shall be of a horizontal or banked configuration as detailed in Section

The Mechanical Services Contractor shall allow for all necessary supports as dictated by the manufacturer and the unit shall be designed to sit on a concrete plinth as detailed by the Structural Engineer. Vibration isolation springs shall be positioned between the unit and the base as detailed in 3.4.8.

- 6. Each air handling unit shall be commissioned to the required airvolume.
- 7. The fans shall be turned manually by the Contractor on a weekly basis for the duration of the installation to avoid bearing damage and suitable certification supplied.

6.8 Extract Fans

6.8.1 The Contractor shall supply, install and commission extract fans and ancillaries as shown on the drawings and specified in Section B.

6.9 Silencers

- 6.9.1 The Contractor shall provide and fix silencers as detailed in the schedules and described below.
- 6.9.2 Silencers shall be suitable for the temperature and quality of air being handled, constructed to DW/144 Specification for low/medium pressure ductwork and type tested to BS 4718 at the manufacturer's works or an approved testing laboratory, and certificates provided.
- 6.9.3 Silencers shall have an outer casing of not less than o.8mm gauge galvanised sheet steel. Longitudinal joints shall be lock formed and mastic sealed. Each connection shall be drilled angle iron Doby flanges to the casing with huckbolts with the casing peened back over the flanges, or extended spigot fixing as detailed in the schedules. The direction of airflow shall be clearly marked on the casing.
- 6.9.4 The infill shall be in organic mineral wool or sufficient density to obtain the specified acoustic performance and packed at not less than 5% compression to eliminate voids due to settling. The fibrous infill shall be non-shedding, non-combustible, non-hygroscopic, vermin proof and chemically inert.
- 6.9.5 Silencers shall be lined with melinex or equal material to prevent the absorption of moisture, dirt and corrosive substances and the release of fibrous particles.



6.9.6 Sound absorbent elements shall have aerodynamic fairings on air entry and exit end of silencer.

6.10 Vibration Isolation Springs

- 6.10.1 The air handling unit shall be isolated from the structure using constant level anti-vibration spring mountings.
- 6.10.2 The Contractor shall supply and fix the mountings at the positions identified by the air handling unit manufacturer and shall be responsible for obtaining this information at tender stage.
- 6.10.3 The spring mounts shall be free standing, laterally stable without housings, snubbers or guards and complete with a 5mm thick ribbed acoustical neoprene pad, cold bonded to the underside of the box plate.
- 6.10.4 Each mounting shall comprise of a polyester coated high frequency isolation pad, spring pressure plate and high deflection colour coded steel spring. Flexible connections shall be utilised to connect the ventilation ductwork to the air handling unit.

6.11 Refrigerant Pipework Installation

- 6.11.1 The air conditioning systems indoor and outdoor units shall be interconnected by means of refrigerant quality copper tubing to BS 2871, Part 2. Pipework sizes 1/4" and 1/2" shall be supplied as coils. Pipework above this size shall be supplied as rigid lengths. All required branches, tees and joints necessary for the satisfactory completion of the works shall be provided.
- 6.11.2 Joints shall be kept to a minimum and bronze connections used where necessary complying to BS 1723. The refrigerant and condensate pipework shall be supported on medium gauge galvanised steel cable tray using 17mm EVA coated galvanised steel cable band straps fixed by proprietary screw fixings. Larger bore pipework shall be mounted using hydrosorb clips on brackets at distances specified in Section 2.3.2. The distance between supports and straps shall be as follows:
- 6.11.3 Band straps maximum 1 metre. Tray supports maximum 2 metres.
- 6.11.4 Mitre bends and tees in the cable tray shall be formed by cutting the tray and removing any sharp edges. Support drop rods shall be cut back to 25mm and fitted with plastic caps.
- 6.11.5 A leak test shall not be conducted until the pressure test is satisfactorily completed and the leak test shall be carried out with Nitrogen or any other inert gas.
- 6.11.6 The leak test pressure shall be held for at least one hour. Any fall in pressure, after due allowance for ambient temperature change, indicates a leak which should be traced. If any leaks are present, the fault shall be corrected, and the system shall be retested. Repairs, particularly involving brazing, shall not be carried out on any part of the system or component whilst under pressure.
- 6.11.7 The system shall be evacuated to 2mm Hg. to eliminate any moisture which may be present in the system. After completion, the system shall be ready for the correct charge of R407C refrigerant and the refrigeration duty oil.



- 6.11.8 All pipework (including copper condensate drains) above ½" nb.) shall be insulated using 20mm thick Class 'O' finish Armaflex fixed in accordance with the manufacturer's instructions. All pipework up to ½" nb. shall be insulated using 12mm Armaflex. All external and exposed pipework shall be finally finished with two coats of 'Armafinish' paint.
- 6.11.9 Pumped condensate drains following the route of the refrigerant pipework shall be installed using suitable seamless PVC braided tube. Joints shall not be allowed. The condensate pipework shall be supported as the refrigerant pipework on the cable tray. The Contractor shall ensure that the drain is not constricted at any point.
- 6.11.10 Where the condensate header enters the main drainage stack, it shall be connected via a suitable deep seal trap and tundish arrangement to the approval of the Consulting Engineers.
- 6.11.11 The Contractor shall include for Hydron or Peristaltic condensate pumps as indicated on the drawings or in the Particular Specification. The pumps shall be of the sump type where practicable and be complete with a failsafe device which shall, in the case of pump failure, switch off the applicable units. The condensate pumps shall be wired to the unit by the refrigerant Contractor and shall be fixed to the unit or adjacent structure as applicable, with suitable provision made to avoid vibration. The condensate pipework shall be connected to the pump discharge port using a proprietary spring clip.
- 6.11.12 The Contractor shall include for the recovery of any refrigerant when plant is "Blown Down". This recovered refrigerant shall be returned to the relevant refrigeration supplier.
- 6.11.13 The refrigerant pipework design shall be carried out in accordance with the requirements dictated by the manufacturers within their technical manuals or advised by the distributor. Refrigeration pipework shall be installed in standard sizes stipulated within the manufacturer's standard Technical Specification.
- 6.11.14 Refrigeration pipework shall be labelled generally as follows:
 - R407C Gas Line
 - R407V Liquid Line.
- 6.11.15 The whole of the installation shall be carried out by an approved accredited refrigeration company.

6.12 Split System Unitary Air Conditioning Units

6.12.1 The Contractor shall provide and fix in the positions indicated upon the drawings and as detailed in Section B Split System Unitary Air Conditioning equipment consisting of condensers, Heat Pump Units or Cassette Units. All such equipment shall be installed, commissioned and set to work strictly in accordance with the manufacturer's recommendations. The Contractor shall demonstrate to the Engineer that suitable access is provided to remove and install filter panels.



- 6.12.2 External condensing equipment shall be fully weatherproof, ceiling mounted, or void mounted equipment shall be supported from the structure using mild steel drop rods cut back and fitted with plastic end caps.
- 6.12.3 All unitary equipment shall be fully packaged, complete with an integral control system and factory decorated to an approved colour.
- 6.12.4 Floor mounted units shall be securely fixed to either an adjacent wall or floor as appropriate using proprietary fixings.
- 6.12.5 Condensing units shall be fixed to steel supports using proprietary fixings. Screwed fixings shall not be used.

6.13 Painting and Finishing Off the Works

- 6.13.1 All items of plant which are finished painted at the manufacturers works shall be protected as required by this Specification and prior to final completion of the works, these items shall be thoroughly cleaned in a manner which does not damage the paint finish and polished to remove all buildings debris, insulation and paint splashes.
- 6.13.2 After cleaning, if any damage is apparent, the plant shall be touched up or completely repainted to the entire satisfaction of the Engineer.
- 6.13.3 The Contractor shall note that all exposed copper pipework shall be cleaned of jointing compound solder etc. and shall when situated in the plant room be polished and given a coat of clear lacquer.
- 6.13.4 The Contractor shall note that exposed copper pipework outside of the plant room which is not required to be chromium plated shall be cleaned prior to decoration by other trades.

IMPORTANT NOTE:

It is the responsibility of the Mechanical Contractor to ensure all items of plant and equipment become operational in a condition equal to that when they left the manufacturers finished assembly line. Damage by other trades will not be accepted as a reason for a sub-standard finish of plant and equipment.



PART 7 AUTOMATIC CONTROL SYSTEMS

7.1 General

- 7.1.1 The installation shall conform to all relevant British Standards and Codes of Practice which are current at the time of installation. The Contractors attention is particularly drawn to the following: -
 - BS 1655 Specification for flanged automatic control values for the process control industry.
 - BS 3955 Specification for electrical controls for household and similar general purposes.
 - BS EN 126 Multifunction controls for gas burning appliances. BS EN50090 Home and Building electronic systems.
 - BS EN 60073 Specification for coding of indicative devices and actuators by colour and supplementary means.
 - BS EN 60534 Industrial process control valves.
 - BS EN 60546 Controllers with analogue signals for use in industrial process control system.
 - BS EN 60654 Industrial process measurement and control equipment. Operating condition.
 - BS EN 60730 Specification for automatic electrical controls for household and similar use.
 - BS EN 60947 Specification for low voltage switchgear and control gear. BS EN 61003 Industrial - process control systems.
 - BS EN 61038 Specification for time switches for tariff and load control. BS EN 61131 Programmable controller.
 - DDENV 1805 Data communication for HVAC Application Management Net.

7.2 General Requirements

- 7.2.1 The automatic control systems for the mechanical services shall be based on the use of local intelligent ddc controllers which shall be housed in control panels strategically located within the building. The control panels shall also have motor starters, fuses, switches indicator light, relays, etc. for the control of mechanical items of plant which together make up the mechanical services.
- 7.2.2 Control valves shall be of the magnetically operating seat type with 500:1 turn down ratio and standard manufacturers 5-year guarantee.
- 7.2.3 The Contractor shall be responsible for coordinating the automatic controls specialist.
- 7.2.4 The whole of the automatic controls installation shall be supervised during the installation by the controls manufacturer. Prior to manufacture and installation, the controls manufacturer shall produce detailed drawings of the controls panels which identifies all external terminals for connection by the Electrical Contractor and provides an illustration of the panel facia.



- 7.2.5 The Contractor shall be responsible for coordinating the automatic controls specialist. The Contractor shall be responsible for confirming all pump/fan motor sizes etc. to the automatic controls specialist.
- 7.2.6 Upon completion the manufacturer shall test and commission the whole of the control installation to the entire satisfaction of the Engineer.
- 7.2.7 The Controls Engineer shall include for the provision of instructing the Client on practical completion with regard to plant operation. A further visit shall be included by the Controls Commissioning Engineer to fully instruct the user of the satisfaction of the Engineer.

7.3 Field Mounting Components

- 7.3.1 All field mounting components provided as part of this automatic control system shall be fully compatible and able to operate in conjunction with the range ddc controls which are used throughout the project.
- 7.3.2 All control valves used throughout this project shall be of the magnetically operated seat type to ensure tight closing, with spring return actuator, manual override feature, a turn down ratio of 500:1 and be provided complete with a manufacturer's 5-year guarantee.

7.4 Operational Requirements

- 7.4.1 If the building fire alarm system should operate, if a fire detector above a burner should operate, or if the emergency stop button is pressed all plant fed from the control panels shall switch off and the gas solenoid valves shall close. Once this situation has arisen it shall be necessary to press the system reset buttons before the system can return to normal. A test override button shall be provided on the panel front and, if this is pressed, the fire alarm cut out circuitry shall be disabled for fifteen minutes so that the building fire alarms may be tested without switching the HVAC system off.
- 7.4.2 All ventilation plant shall be started and stopped automatically at fixed times under the direction of their own dedicated time switch programmes entered into the ddc control system.
- 7.4.3 When a ventilation plant is switched off its associated motorised dampers shall move to the closed to fresh air position.
- 7.4.4 If the temperature in the ductwork immediately downstream from the heater battery, or frost coil, should fall to near freezing the associated supply and extract fans shall automatically switch off to reduce the possibility of the coils freezing.
- 7.4.5 The extract fans shall automatically switch on and off whenever required to run. Supply fans and overdoor heaters shall not run until the common flow water temperature from the duty constant temperature heating pump has risen to a pre-selected level.



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PART 8 THERMAL INSULATION

8.1 General

8.1.2

8.1.1 The installation shall conform to all relevant British Standards and Codes of Practice which are current at the time of installation. The Contractors attention is particularly drawn to the following:

BS 476	-	Fire test on building materials and structures
BS 874	-	Methods of determining thermal properties, with definitions of thermal insulating terms
BS 1710	-	Specification for identification of pipelines and services
BS 3533	-	Glossary of terms relating to thermal instation
BS 5422	-	The use of thermal insulating materials
BS 3958	-	Thermal insulating materials
BS EN 14314	-	Thermal Insulation for building equipment and industrial installations Phenolic Foam
BS 4508	-	Thermally insulated underground pipingsystems
BS 5970	-	Thermal insulation of pipework and equipment in the temperature range of - 100°C to + 870°C.
BS EN 13941	-	Design and installation of pre-insulated bonded pipe systems for district heating
Insulating mate	erials a	and finishes shall be completely free of asbestos.

- 8.1.3 All materials shall have a Class 'O' fire rating to the current edition of the Building Regulations, when tested to BS 476 Parts 6 and 7.
- 8.1.4 All thermal insulation materials shall a Specific Optical Density less than 5 when exposed to an irradiance of 25 kW/m2 and less than 15 when exposed to an irradiance of 50 kW/m2 in accordance with BS 5659-2 (note: BS 5111-1 Status : Superseded, Withdrawn Replaced By : BS ISO 5659-2.)
- 8.1.5 To ensure that the correct thickness and Specification of insulation has been applied, one section of each type of insulation shall be cut out for inspection. If the insulation reveals defects a further two sections shall be cut out for inspection. If these prove defective the whole of the insulation shall be removed and new insulation and finishes, as specified, applied at the Contractor's expense.
- 8.1.6 Particular attention shall be given to the finished appearance of all thermal insulation which must present a neat and symmetrical appearance running true in line with pipe layouts. Any rough, irregular or badly finished insulation at surfaces, bends, tees and supports shall be



stripped down and re- insulated at the Contractor's expense. Allowance for expansion and contraction of insulation shall be made in accordance with the manufacturer's recommendations.

- 8.1.7 Where instrument points, tappings, name plates, plant instructions, etc. are provided in the installation, the insulation shall be cut away and the edges neatly finished and sealed.
- 8.1.8 Pipework or ductwork shall be insulated separately, and adjacent parallel pipes shall not be married together in one common insulation covering.
- 8.1.9 Insulation shall be neatly squared off at all insulated separated or uninsulated obstructions in pipework and ductwork allowing for expansion, contraction, easy access and disconnection of removable items without the disturbance of the surrounding insulation. All squared off ends shall be covered with purpose made end caps, which match the insulation outer covering.
- 8.1.10 Vapour barriers incorporated in insulation shall be continuous. The removable portions of the insulation to access doors, flanged joints, manholes, etc. shall be fitted as separate items with their vapour barrier overlapping and sealed to the main vapour barrier.
- 8.1.11 External weatherproof insulation shall be continuous and shall not be punctured by supports, special care being paid to sealing of the insulation at access doors, manholes, valves, flanges, expansion joints and anchor points to prevent ingress of water. The external finish shall be perforated with 6mm diameter holes at 150mm centres on the underside.
- 8.1.12 Components such as bolted ends, manholes, access doors, removable chests on vessels, valve bodies, flanges, pipe guides, anchor points and expansion bellows shall be insulated.
- 8.1.13 All insulating materials shall be installed in accordance with the manufacturer's recommendations. All adhesives used shall be fire resistant.
- 8.1.14 Before applying any type of insulating material over copper pipework the following procedure should be carried out in order to reduce the risk of pinhole corrosion which can be caused by corrosive elements sometimes present in water and in the dust from building site materials.
 - 1. Completely wipe clean the surface of the copper pipe remove all traces of moisture and dust.
 - 2. Smear on to the surface of the copper a thin coating of anti-corrosive gel, such as Denso paste or equivalent.
 - 3. Proceed to fit the insulating material in the normalmanner.
- 8.1.15 Where electric trace heating is fitted to pipework oversized pre-formed sections of insulation shall be provided to accommodate the thickness of the trace heating cable.

8.2 Service to be Insulated

8.2.1 Insulation shall be applied to the following services:



- 8.2.2 LPHW heating and chilled water pipework, but excluding any pipework located and designed to contribute heat to the space.
- 8.2.3 Hot and cold service pipework but excluding final connections to draw off points in domestic locations. Pipework and vessels in a DX refrigeration system.
- 8.2.4 Intake ductwork to plant.
- 8.2.5 Ductwork carrying heated, cooled, tempered or conditioned supply air.
- 8.2.6 Cold feed and open vent pipework.
- 8.2.7 All water storage vessels and calorifiers.

8.3 Insulation of Materials

- 8.3.1 The following insulation materials are available for use within buildings except where their use is restricted under Sub Section 5.4.
- 8.3.2 Rigid phenolic foam pipe insulation, FM approved, with a nominal density of 35kg/m³ and a thermal conductivity value not exceeding 0.025 W/mK at mean temperature 100C. Bore face all sections to be de-dusted and coated with a non-odorous passivating solution. All sections to be supplied with a fully bonded reinforced aluminium foil facing.
- 8.3.3 Rigid phenolic foam laminate, FM approved, with a nominal density 40kg/m³ and a thermal conductivity value not exceeding 0.022 W/mK at mean temperature 100C. Laminate to have reinforced aluminium foil bonded to one face.
- 8.3.4 Phenolic foam laminate as above but back slotted to accommodate curvature on circular ductwork.
- 8.3.5 Mineral wool pipe insulation resin bonded with a minimum density of 80kg/m³ for rock fibre. Thermal conductivity value shall not exceed 0.043 W/mK at mean temperature 1000C.
- 8.3.6 Mineral wool duct insulation resin bonded in a range of densities from 35kg/m³ to 100kg/m³ dependant on location. Thermal conductivity value shall not exceed 0.043 W/mK at mean temperature 1000C.

8.4 Material Restrictions

- 8.4.1 Phenolic foam insulation shall not be used on pipework or equipment operating at temperatures above 1100C.
- 8.4.2 Insulation materials containing glass or rock fibre shall not be installed in kitchens, food preparation or food storage areas (including ceiling voids and ducts and access from these areas) nor in air-conditioned spaces.
- 8.4.3 Hygroscopic insulation materials shall not be installed in areas subject to weather exposure or in external ground ducts subject to flooding.



8.5 Installation Requirements

- 8.5.1 The Contractor shall ensure that the correct thickness, thermal conductivity, fire rating and density of insulation meet the requirements of this Specification.
- 8.5.2 Where insulation is not required at valves, flanges or supports it shall be finished 50mm short of the fitting, squared off and the end covered with a purpose made cap.
- 8.5.3 All work shall be left perfectly smooth, clean and properly finished. Any poor quality work shall be stripped and replaced at the Contractor's expense and to the satisfaction of the Engineer.
- 8.5.4 All unused insulation finishes, and packaging shall be removed from the site before the final acceptance of the work.

8.6 Pipework

- 8.6.1 Pipework shall be insulated with foil faced rigid sections to the thicknesses tabulated in the appropriate table, it shall be secured by means of circumferential bands of non- ferrous metal or 50mm wide self- adhesive aluminium foil tape at maximum 300mm centres.
- 8.6.2 The foil facing to insulation on mains cold water services, chilled water and other pipes carrying liquid at or below the dew point shall have circumferential and longitudinal joints sealed with 50mm wide self- adhesive aluminium foil tape to complete with vapour barrier.
- 8.6.3 All ends of the insulation at entry to valve or flanged boxes and points where the covering is penetrated shall be sealed so that the continuity of the vapour barrier is maintained.
- 8.6.4 Where pipework or other services are used externally to buildings increase insulation thicknesses by one standard size or as indicated.

8.7 Ductwork

- 8.7.1 Thermal insulation shall be applied to supply ductwork throughout the installation, fresh air intake ductwork, extract and recirculation in plant rooms.
- 8.7.2 Insulation shall be fixed with a minimum of direct metal paths which thermally bridge the insulation, particularly when the insulation is metal faced. Ensure that thermal insulation covers all flanged joints, fasteners and stiffeners, either by means of purpose made boxes or by increasing the general thickness of the insulation to give at least 6mm cover.
- 8.7.3 Apply foil faced/resin bonded insulation slab to all faces with adjacent sides lapped to maintain a uniform thickness at corners.
- 8.7.4 The insulation shall be bonded on all sides with a fire-resistant contact adhesive, on inverted surfaces or where the sides of the ducting exceeds 600mm, the adhesive shall be used in combination with mechanical support comprising rust proof metal studs or plastic studs bonded to the duct surface. Insulation shall be impaled onto the stud and secured with washers.



8.7.5 All joints in the foil facing or protrusions through the facing are to be sealed with 100mm wide self- adhesive aluminium foil tape.

8.8 Insulation of Supports

- 8.8.1 On pipework conveying liquids or gases at temperatures lower than 1000C the pipe shall be isolated from supporting clips, props or struts by fitting high density phenolic foam inserts. These shall be purpose made blocks 100/125mm long, with bonded spreader plate and with factory applied reinforced aluminium foil facing.
- 8.8.2 On pipework conveying liquids or gases at temperatures above 1000C the pipe shall be isolated from supporting clips, props or struts by fitting high density water resistant vermiculite inserts.
- 8.8.3 The inserts shall be purpose made blocks with aluminium foil facing.
- 8.8.4 On ductwork conveying conditioned air the duct shall be isolated from supporting struts by fitting foil faced high density phenolic foam strip 150mm wide x the full duct width and to match the thickness of adjacent insulation.

8.9 Valve and Flange Boxes

- 8.9.1 All valves and flanges operating at or above 1000C shall be enclosed in removable insulated boxes. The boxes are to be fabricated from 0.91mm thick stucco embossed aluminium sheeting and be in the form of two sections, hinged on one side and secured on the other side with two quick release toggle fasteners of the spring shackle lock type.
- 8.9.2 Boxes shall be internally lined with mineral wool slab/section or mattress to the same thickness as insulation on adjacent pipework.
- 8.9.3 Outside of plant rooms or away from viewable areas, metal boxes shall be omitted, and the fittings will be insulated with prefabricated faced mattresses filled with mineral wool and secured with hooks and malleable copper binding wire or 'velcro' straps.
- 8.9.4 All valves and flanges operating at temperatures below 1000C shall be enclosed in removable insulated boxes as described above, except that the insulation shall comprise 35kg/m³ CFC and HCFC free rigid phenolic foam insulation in place of mineral wool.
- 8.9.5 On pipework operating at temperatures below 150C, i.e. cold water mains, chilled water, brine mains and other refrigeration lines, it is essential that maximum vapour tightness is maintained at fittings.
- 8.9.6 The insulation and vapour barrier either side of the fitting shall be carried into the box. At this point the vapour barrier shall be returned and taped to the pipe to eliminate the migration of water or moisture vapour into the insulation system.
- 8.9.7 Where the insulated box fits over the pipe insulation, the mating surfaces shall be sealed with a non- setting/non shrinking sealant, which shall also to be used in way to seal the spindles on valves and joining surfaces to the box.



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8.10 Finishings

- 8.10.1 Internal Locations other than Plant Rooms
 - Pipework Factory applied glass reinforced aluminium foil with joints sealed 50mm wide self-adhesive aluminium foil.
 - Ductwork Factory applied glass reinforced aluminium foil with joints sealed 100mm wide self-adhesive aluminium foil.

8.10.2 Plant Rooms

- Pipework As above, plus fabricated polished or hammered aluminium cladding of a thickness not less than 0.9mm.
- Ductwork As above, plus fabricated polished or hammered aluminium cladding of a thickness not less than 1.2mm.
- 8.10.3 External Locations including Below Ground Ducts
 - Pipework Plus o.8mm thick polyisobutylene sheeting wrapped around the insulation with minimum 30mm overlap and sealed by solvent welding.
 - Ductwork Plus two full applications of a polymeric emulsion mastic with reinforcement of number 10 glass cloth between coats.
 - NB. Where insulating materials are finished with metallic cladding, bond the cladding in accordance with the latest edition of the IEE Regulations.

8.11 Identification

- 8.11.1 Identify all pipework whether insulated, insulated and cased, or uninsulated by self-adhesive colour banding having colours complying with BS 1710. Provide indication of direction of flow. Locate identification banding at all entries and exits to plant rooms, service ducts, voids etc. and at connections or branches to or from headers, pipe runs and the like. Otherwise, provide identification banding at intervals of not more than four metres.
- 8.11.2 Identification coding for ductwork shall be in accordance with the relevant appendices given in HVCA Specification DW/144.

8.12 Energy Conservation

8.12.1 The thickness of insulation shall comply with the current Building Regulations Approved Document L (conversation of fuel and power).



8.13 Condensation Control on Refrigeration Pipework

8.13.1 The following thicknesses of Armaflex Class O thermal insulation shall be applied to refrigeration pipework applied in accordance with the Armstrong Armaflex Installation Manual (current edition) and installation techniques technical literature.

Refrigeration	Thickness
Refrigeration to -20°C	
Pipes 15-42mm OD	19mm
Refrigeration to -30°C	
Pipes 15-22mm OD Pipes 28-42mm	25mm
Refrigeration to -40°C	
Pipes 15-28mm OD Pipes 35-42mm OD	25mm

8.14 Thickness of Insulation

8.14.1 The thickness of insulation material which is applied to the various services shall be as identified in Tables below.

Nom. OD of Pipe (mm)	Declared Thermal Conductivity (W/m°C)						
	0.000 to 0.040	0.040 to 0.055	0.055 0.070	0.000 to 0.040			
	Minimum Nom	inal Thickness of	Insulation (mm)	•			
15	20	32	50	50			
22	20	32	50	50			
28	25	32	50	50			
35	25	44	50	50			
42	25	50	50	50			
Flat Surfaces	35	65	65	75			

Table 1 - Schedule of Technical Requirements - Insulation Thickness for DHW System



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Table 2 – Schedule of Technical Requirements - Insulation Thickness for Cold Water Systems (Frost Protection

Nom. OD of Pipe (mm)	Declared Thermal Conductivity (W/mK)						
	Pipework			External Pi	pework		
			withi				
	0.000 to	0.019 to	0.040 to	0.000 to	0.019 to	0.040 0.05	
	0.01	0.04	0.05	0.01	0.04		
	Minimum I	Nominal Thi	ckness of In	sulation (mr	n)		
15	30	65	100	110	230	450	
22	25	60	75	60	120	300	
28	25	50	75	30	65	125	
35	15	35	50	25	50	63	
42	15	30	50	25	50	63	
Flat Surfaces	15	19	25	15	25	32	

Table 3 - Schedule of Technical Requirements - Insulation Thickness for Warm Air Ductwork to control heat loss

Thermal Conductivity	Maximum permissible		
0.022	heat loss (w/m²)		
Thickness of insulatio			
20	35	45	16.34

Table 4 - Schedule of Technical Requirements - Insulation Thickness for Condensation Control on Chilled Air Ductwork

Minimum Temperature of Air Inside Ductwork											
o°C			5°C		10°C		15°C				
	Thermal Conductivity W/mK										
0.02	0.04	0.05	0.02	0.04	0.05	0.02	0.04	0.05	0.02	0.04	0.05
Thickness of Thermal Insulation (mm)											
55	100	120	45	75	95	30	55	65	20	30	40



PART 9 ABOVE GROUND INTERNAL DRAINAGE

9.1 General

- 9.1.1 The specification shall be used for all above ground internal drainage including foul and surface water drainage.
- 9.1.2 The installation shall conform to all relevant British Standards and Codes of Practice which are current at the time of installation. The Contractor's attention is particularly drawn to the following:
 - NBS Specification Section R Disposal Systems
 - BS 4576 Unplasticized PVC rainwater goods and accessories
 - BS 4514 Unplasticized PVC soil and ventilating pipes
 - BS 6367 Code of Practice for drainage of roots and paved areas BS 8000 Workmanship on building sites
 - BS 5255 Thermoplastic waste pipe and fittings
 - BS 5572 Code of Practice for sanitary fittings
- 9.1.3 Allowance for expansion and contraction of the installation shall be made in accordance with the manufacturers' recommendations.
- 9.1.4 Pipework shall be supported independently directly from the structure no support shall be taken from any other services installation.
- 9.1.5 All adhesive used shall be fire resistant.
- 9.1.6 The Contractor may substitute the manufacturers named in this section of the specification with another equal and approved.

9.2 Pipework and Fittings

- 9.2.1 Pipework shall be supported independently directly from the structure; no support shall be taken from any other services installation
- 9.2.2 Plastics Pipework for Soil Vent Pipes (NBS 110)

Pipes, fittings and accessories:	PVC-U to BS 4514, Kitemark certified.
Manufacturer and reference:	Caradon Terrain Limited Soil System 100. Size(s): 110mm diameter. Colour: Black.
Accessories:	bends, branches, access points, automatic air admittance valves, waste bosses, drain connectors and WC connectors, reducers.
Method of fixing:	Caradon Terrain Limited Holderbat at 1800mm centres vertically and 900mm centres horizontally.



9.2.3	9.2.3 Plastics Pipework for Waste Pipes (NBS 120)						
	Pipes, fittings and accessories:	PVC-U to BS 4514, kitemark certified.					
	Manufacturer and reference:	Caradon Terrain Limited Waste System 200.Size(s): 50 40 and 32mm diameter.					
	Colour:	White, to be confirmed.					
	Accessories:	bends, tees, automatic air admittance valves. Traps shall be anti- syphon with 75mm seal.					
	Method of fixing:	Caradon Terrain Limited pipe fixing clip at 1200mm centres vertically and 500mm centres horizontally.					
9.2.4	Plastics Pipework for Overflow Pipes (NBS 130)						
	Pipes, fittings and accessories:	PVC-U to BS 4514, kitemark certified.					
	Manufacturer and reference:	Caradon Terrain Limited Overflow System 500. Size(s): 19mm diameter.					
	Colour: White, to be confirmed.	Accessories: bends, tees, connectors.					
	Method of fixing:	Caradon Terrain Limited pipe fixing clip at 1200mm centres vertically and 500mm centres horizontally.					
9.2.5	9.2.5 Fire Protection Collars (NBS 200)						
	Manufacturer and reference:	Caradon Terrain Limited Firebrake 3.					
	Sizes:	110mm Reference 1725.4 50mm Reference 1725.2					
	Installation:	Shall be built into masonry walls strictly in accordance with the manufacturer's recommendations.					
9.2.6	9.2.6 Floor Drain to Plant Room F	Floor (NBS 250)					
	Floor construction:	Suspended concrete floor.					
	Manufacturer and reference:	Aco Fulbora Classic floor drain. Body type/material: Powder coated aluminium reference 3FFD Grating/Cover type/material: aluminium reference GSF.					
	Outlet:	Type and direction to suit pipework with adaptors and connections recommended for the purpose by drain manufacturer.					
9-3	Installation						

- 9.3.1 Performance Criteria (NBS 510)
- 9.3.2 Above ground foul drainage pipework has been designed to BS 5572.



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- 9.3.3 Install pipework, fittings and accessories to ensure that:
 - 9.3.3.1 Appliances drain quickly, quietly and completely at all times without nuisance or risk to health. Discharge is conveyed without crossflow, backfall, leakage or blockage.
 - 9.3.3.2 Air from the drainage system does not enter the building.
 - 9.3.3.3 Pressure fluctuations in pipework do not vary by more than 38mm water gauge and traps retain a water seal of not less than 25mm.
 - 9.3.3.4 The system can be adequately tested, cleaned and maintained.
- 9.3.4 Installation Generally (NBS 520)
 - 9.3.4.1 Install pipes, fittings and accessories in accordance with BS 8000: Part 13, Section 3 and BS 5572.
 - 9.3.4.2 Obtain all components for each type of pipework from the same manufacture unless specified otherwise.
 - 9.3.4.3 Form junctions using fittings intended for the purpose.

Fix pipes at centres not greater than those specified in BS 8000: Part 13.

- 9.3.4.4 Provide additional supports as necessary at junctions and changes in direction. Fix every length of soil vent pipe at or close below socket collar.
- 9.3.4.5 Where not specified otherwise use plated, sherardised, galvanised or nonferrous fastenings, suitable for the purpose and background and compatible with the material being fixed or fixed to.
- 9.3.5 Pipe Routes (NBS 540)
 - 9.3.5.1 To be the shortest practical, with as few bends as possible and no bends in wet portion of soil stacks, unless specified otherwise. Pipe routes not shown on drawings to be approved before commencing work.
- 9.3.6 Connect Plastics Pipework (NBS 640)
 - 9.3.6.1 To pipework of other materials using approved connectors and methods in accordance with plastics pipework manufacturer's recommendations, to form a watertight joint.
- 9.3.7 Electrical Continuity (NBS 710)
 - 9.3.7.1 Use clips supplied for the purpose by pipework manufacturer to ensure electrical continuity at all joints in metal pipes with flexible couplings and which are to be earth bonded.
 - 9.3.7.2 Identification of Internal Foul Drainage Pipework (NBS 730)



9.3.7.3 To BS1710 using self - adhesive bands or identification clips located at junctions, at both side of each slab, bulkhead and wall penetration, and elsewhere as directed.

9.4 Testing and Commissioning

- 9.4.1 General (NBS 810)
 - 9.4.1.2 Inform the Engineer sufficiently in advance to give him a reasonable opportunity to observe tests. Check that all sections of installation are securely fixed and free from obstruction and debris.
 - 9.4.1.3 Ensure that all traps are filled with clean water.
 - 9.4.1.4 Carry out tests as specified. After testing, locate and remedy all defects without delay and retest as instructed. Do not use smoke to trace leaks.
 - 9.4.1.5 Keep a record of all tests and provide a copy of each to Engineer.
- 9.4.2 Pipework Test (NBS 820)
 - 9.4.2.1 Temporarily seal open ends of pipework with plugs.
 - 9.4.2.2 Connect a 'U' tube water gauge and air pump to the pipework via plug or through the trap of an appliance.
 - 9.4.2.3 Pump air into pipework until gauge registers 38mm.
 - 9.4.2.4 Allow a period for temperature stabilisation, after which the pressure of 38mm is to be maintained without loss for not less than 3 minutes.
- 9.4.3 Siphonage and Back Pressure Tests (NBS 830)
 - 9.4.3.1 Test WC pans by flushing and test other appliances by filling to overflow level, then removing the plug.
 - 9.4.3.2 Carry out tests at least 3 times with traps recharged before each test.
 - 9.4.3.3 Test each appliance individually for self-siphonage, then test for induced siphonage and back pressure by discharging the following numbers of appliances simultaneously on each stack:
 - WCs: 2
 - Washbasins:2

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Mechanical Services Specification



SECTION C – STANDARD SPECIFICATION

PART 10 SPRINKLERS

NOT USED