Section M2

Mechanical Engineering and Plumbing Services

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M2.01 Foreword

Introduction

This Specification has been prepared to describe the mechanical engineering works at **49-59 Old Street, Islington EC1V 9HX** in the London Borough of Islington. It is proposed to be an office building with several business units.

49-59 Old Street consists of one existing multi-storey building within a 7 storey block. It has two commercial units at ground floor level and the business units will be 2 per floor for the 6 floors above.

This specification is prepared to assist the Contractor in the mechanical engineering services replacement to provide air conditioning, hot and cold water, Ventilation and soil and waste plumbing and associated works for the building.

This particular section of the specification shall be read in conjunction with the Section M1 relating to Standards and Technical requirements. Where the two sections describe the same or similar subject but have different specific requirements the Particular section shall take precedence, but the matter shall be brought to the Services Consultant's attention

This document must be read in conjunction with the electrical services specification provided by Rosiek Electrical, the Architectural package and the main contract documents from Islington Council.

M2.02 Hours of Work

The hours of work shall be between 8.00am and 5.00pm Monday to Friday. Out of hours/Overtime working shall only be allowed with written authority from the Contract Administrator, and shall not be paid additional to the contract.

M2.03 Asbestos

A type 3 Asbestos survey has been arranged. The contractor shall ensure that he obtains a copy of the report before commencing work, but for the purposes of this tender he should assume that asbestos based materials could be present in parts of the existing mechanical services installation and building fabric.

The Contractor should proceed with caution when dealing with existing gas and water services etc.

M2.04 Removal and Disposal of Existing Plant and Materials

The Contractor shall make good any damage to the existing structure, as a result of the works described under this contract.

Provisional Sums

The Tender sum shall include the provisional sums shown in the Summary of Tender, which can be expended in whole or in part by the Contract Administrator.

Drawings

The works shall be generally as shown on the drawings to be attached to the contract documents.

The air conditioning equipment, pipe work, controls etc. shall be generally as shown on the AC layout drawings. All Public Health hot and cold water services are shown on their respective layout drawings.

The Contractor shall provide one set of 'working drawings' and wiring diagrams for the approval of the Contract Administrator prior to starting work on site and one set of 'as fitted' drawings on completion of the works.

Access and Occupation

During the Contract period The Contractor shall comply with the security arrangements of the building and site.

All entry points to and into the site shall be supervised and secured throughout the Contract.

Access to the areas affecting adjacent buildings is strictly forbidden unless approved by the Contract Administrator.

Note: No delays/costs to contract will be considered in respect to failure to comply with the above.

The Contractor is to ensure that sufficient time is allocated within the main programme for all requirements of these specifications/drawings to be met.

M2.05 Stripping out

The Contractor shall remove and dispose of all existing redundant heating and water pipelines, equipment and water heaters including thermal insulation, brackets and supports in the buildings to be demolished and altered in the Lower and Upper floors of the office. Before removing any service the Contractor shall identify where the buildings are fed from and to shut-off and disconnect at the connection to the existing live service. It should be noted that the ground floor commercial units may be connected to the existing heating and cold water systems which are supplied from a central boiler house district heating system.

The Contractor shall ensure that when a cold water pipeline is disconnected no dead leg length of cold water pipeline remains on the live service in order to prevent unused water becoming stagnant. The Contractor shall show the Contractor Administrator and Premises Manager where the point of disconnection is to be made. The Contractor shall include to sterilise any existing live services.

Material

The installation materials and equipment shall be as specified. Where the installation materials and equipment are unspecified, these are at the discretion of The Contractor but must conform to the appropriate British Standard Specification where applicable. Where the tenderer is unable to obtain prices for the uniquely specified plant and equipment within the quotation offer period, this shall be brought to the attention of the Contract Administrator at the time of the quotation submission and equal alternative equipment shall be scheduled if available. No provisional sums, contingency or daywork allowances shall be included within the quotation offer except those detailed within the Specification.

M2.06 Plant and Equipment

The contractor shall ensure that plant, equipment and services have sufficient space to allow them to be easily and efficiently accessed for maintenance.

Routing of Services

The Contractor shall prepare detailed and coordinated working drawings, which shall be prepared with due regard to other building, structural and constructional details and existing elements. These drawings shall be submitted to the Contract Administrator for comment and approval. These drawings shall be amended during the progress of the works, in line with all revisions made to the project.

Responsibility and Cognisance

Responsibility and cognisance of all factors relevant to the carrying out of these works rests with The Contractor and no additional costs shall be permitted if due to The Contractor's failure to carry out pre-quotation surveys. This can be arranged with the Contract Administrator.

The Contractor must ensure that constant reference is made to the latest drawings before work is installed in each area.

No claim for extra payment will be accepted in respect to failure to comply with the above.

M2.07 Health and Safety

All Works and operations on site are to strictly comply with the requirements and rules relating to safety, health and welfare. The Contractor shall comply with CDM regulations.

Permit to Work and/or hot works permit and procedures shall be exercised where this would provide additional safeguards in achieving the highest levels of safety for all personnel during the progress of the Works.

M2.08 Standard of Work

The works under Contract shall be installed to a high standard and will require particular attention by The Contractor to co-ordinate the services.

The Consultant Engineer's drawings are issued for **design intent purposes** only and may not show all components required. The Contractor is to allow within the Tender the costs for all elements necessary to provide complete installations.

The Contractor shall ensure that all equipment is installed in accordance with the requirements of the manufacturers.

Not later than one week before commencement of installation works, the Contractor shall submit for comment two copies of fully co-ordinated working drawings of all services to the Contract Administrator. Comments by the Contract Administrator shall be incorporated prior to installation work commencing.

The Contractor is to co-ordinate the mechanical engineering work with the other services and is to ensure sufficient distances are allowed for lagging thickness to be maintained with access to valves, etc.

The Contractor is to allow for liaison with the local authorities where appropriate on all aspects necessary during the course of the works.

The Contractor shall be responsible for the making good of any areas damaged within the building or on site as a result of site traffic or the spillage of substances by the Contractor.

To gain access to the site for pre-tender assessment Prior arrangement must be made with the London Borough of Islington to visit site. Contact details.

Fiona Monkman
Principal Architect
Architects Group 3
Islington Council, Northway House,
257-258 Upper Street
London, N1 1RU.
Tel: 020 7527 2398
Mobile: 07905 106 354
Alternative contact: Paul Tobin 020 7527 2440

Nuisance noise will not be permitted except when approved by the Contract Administrator. Failure to comply with this requirement will result in the noisy work being stopped immediately.

M2.09 Scope of Works

The work covers the provision and installation of mechanical building services including soil and waste together with associated pipe work and fittings at 49-59 Old Street, Islington.

- **Office block** – The existing district heating system is to be removed and suitably plugged off as necessary.

- All existing hot and cold water systems including cold water storage tanks are to be removed and replaced with a new boosted cold water buffer tank, booster pump set and instantaneous electric hot water heaters and distribution services.

- Air conditioning units are to be installed in each business unit and will be capable of heating or cooling. Fresh air will be provided with a heat/cooling recovery unit.

- All existing soil and waste systems that are not retained are to be removed and replaced with new waste water pipework to serve the new sanitary ware fittings.

- **Ground floor retail units –** The existing services within the two ground floor retail units are to be retained.

Note:- The Contractor shall allow to strip out and remove from site all redundant mechanical items comprising of radiators, pipelines, water heaters, accessories, soil and waste pipelines etc. that are made redundant by these works. For tendering purposes, the Contractor shall assume none of the aforementioned will be re-used.

M2.10 Removal and Disposal of Existing Plant and Materials

The Contractor shall isolate, make safe, disconnect, and drain down as described hereafter. Notwithstanding the above, the Contractor shall remove from site all redundant services.

The Contractor shall provide a lockable skip for waste/scrap materials.

All disconnection and removal works shall be carried out in a controlled and orderly manner. Services once disconnected and taken down shall be removed from site or moved to an agreed area.

Protection of Existing Building

The Contractor shall take due care of the existing structure to ensure that repair and making good to the building fabric, as a result of services removal, is kept to an absolute minimum. The Contractor shall protect existing floor and wall finishes from damage.

The Contractor shall make good any damage to the existing structure, furniture and fittings as a result of the works described under this contract.

Where services are specified for only partial removal and where local means of isolation are not available or operational, the Contractor shall make all due allowances in his tender for the provision of all additional isolating valves etc.

Testing and Commissioning

The Contractor shall supply and install, test and commission, to the complete satisfaction of the Employer all of the mechanical engineering services and associated works in accordance with the following references, criteria in this Specification and design drawings. The services shall be complete with all connections.

The Contractor shall co-ordinate the mechanical engineering services installation with all other engineering services in order to avoid clashes and subsequent delays.

The work shall generally comprise of, but not be limited to, the following:

Building Services

- Supply and install a new cold water booster pump set and buffer tank..
- Install new instantaneous hot water heaters in the offices and toilets.
- New ventilation to the kitchen and bathroom areas.
- Install air conditioning systems and controls to the office units.
- Thermal Insulation of pipes
- Electrical power to plant and control installations.
- Above ground soil and waste plumbing systems
- Testing, commissioning and demonstration of all the new engineering systems.
- As-fitted drawings, Operating and Maintenance Manuals.

General

The mechanical engineering services installation shall be installed and commissioned in accordance with the following standards and outline description, and in accordance with relevant information stated in this specification and/or indicated on the drawings. The installations shall be fully co-ordinated with all other trades and carried out in accordance with agreed detailed working drawings.

As well as the Regulations and Codes of Practice referred to in this Specification, the hot and cold water, drainage, soil and waste installations shall comply with the following additional requirements:

Standards

- The Building Regulations, Parts
  - F : Ventilation
  - H : Drainage and waste disposal
  - L : Combustion appliances and fuel storage system
  - L : Conservation of fuel power
  - M : Access and use of building
- Water Supply (Water Fittings) Regulations 1999 and Local Water Authorities By-Laws
- All The CIBSE Guides and commissioning code
- All relevant current British Standards with Particular reference to BS EN 806, Part 1 - 5: Specification for the design, installation, testing and maintenance of the service supplying water for Human consumption. BS EN 12056 Part 2 (Sanitary plumbing)
- HSE Guidelines and Construction (Design and Management) Regulation 2015
- BSRIA Hand over O&M Manuals and project feedback BG1\ 2007 Building Services
- HS(G) 70 and associated Code of Practice
- Model Water Bye Laws (as appropriate)
- National Health Service (NHS) Estate, Health Guidance Note ‘Safe Hot Water and Surface Temperatures’
- Local Authority Bylaws

- Health and Safety at Work Act
- Electricity Supply Regulations 1988
- Electricity work Regulations 1989
- Statutory Authorities/Undertakers By-Laws, regulations and Recommendations
- IEE Regulations 17th Edition including all the latest amendments (BS7671)
- Offices Act
- Environmental and Public Health Approvals
- The Electricity at Work Regulations 1989
- All current Technical Memoranda particular reference to TM53: Refurbishment of non-domestic buildings
- CIBSE Energy Codes
- CDM Regulations
- COSHH Regulations
- L8 – The prevention of control legionellosis
- Relevant EN (ECC)
- The latest editions of all the standards shall be used.

All drawings and specifications are to be in accordance with the relevant Local Authority and Water Authority requirements before any installation is commenced. Due notice is to be given to the Authorities before any work is commenced on site, by the Building Contractor or Services Sub-Contractors.

Environmental Criteria

Internal Room Temperatures

Generally except as follows:	23ºC
Toilets	19ºC
Lobbies	19ºC
Corridors	19ºC
Office	23ºC

M2.11 Hot and Cold Water Pressures at Outlets

Wash hand basin:	Maximum 1 bar gauge
WC:	Maximum 1 bar gauge
Sinks:	Maximum 1 bar gauge

All taps (apart from those to cleaners sinks and in the Kitchen) shall have a flow restrictor fitted to reduce the flow to a maximum of 4 litres per minute. If the tap selected by the Architect will not accept or include a restrictor, a flow regulating valve shall be installed in the supply pipe to each tap.

M2.12 Hot Water Temperatures

Storage temp:	60ºC
Flow in pipelines:	60ºC

Any thermostatic blending taps shall be set to the following temperatures.

Hand Basin	41ºC
Kitchen Sink	48ºC
Cleaners Sink	60ºC
Shower	41ºC
Bidet	38ºC

Full hot water temperature draw off outlets shall be provided with warning labels which read **Very Hot Water** to be secured above the tap.

M2.13 Design Intent

The Design Intent is to give an insight for the Contractor into the systems and installations proposed to be installed within the scope of these works, the Contractor is responsible to fully complete and leave all of these systems, plant and equipment in good working order at handover to the Client.

Heating

The following description of the systems is to assist the Contractor in understanding the design intent.

Each business unit will have fan coil units capable of providing heating and cooling in addition to fresh air.

To provide temperature control in rooms and spaces each fan coil will be fitted with controls to allow either heating or cooling.

M2.14 Mechanical Extract Ventilation

Toilets and Vent Systems

Decentralised Mechanical extract ventilation systems to be provide in each toilet cubicle will be provided with extract ventilation via re-arranged/extended ductwork to the out side wall. The extracted air will be discharged to atmosphere outside the building, none will be re-circulated. Toilet extracts ventilation system that will run when activated by a local occupancy sensor.

Kitchen area *Vent Systems*

Decentralised Mechanical extract ventilation systems to be provide in each kitchen/ tea area will be provided with extract ventilation via re-arranged/extended ductwork to the out side wall. The extracted air will be discharged to atmosphere outside the building, none will be re-circulated.

M2.15 Installations Generally

The contractor shall ensure that plant, equipment and services have sufficient space to allow them to be easily and efficiently accessed for maintenance.

The Contractor shall ensure that all materials and equipment provided/installed are compatible and suitable for the particular application and system test and operational temperatures and pressures.

All plant and equipment shall be exposed to view. All equipment locations will be subject to the approval of the Contract Administrator.

Provide unions, isolating valves, water flow measuring devices and double regulating valves to all items of equipment, pipe circuits and sub circuits for maintenance, balancing and commissioning purposes. Provide drain cocks at all low points. Provide automatic air vents at all high points on the heating systems. All valves and unions shall be in accessible positions and any ducts/boxing in shall be provided with screwed access panels.

All pipework and ductwork not used as a heating surface, including hot and cold water services and main water pipework, boilers, tanks etc shall be thermally insulated and in the case of cold water pipelines also vapour sealed.

No pipework shall be installed in the floor/screed without the prior written consent of the Contract Administrator. Under no circumstances will joints be permitted in the screed/cast into concrete floors. Buried pipework will only be permitted in purpose made ducts cast into the structural slab/floor. Any such ducts will be provided with removal covers to allow maintenance, repair or replacement of the entire pipework distribution system, joints and valves. No ducts shall be installed in the slab/floor without the prior written consent of the Contract Administrator. The design and routes of any such ducts shall be submitted to the Contract Administrator for approval before instruction.

The Contractor shall ensure that the mechanical services systems do not cause or generate nuisance noise or vibration which would be a nuisance to staff or pupils and shall design out or provide any noise and vibration suppressing/isolating equipment necessary for the quiet operation of the mechanical services systems.

The Contractor shall note that there is a limit to what weight can be supported from the building structure. The Contractor shall therefore include for additional secondary support steelwork to support pipelines and equipment at high level in the Plant Rooms independent from the structure and supported/fixed at floor level only. It is possible that the secondary steel can be braced laterally from the building but this must not cause cracking or deflection of any part of the building. The Contractor shall submit detail drawings to the Contract Administrator for approval. The drawings shall be accompanied by weights and forced imposed on the structure. The Contractor shall also include for any additional secondary steelwork for pipelines where the centres of the steel structure are too wide apart to meet the requirements of support centres for the pipes in this specification.

M2.16 Comfort Cooling and Heating System

The Contractor is to design, and with the assistance of a specialist subcontractor, install, test and commission, a variable refrigerant volume heat pump system with heat recovery ventilation, serving the twelve business units as manufactured by Daikin or equal and approved generally as indicated on the drawings

The system should be supplied and installed by one of the manufacturers recommended dealer/installers in order to benefit from an extended 5 year warranty period.

The design, construction and installation of the VRV systems system shall be in accordance with BSEN 4434 378 Parts 1 to 4 - Safety & Environmental Aspects in the Design, Construction & Installation of Refrigerating Appliances and Systems.

The systems will comprise 4 VRV condensing units, 48 ducted fan coils, 12 heat recovery air handling units, duct mounted electric heaters, refrigeration pipework, condensate drains, controls and all other ancillary items required to achieve the design intent.

The system will be exposed to view from those working in the office zones. It is therefore essential that the layout of fan coil units, heat recovery ventilation unit, ductwork, pipework and cables is regular, logical and neatly installed.

M2.16.1 Comfort Cooling and Heating System

Each business unit will be served by four ducted type fan coils connected, via an attenuator to a double deflection grille with manual opposed blade damper.

The units shall be constructed from galvanised sheet steel. All external surfaces shall be thermally and acoustically insulated and vapour sealed with a material conforming to Class 0 Fire Specification. The units shall incorporate centrifugal fans with 2 or 3 speed direct drive motors, sealed and lubricated for life, the whole assembly being statically and dynamically balanced. The motors shall be of the totally enclosed permanent split capacitor type with thermal safety cut-out. The heat exchanger coils shall be manufactured from solid drawn copper Hi-X tubes bonded by expansion to preformed collars on continuous plate aluminium waffle louvre fins. All tubes shall be brazed into copper headers and fully tested at works. The exchangers shall be fitted with flared liquid and suction connections, complete with flare nuts. The units shall incorporate one piece insulated drain trays. The drain connection shall be of suitable size and connected into a gravity condensate system connecting to a suitable drain point within the core areas.

The fan coil units shall be complete with all necessary controls including return air and refrigerant temperature sensors and electronic expansion valves thus giving individual refrigerant flow. PID control shall be utilised to maintain the room air temperature at the control point i.e. the wall mounted remote sensor position, to within +/- 1□C of the set point temperature.

The units shall be suitable for a power supply of 230 V/1phase/50Hz. Fused spurs shall be provided external to the units. The units shall be fused at the appropriate rating.

Each indoor unit shall be fitted with a discharge spigot and suitably sized attenuator to suit the acoustic requirements of the project. Air shall be discharged into the space through a double deflection grille complete with an opposed blade volume control damper supplied by Gilberts Ltd of Blackpool, or equal and approved.

The contractor shall size the diffusers and demonstrate that the throw of diffusers will provide room air velocity within CIBSE recommended band.

M2.16.2 VRV Outdoor Units

Four VRV out door units shall be provided, each connected to 12 indoor fan coils spread across three floors.

The units shall be located on the roof on a suitably designed steelwork frame such as a Big Foot system or other base in a location to be agreed with the CA. The Contractor shall provide all necessary supporting steelwork for the plant and equipment installations as part of the works. The units shall be mounted on suitable acoustic material to prevent noise or vibration transfer

Each VRV Outdoor Unit shall serve three of the business units via a single set of refrigerant pipework.

The outdoor units shall be completely weather proofed to corrosion resistant type E1, factory assembled, pre-wired and complete with all necessary electronic and refrigerant controls for easy installation. The outdoor units shall have inverter driven compressor(s) electronically controlled and capable of changing the speed linearly to follow the variations in the load.

The electrical subcontractor shall provide a 40A weatherproof isolator adjacent or fixed to each unit.

The units shall be complete with electronic expansion valves, oil separators, crankcase heaters, suction and liquid shut off valves, filter/driers, liquid receivers and accumulators. The units shall be complete with safety devices including high pressure switch, fuse, crank case heaters, thermal protectors for compressor and fan motors, over current protector for inverter and compressor motors and recycling timers. Oil return shall be controlled electronically to ensure correct operation even with continuous low load operation.

All condensing heat exchanger(s) shall be manufactured from HI-X seamless copper tube bonded to aluminium fins treated with high corrosion resistant type E1 Acrylic resin-1 micron.

The fans shall be of the direct drive propeller type manufactured from aluminium waffle louvre fins.

The fan motors shall be totally enclosed and incorporate a thermal safety fuse. The outlets shall be plastic coated wire guards. The unit casing shall be manufactured from polyester powder coated galvanised sheet steel. The colour shall be to the manufacturer's standard colour.

The outdoor fan motors shall have multi speed operation to maintain constant head pressure control in all ambient conditions and modes of operation.

Refrigeration pipework shall be installed between the indoor fan coils and out door condensing units to the manufacturers specification and requirements and, out side of the risers shall be run on suitably sized cable tray.

M2.16.3 Heat Recovery Units

The contractor shall supply, install and commission a heat recovery air handling within each business unit as per the schedule of equipment and the drawings. This unit shall be manufactured by the VRV equipment manufacturer and be integrated seamlessly into the control system.

The heat recover units shall be seized to achieve the desired air flow rate at low fan speed.

Each heat recovery unit shall be fitted with the manufacturers optional duct mounted electric heater model VH3B.

The contractor shall supply and install suitable weather louvres and plenum boxes in the external wall in a location agreed to which the HRV unit will be connected using insulated rigid ductwork. The fresh air supply shall be ducted to the rear of the fan coils as outlined on the tender drawings, via a discharge attenuator. The air discharges into the VRV fan coils shall be complete with volume control dampers. The extract from the space will be via a bell mouth and suitable attenuator. No flexible ductwork shall be used.

M2.17 Comfort Cooling and Heating System Controls

The following controls are required:-

Each business unit shall be provided with a branch selector refrigerant control device as shown on the drawings to enable each fan coil to provide heating or cooling independent of the mode of operation of the others. The refrigerant control device should contain spare, unused connections so that future tenant subdivision of the areas can be accommodated.

Each fan coil shall be fitted with a suitably located remote temperature sensor and a separate remote controller. The locations of to be agreed.

Each heat recovery ventilation unit shall be complete with a remote controller in a location to be agreed. The external louvre shall be powder coated to a colour to be agreed.

The duct mounted electric heater shall be complete with controls that integrate with the heat recovery unit.

iTouch Manager central controller, model DCM601A51 shall be installed, and this shall be complete with the PPD Software, DCM002A51 that enables energy use by the condensing units to be proportioned to each fan coil or business unit as required. In order to achieve this, the supply to the VRV condensing unit distribution board in the roof plant room will need to be metered and suitable cabling installed between the two. A fixed IP address broadband connection shall be provided to this controller.

This controller will be located in the basement server/comms room.

The testing and commissioning of the central control system and metering shall be undertaken by a specialist subcontractor such as Intelligent Air Conditioning of Woking Surrey (Contact Sibat Butt 01483 487215)

M2.17.1 Control Wiring

The installation Engineers shall be responsible for the inter-connecting control wiring between the indoor and outdoor units and the control wiring between remote controllers, centralised control and all other relevant components. This work shall be co-ordinated with the main Electrical Contractor with regard to the and spacing routing of both cables and cable support system in order to avoid any EMF effects.

All control wiring shall be carried out in 2 core 0.5mm2 - 1.5mm2 PVC non-screened CY flexible control cabling to BS6141 and BS6500 (To comply with CE Regulations 1995).

The cable shall be colour coded at 3 metre intervals for ease of identification and maintenance.

M2.18 Refrigeration Pipework

Supply, install, test and commission all interconnecting refrigeration pipework between the outdoor unit and the connected indoor units.

The pipework installation, charging, testing and commissioning shall be carried out by REFCOM registered refrigeration engineers, who shall be fully trained in the safe handling of refrigerants and CITB trained in brazing techniques.

The installation shall be fully in accordance with British Standard BS EN378: 2000 Parts 2-3 and Daikin's design and installation instructions Si39-303.

All pipework installations shall be carried out in refrigerant quality soft or half hard drawn copper tubing to BS2871 Part 2: 1972 and complete with the appropriate refnet headers and refnet joints (as manufactured by Daikin).

The pipework shall be selected to ensure that the SWG of the pipe is suitable for the system pressures of a R410A system in accordance with BS1306.

Longest possible lengths of copper pipe shall be utilised to minimise joints on site, appropriate refrigeration installation tools must be utilised to avoid the use of elbows. Oxygen free dry nitrogen purging must be utilised during brazing.

Where pipes are jointed or attach to equipment utilising flare fittings, the pipes shall be tightened to the correct tension by use of a torque wrench all in accordance with BSEN378:2000.

Pipework is to be properly and tidily fixed and supported in accordance with BSEN378:2000 Parts 1-4. Where required it should be run on galvanised trays.

All pipework shall be identified along its length at 3 metre intervals.

Pipe supports shall not restrict expansion or contraction of the pipe and restraint must not be applied to refnet joints or headers.

All pipework (suction, liquid and discharge) shall be insulated with slip on close cell elastomeric pipe insulation fire rated to Class "O" Building Regulations 1985, with a wall thickness of not less than 13mm. Insulation shall be protected when exposed to atmosphere by use of special paint or an enclosure.

All insulation joints, shall after pressure and leak testing, be properly glued and or taped as to provide a complete seal to prevent any condensation.

After installation of pipework, but prior to connection to the condensing units, sealing of insulation joints and starting of equipment, the pipework shall be pressure tested, in stages, using oxygen free dry nitrogen to 38 bar (550 psi), held for 24 hours and checked for leaks.

The pipework shall then be connected to the condensing units and the system shall be vacuumed/dehydrated to (-752mmHg) and held at that setting for 1 hour (minimum) to 4 hours depending on pipe length.

All of the above works shall be carried out before electrical connection is made to the fan coil units.

The additional refrigerant (HFC410A) charge must be calculated and weighed into the system to accommodate the actual installed and measured length of pipework all in accordance to Daikin recommendations and instructions Si39-303.

The charging should be carried out with an appropriate charging station.

M2.19 Comfort Cooling and Heating System Installation

The air-conditioning equipment, associated controls and control panel shall be supplied and delivered to site.

A manufacturer approved installation contractor shall carry out the installation of the air conditioning equipment, refrigeration pipework and commissioning in order that the client may benefit from the manufacturers extended warranty period of 5 years.

Should it be deemed necessary or requested, full access should be afforded to site during the installation stage of the project to the supplier to allow them to verify that installation methods comply and are fully in accordance with their requirements in order that the equipment warranties will be valid.

Both the specialist refrigeration installers and the supplier shall carry out witnessing of the commissioning of the refrigerant system, and final inspection.

M2.20 Hot and Cold Water Distribution

The contractor shall be responsible for the safe isolation, draining, dismantling and removal of all existing plant and services.
The existing cold water boost set and associated cold water storage tank will be drained and fully dismantled before being removed from the basement plantroom.

The existing incoming mains cold water service will be isolated at the existing stop valve at the base of the riser in the basement plant room and capped to protect it during the period of new works.

The existing rising cold water main will be removed in total from the existing riser all the way from the basement plant room through the entire building to the roof plantroom.

The existing hws cylinders and high level storage tanks in both bathrooms at each floor level will be isolated, drained, disconnected and removed in total.

All hot and cold water distribution pipework serving the bathrooms at each floor level will be removed in total.

The existing, sectional cold water storage tank in the roof tank room shall be carefully dismantled and removed from site in total.

A new cold water booster set shall be supplied, delivered and installed within the basement plant room. The cold water boost set shall be installed on a level base as per the manufacturer's instructions and adjacent to a new cold water storage break tank supplied complete with a purpose built stand in order to provide positive flooding to the inlet of the booster set.

The cold water boost set shall be;

Model; AMV3-F-E-6-6
Duty: 4.39 l/s @ 360 kPa
Electrical Supply: 415v/3ph/50hz
Power: 2.20 kW
Dry Weight; 236 kG
Complete with: BMS Interface

The cold water storage tank shall be;
Model: APT910-1 – One Piece
Insulation: Standard 25mm GRP Bonded with a U Value of 0.83 w/m2
Complete with: High & Low Water Level Alarm & Delayed Action Ball Valve.

The cold water boost set and the cold water storage tank shall be suitable for use with potable water supplies as defined in BS EN 806 parts 1 to 3 and the Water regulation bylaws.

The cold water boost set and cold water storage tank and stand shall be as manufactured by;

AquaTech Pressmain Ltd
AGM House
London Road
Copford
Colchester
CO6 1GT

The existing mains cold water supply shall be modified to connect to a new delayed action ball valve within the cold water buffer tank complete with a new stop valve.

The cold water storage tank shall be fitted with a warning pipe and an overflow pipe in accordance with BS EN 806 parts 1 to 3 and the Water Regulation Bylaws. The warning pipe and overflow pipe shall be taken to terminate adjacent to the floor gully within the basement plantroom.

A new boosted cold water supply shall be extended from the cold water boost set within the services riser.

All new boosted cold water supplies shall be installed in copper tube with either soldered or crimped fittings as appropriate. All copper tube shall be in accordance with BS EN 1057:2006+A1:2010 and all copper fittings in accordance with BS EN 1254-3:1998.

A branch shall be extended from the new rising boosted cold water main to serve the appliances on each floor as shown on the drawings. Each primary branch from the rising boosted cold water main shall be fitted with a stop valve in accordance with the Water Regulations Bylaws.

All boosted cold water service connections to appliances shall be fitted with a suitable service valve as defined in BS EN 806 parts 1 to 3 and the Water Regulations Bylaws.

All boosted cold water supplies on each floor of the building shall be installed in copper tube using either soldered or crimped fittings as appropriate. All copper tube shall be in accordance with BS EN 1057:2006+A1:2010 and all copper fittings in accordance with BS EN 1254-3:1998.

All boosted cold water services pipework in concealed or unheated spaces shall be insulated in accordance with BS 5970:2012. All insulated pipework will be complete with service identification bands and direction of flow arrows.

All pipelines to be installed tested and sterilized in accordance with BS HSE L8, BS EN 806/2/2005, the water supply regulations and the leagionella proliferation control requirements of CIBSE TM 13.

The existing domestic services are to be removed and replaced with new to serve each of the new sanitary ware fitting, hot water heaters etc, via a distribution network of insulated copper pipework. Internal pipework shall be installed using copper tube to BS EN1057-1996-R250 and fittings with lead free solder ring joints to BS 864: Part 2.

Hot and cold water pipework distributed within the building shall be installed in a professional manner and shall be as unobtrusive as possible. Provision shall be made to drain the complete hot and cold water installation in each room.

Pipework comprising horizontally runouts shall be installed with the cold water pipeline lower than the DHW pipework.

The hot and cold water systems shall feed all fittings and appliances within the building.

Pipework shall be fully concealed throughout where practical.

A servicing isolating valve shall be provided on each hot and cold water supply to each outlet point, in a readily accessible location and an isolating valve on each range of fittings. Isolating valves shall be fitted on all branch pipelines from the main distribution mains.

M2.21 Hot and Cold Water Connection to Appliances and Sanitary Fittings

The Contractor shall be responsible for connecting all hot and cold water services to sanitary fittings and appliance (as supplied by others), with a quarter turn service valve (or other indicated valve). Final position of termination to appliances to be in accordance with the Contract Administrator's latest layout drawing identified by the Contract Administrator.

M2.22 Hot Water Heaters

Hot water services to all new wash hand basins, sink units and cleaners sinks shall be provided by the use of electric unvented water heaters.

The electric water heaters will be;

Model: Multipoint 10
Capacity: 10 litre
Duty: 3.0 kW
Electric Supply: 240v/1ph/50hz
Complete with: Pack U2 – Expansion Vessel, Pressure Relief Valve & Check Valve

The electric water heater and accessories shall be as manufactured by:

Heatrae Sadia Ltd
Hurricane Way
Norwich
Norfolk
NR6 3EA

All electric water heaters will be fitted in accordance with the manufacturer's instructions and by qualified personnel only.

The hot water service from the electric water heaters will connect to the relative wash hand basin, sink unit or cleaners sink via a thermostatic mixing valve. The thermostatic mixing valve shall be:

Model: Pack U3 TMV 3 standard

The thermostatic mixing valve shall be as manufactured by:
Heatrae Sadia Ltd
Hurricane Way
Norwich
Norfolk
NR6 3EA

Each of the electric water heaters will be provided with a safety discharge pipe in accordance with BS EN 806 parts 1 to 3 and the Water Regulations Bylaws. The temperature/pressure discharge pipe from each electric water heater and from the associated valve on the

incoming mains cold water supply will discharge into the safety discharge pipe through an approved tundish fitted adjacent to each water heater.

A safety discharge pipe from each water heater will connect to a rising safety discharge pipe located within the service riser. All safety discharge pipework will be installed in MuPVC pipework with solvent welded fittings and all resistant to water at 100oC. All MuPVC pipework shall be in accordance with BS EN 1328-1:2014.

All safety discharge pipework will be identified with clear labelling in the vicinity of all appliances and within the service riser.

All safety discharge pipework will be fitted with suitable 2 hour fire collars where it exits the service risers onto each floor and between each floor within the service riser.

The safety discharge riser will be terminated in the basement plantroom in the vicinity of the washdown gully.

An electric shower water heater will be provided to the new shower on the ground floor.

The electric shower heater will be;
Model: Multipoint Instantaneous
Duty: 7.0 kW
Electric Supply: 240v/1ph/50hz

Complete with: Heatrae Sadia Temperature & Pressure Relief Valve and Pressure Regulating Valve

The Multipoint Instantaneous water heater will be connected to the boosted cold water service through a pressure regulating valve. The hot water outlet will connect to the shower mixing valve.

A separate cold water supply will be taken to the shower mixing valve from the incoming supply to the shower water heater before the pressure regulating valve and with its own pressure regulating valve as shown on the drawings.

A safety discharge pipe will be taken from the Multipoint Instantaneous temperature/pressure relief valve to discharge into a tundish adjacent to the unit. The safety discharge branch terminating in the tundish will connect to a rising safety discharge pipe located within the service riser. All safety discharge pipework will be installed in MuPVC pipework with solvent welded fittings and all resistant to water at 100oC. All MuPVC pipework shall be in accordance with BS EN 1328-1:2014.

M2.23 Hot Water Scale Protection

The contractor shall supply and install on the incoming main cold feed pipework a Sentry Unit as supplied by Lifescience (tel 01608811707) suitable for 22 diameter pipework. Electrical supply 230V /1Ø/ 50Hz.

M2.24 Pipe Sleeves and Fire Stopping

As described in this Specification, each pipe passing through a masonry wall, partition and/or concrete slab shall be sleeved. All sleeves shall be of the same material as the pipe-line passing through it. Sleeves shall be sized to allow for required thermal insulation.

Exposed pipes passing through floors and/or walls shall be fitted with chrome plated mild steel plates.

Note: Pipes passing between areas of differing fire zones shall be fire stopped by filling the gap between the sleeve and pipe with fire stop material. The Contractor shall assume that each wall between room and a corridor and lobby is fire rated.

M2.25 Pipework and Fittings

Pipework and fittings shall be generally as specified and as detailed below.

All connections to plant and equipment shall be made with unions.

All exposed pipework shall be painted to match existing decorations.

a) Hot and Cold Water Service, and Mains Water

Generally, all new hot water service flow and mains water shall be Copper tube to BS EN 1057 assembled with 'Yorkshire Potable' (or equal and approved) capillary fittings to BS 864 with lead free solder.

NB The allowable sequence of metals is given in the Model Water Bylaws and must be adhered to.

M2.26 Run of Pipework

Pipework shall be generally as indicated on the drawings. The mechanical Contractor shall prepare working drawings for the approval of the CA prior to starting work.

Final connections to the boiler and all other normally removable components will be made with the appropriate flanges unions or compression fittings as applicable to facilitate servicing.

Generally un-insulated cold water services shall not be routed alongside heating or HWS pipework so as to avoid any heat transfer.

The pipework shall be neatly run on surface and graded to enable air to be discharged from the system, thus avoiding air-locks.

M2.27 Thermal Insulation

a. General

The Contractor shall supply and install thermal insulation to all heating, hot and cold water pipelines and ventilation ducts and shall install this in accordance with the provisions of

BS5422:1990. The bonded pre-formed mineral wool pipe sections are to be as BS 3958: Part 3: 1982. BS 1710 system and BS4800 colours

The contractor shall provide evidence which demonstrates that thermal insulation products used in the building have a low embodied impact relative to their thermal properties, determined by the Green Guide to Specification ratings.

The contractor will also provide evidence which demonstrates that thermal insulation products used in the building have been responsibly sourced.

All heating, hot and cold water pipelines and their valves shall be thermally insulated.

The Contractor or his specialist shall be deemed to be fully conversant with the manufacturer's recommendations on the use of the material and is to execute the installation in strict accordance with those recommendations.

Asbestos or asbestos products containing "Crocidolite", "Amosite" or any other product giving rise to "Asbestosis" shall not be used.

Where two pipes or more are run together, the covering shall not be blended. All flanges, unions, valves etc shall not be insulated except in boiler room and plant-room and on steam and condense pipelines.

Where insulation covering butts up to a valve or bracket, the insulation must be secured with end caps. Bands will not be accepted.

Insulation shall generally be foil covered with fixing bands and end caps.

Where exposed in the buildings it shall be covered with white isogenopac and painted to match existing decorations.

All insulated pipework shall be identified with colour coded bands in accordance with the recommendations of the CIBSE or relevant British Standard.

(i) Cold water and chilled water pipework (including valve bodies and flanges) run in ducts, chases, ceiling spaces and elsewhere to protect from freezing and to prevent shedding of condensation.

(ii) Fresh air ducts and supply ducts carrying cold or hot air to prevent condensation or excessive heat gains and losses.

Thermal insulation materials and their finishes shall be asbestos free. Where any work is carried out on existing thermal insulation material or finish which contains asbestos in any form, the Contractor's attention is drawn to his responsibilities under the provisions of the Asbestos Regulations 1969.

M2.28 Valve Chart

The Contractor shall produce, supply and fit on the wall a valve chart not less than A1 size. The chart is to comprise a schematic diagram of the hot and cold water systems showing all valves and their numbers to tie up with the labels placed on the valves. The chart shall incorporate a schedule of the valves giving reference number, size and purpose of each valve.

The chart shall be encapsulated in clear Perspex sheet and with an aluminium frame.

M2.29 Electrical Power

The Contractor shall supply, install and test all electrical power cabling as from the distribution board to the plant:

The Contractor shall supply and install an electricity service isolator for each item of Mechanical Plant and Equipment.

The standards of the electrical engineering installation works in the Electrical Specification shall apply to these works.

Cabling shall all be run installed inside metal conduit/trunking.

Power cables shall be separated from control and low voltage cabling.

The sheathing to all cables shall be low smoke and fume type.

M2.30 Electrical Controls

Testing and Commissioning

Test Certificates and tables of results for works tests and site tests etc. shall be submitted in duplicate to the Engineer for approval.

The Contractor shall include the cost of all tests, necessary instruments, plant, supervision and labour. The accuracy of the testing instruments shall be demonstrated where so directed by the Clients appointed Mechanical Engineer.

The site tests shall be witnessed by the Clients appointed Mechanical Engineer and any defects of workmanship, materials, performance, maladjustment or other irregularities which become apparent during the tests shall be rectified by the Contractor at his expense and the tests shall be repeated to the satisfaction of the Clients appointed Mechanical Engineer.

The Contractor's representative present on site shall be fully conversant with the operation of the installation and controls; otherwise representatives of the manufacturer's shall attend.

Fuel, water and electricity for site tests will be provided free of cost to the Contractor and where appropriate, each meter reading shall be taken and recorded at the start and finish of each test.

All tests shall be carried out as required and approved by the Clients appointed Mechanical Engineer before any insulation is applied.

The Contractor shall give seven days written notice of his intention to test and commission. Should any section of the works be tested without any notice having been given to the Clients appointed Mechanical Engineer, such tests shall be carried out again in his presence and if any work has been covered up, it shall be uncovered, all at the Contractor's expense.

All controls shall be calibrated and adjusted and particular attention shall be paid to the following:-

(a) Satisfactory operation of any automatic or manually operated sequences to be used in the event of fire.

(b) Safety in the event of failure or sudden resumption of electrical supply.

(c) Satisfactory operation of safety interlocks designed for the protection of personnel.

(d) Satisfactory operation of equipment protection devices.

(e) Satisfactory operation of all sequencing operations and alternative working selections and automatic or manual changeover of duplicate plant.

All commissioning shall be in accordance with the latest relevant CIBSE codes of practice.

Controls shall conform to the requirements of the Building Regulations. All electrical installations shall comply with the requirements of the 17th Edition IEE Regulations.

Control cables shall be screened to DEF standard 61-12 (Part 5). Each screen shall be earthed at the point only so as to avoid earth loops. They shall be stranded or flexible twin twisted pair screened Belden cable, or other equal and approved, run in unbroken lengths. The cable group shall be selected to ensure that the band rate can be achieved.

Cabling shall all be run installed inside metal conduit/trunking.

Control and low voltage cabling shall be separated from power cables.

The sheathing to all cables shall be low smoke and fume type.

Control cables run outside of buildings shall be installed in galvanised metal conduit of 20mm minimum size.

Conduit and accessories shall comply with BSS 31 and manufactured by a member of the BECSM. The conduit is to be galvanised heavy

gauge, seam welded, mild steel screwed jointing. Conduit is to be supported or saddled fixed to walls at 1 metre intervals. Where conduit spans unsupported a suitably sized mild steel beam shall be installed providing sufficient headroom to which the conduit is to be fixed.

All sensors shall be located in positions as agreed on site. All sensor positions shall be labelled on site.

The Contractor shall ensure that wiring diagrams of the Control Panel are sent to the Contract Administrator for approval prior to installation. The diagrams shall also include the power wiring in the control panel and show terminal connections for wiring outside of the Panel.

M2.31 Earth Bonding

The Contractor shall carry out all necessary earthing and bonding requirements which shall include:-

a) Cross-bonding of all incoming services
b) Bonding to all items of mechanical plant including steel and copper pipework, steel supporting frame works flues and ducts.

All metal sheaths and/or armouring of cables shall be bonded to the metal parts of equipment to which they are connected.

M2.32 Fire Requirements

The Contractor shall provide fire stopping, fire sealing, thermal insulation etc and all necessary items to ensure that the heating and ventilation systems are designed and installed in full compliance with the Fire Separation Plan and the specific requirements of the Building Control Officer.

Where fire and/or smoke protection of escape routes and protected areas is required, due allowance shall be made such that the engineering services do not compromise the integrity of the built form. Where fire rated ceilings, wall panels and enclosures are required, the engineering services shall be provided with full protection to maintain the integrity of the ceiling, wall panels or enclosures.

M2.33 Painting of Pipework

The Contractor shall include in the Tender for painting all new un-insulated pipework and brackets exposed to view. The pipes shall be thoroughly cleaned and painted one coat of undercoat and two coats of gloss paint as the installation proceeds. The gloss colour to match decorations.

M2.34 System Cleansing, Flushing and Treatment

1.0 Hot and Cold Water Systems

The entire hot and cold water supply systems shall be thoroughly disinfected to eliminate any possibility of bacteria forming.

Disinfection shall be carried out in accordance with BS EN 806-5:2012

Due to its nature, this process shall only be carried out during a period when the building is completely unoccupied. The Contractor shall obtain prior approval to proceed from the Contract Administrator before any disinfection process is

commenced. In addition The Contractor shall fix to every affected draw-off point a temporary label stating the following:

'No water to be drawn from this tap until further notice, disinfection in progress'

The Contractor shall carry out biological testing and certify that the system has been sterilized and the water is potable and is drinkable without harm.

The Contractor shall provide 48 hours notice to the Contract Administrator of his intention to carry out any of the above processes to enable him, to witness the cleansing and dosing operations.

1.1 Flushing

Every new water service, cistern, distributing pipe, hot water cylinder or other appliance and any extension or modification to such a service shall be sterilised, and any system that is not brought into service immediately after commissioning and it has not been flushed at regular intervals (up to 30 days depending on the characteristics of the water) it shall be disinfected before bringing into use.

1.2 Disinfection

The Contractor shall carry out sterilisation of all domestic water services.

Where new pipe services have been extended form the existing, the contractor shall include for the fitting of an injection point (s), 15mm hose union drain cock (s), and isolate service back to the nearest isolating valves and sterilise the branch complete.

Cisterns and cold water storage tanks shall be cleaned and chlorinated. Domestic hot and cold water pipework shall be thoroughly flushed to remove plumbing debris, solder etc. and chlorinated using chlorine in accordance with BSRIA guidelines.

To carry out system sterilisation, the Contractor shall employ the services of an independent specialist water treatment company.

During sterilisation, notices advising that the test is being carried out shall be attached to all outlet points.

On completion of sterilisation, certificates shall be provided and included with the Operation and Maintenance Instructions.

a) After flushing, systems shall be disinfected in accordance with the procedure below.

b) Where sterilising any pipe work under mains pressure or upstream of any back-flow prevention device, the mains water provider must be informed. Chemicals used for disinfection must be one of those listed by the Drinking Water Inspectorate.

c) Where water that has been used to disinfect an installation is discharged into a sewer, the authority responsible for that sewer shall be informed prior to discharge. Where this water is to be discharged into a water course or into a drain leading to the same, consent to discharge shall be obtained from the appropriate authority.

1.3 Safety

a) Systems, or parts of systems, shall not be used during the disinfection procedure and all outlets shall be marked with a suitable warning card.

b) To avoid the generation of toxic fumes, no other chemicals (such as toilet cleaners) shall be added to the water until the disinfection is complete.

c) All building users shall be informed of the disinfection before it takes place. This includes those users not normally in attendance during normal working hours i.e. cleaners and security guards.

1.4 Disinfection Procedure

a) The system shall be filled with chlorinated water at an initial concentration of 50mg/litre (ppm) for a contact period of 1 hour. If the free residual chlorine level at the end of the contact period is less than 30 mg/litre (ppm) the disinfection process shall be repeated.

b) Full contact shall be achieved by first dosing all pipework with a measured amount of sodium hypochlorite solution, and then isolating the incoming mains water supply to the building. This can then be drawn to all outlets, working progressively away from the incoming main. Once all outlets have the desires chemical concentration, the mains supply to the building can be re-opened, and the pipelines re-dosed to the correct concentration.

c) Mains water services shall be injected with a suitable low voltage chemical pump, proportional to water flow, to achieve the required dose rate. To achieve this a gate valve shall be installed on the incoming mains to the building.

d) After successful chlorination, the entire system shall be thoroughly flushed with clean water until the free residual chlorine level is at the level present in the drinking water supplied.

1.5 Post Disinfection sampling

After sterilisation treatment a sample of water from each of the systems shall be analysed by the Public Analyst and only when The Public Analyst has approved its use can the system be brought into service for the occupants. At least 4 weeks shall be allowed in the programme prior to practical completion for the water samples to be taken and analysed.

After flushing the samples for bacteriological analysis shall be taken and analysed, under the supervision of a microbiologist, who shall also determine the number and method of collection of samples.

Where a bacteriological analysis of the sample indicates that adequate disinfection has not been achieved, the installation shall be flushed, re-disinfected and further samples taken.

M2.35 Water Balancing

The Contractor shall include in the Tender all costs associated with employing the services of a Specialist Company to carry out the balancing of the Air Conditioning and ventilation systems including setting the required fan speeds. Upon completion of the balancing the Contractor shall supply copies of the balancing reports, giving settings and flow rates achieved, to the Contract Administrator for inclusion in the Operating and Maintenance Manuals. The Commissioning contractor shall supply two copies of the balancing report giving settings and flow rates for inclusion in the operating and maintenance manuals.

M2.36 Above Ground Soil and Waste Plumbing Systems

Soil and Waste General

The soil and waste installations shall be carried out in accordance with all Building Regulations and British Standards or Codes of Practice current at the time of installation together with:-

. 01 Factories Act 1961

. 02 Offices Shops and Railway Premises Act 1963

. 03 Food Hygiene (General) Regulations 1970

. 04 Home Office Regulations

. 05 Public Health Act 1936 and 1961

. 06 Health and Safety at Work Act 1974

. 07 The Building Act 1984

. 08 The Building Regulations 1985

. 09 The British Standard BS EN 12056-2:2000.

. 10 The British Standard BS EN 12056-3:2000.

M2.37 Soil and Waste Approvals

All drawings and specifications are to be in accordance with the relevant Local Authority Requirements before any installation is commenced. Due notice is to be given to the Authorities before any work is commenced on site, by the Building Contractor or Services Sub-Contractors.

The entire soil, waste and rainwater system shall be installed, tested and commissioned in accordance with the specification for Public Health Engineering Services and shall be handed over in clean working order to the satisfaction of the Engineer/Architect and Local Authority.

M2.38 Quality Control

The Works shall be carried out in strict accordance with recommendations of the manufacturers of the fittings, plant and equipment.

M2.39 Fire Requirements

The Contractor shall provide fire stopping, fire sealing, thermal insulation etc. and all necessary items to ensure that the soil and systems are installed in full compliance with the Fire Plan and the specific requirements of Building Control.

Where fire and/or smoke protection of escape routes and protected areas is required, due allowance shall be made such that the soil and waste water services do not compromise the integrity of the built form. Where fire rated ceilings, wall panels and enclosures are required, the soil and waste water services shall be provided with full protection to maintain the integrity of the ceiling, wall panels or enclosures.

M2.40 Materials

A list of manufacturers of all items of equipment to be supplied shall be submitted to the Engineer for acceptance prior to ordering.

Where required, samples of materials shall be provided to the Architect.

M2.41 Above Ground Drainage - Scope of Work

The work covers:-

The installation of new above ground soil and waste pipelines and fittings serving the new sanitary ware and kitchen sinks/appliances and safety valve discharges.

Existing soil and vent pipework shall be utilised as indicated on the drawings.

M2.42 Regulations and Standards

Sanitary systems shall be installed in compliance with BS EN 12056 Part 2 (Sanitary Plumbing). And the building regulations approved document H.

M2.43 Extent of Work

The Contractor shall ascertain all architectural features, structural features, positions of existing drains and other services and all other relevant information that may be required to establish satisfactory positioning and installation of the Works.

The Contractor shall include for all costs associated with liaising with other trades, liaising with Utility Services and the Local Authority, preparing working drawings, co-ordinating with all other trades, services or elements together with adequate site supervision to ensure that the Works are arranged to make efficient use of the space available.

The Works shall comprise the whole of the labour and unless otherwise indicated, all of the materials necessary to form a complete installation together with such tests, adjustments and commissioning to give an effective working installation to the satisfaction of the Engineer.

The works shall be complete in providing the following:

Specified performance and environmental conditions.

All ancillary and sundry items required for the installation to operate efficiently and to ensure maintenance can be carried out in a practical manner.

Safety under all possible conditions, i.e. during installation, operation and maintenance.

Allowance shall be made for services positions being varied due to the following:

Co-ordination with all other items.

Comments from the Architect and Engineer during the course of drawing approvals for Working or Builderswork Drawings.

Offsetting, changes in direction or position to suit structural features e.g. changes in floor levels, beams, columns etc.

Access for general building maintenance or access for other items.

Practical services maintenance, subsequent removal or dismantling.

Final setting-out and positions of ceilings, wall tiles and other finishes.

M2.44 Performance Objectives

The soil and waste from the building will be collected and discharged to the below ground drainage systems by the Geberit Ltd. PVC-U systems in full compliance with BS EN 12056 part 2 gravity drainage systems inside buildings and BS EN 12056-3:2000 Gravity drainage system. All products to be either manufactured to BS EN 1519 or third party approved covered by BBA Certificate No. 92/2729.

M2.45 Installation

Pipework shall be installed in the positions and to the sizes shown on the drawings in accordance with the recommendations of Code of Practice BS EN 12056. Horizontal pipework shall be installed not flatter than 1 : 70. Branch connections in horizontal pipework of equal size and not less than 75mm shall be constructed from fittings with angles not less than 135º. Access fittings shall be provided on all vertical pipework at each storey level above the spill over level of the highest appliance or fitting connected to the vertical pipework and at all changes of direction.

The Contractor shall, in the production of working drawings and the execution of the works, consult the manufacturer's recommended guidelines for installing PVC-u to ensure adequate provision, by the use of the appropriate fittings, is incorporated in all pipework systems for the compensation of thermal expansion.

M2.46 Sanitary Systems

Sanitary systems shall be installed in compliance with BS EN 12056 Part 2 (Sanitary Plumbing).

Soil and waste pipes shall be installed to receive discharges from each sanitary fitting and appliances.

Soil and vent pipes shall be installed in PVC-U pipe and solvent welded fittings manufactured In accordance with BS 4514. Waste pipes shall be installed in MUPVC pipe and solvent welded fittings manufactured In accordance with BS 5255. Soil pipes and waste pipes in exposed locations to be installed in white colour pipe and fittings complying with BS 4514 (soil pipe) and BS 5255 (waste pipes) and using solvent weld Joints. Proprietary two-piece tubular taps to BS 3943 shall be installed in each waste pipe from water closets, basins, sinks and kitchen appliances.

Vertical soil vent pipes shall be installed (In service ducts where provided) with connections to receive soil and waste discharges from each sanitary appliance. Unless specified otherwise each soil vent pipe shall be vented to atmosphere above roof level utilising proprietary pipe guards at the termination point and proprietary weathering devices at the point of penetration of the roof fabric.

Soil and waste pipes shall, using proprietary connectors or adapters where practical connect to the underground drainage system.

M2.47 Thermal Movement

Where boss or branch connections are made to soil or waste stacks, the distance between the entry and the nearest fixed point shall not be less than 500mm.

Expansion joints in general shall be provided at a maximum of 4 metre centres for soil pipework and 2 metre centres for waste pipework and between fixed points over one metre apart. Pipework shall not be inserted fully into expansion fittings. A sufficient gap shall be allowed to allow lateral movement of the pipe into the socket of the fitting.

M2.48 Waste Traps

Waste traps shall be of polypropylene as Geberit Plastics System and where exposed shall be white. They shall be of the appropriate sizes and type specified elsewhere and indicated on the Tender drawings. They shall be fixed in accordance with the manufacturer's recommendations. Metal traps shall only be used where specified.

M2.49 Connection to Drain

Main and stub stacks shall be connected to the buried drainage system (by others) at slab level using proprietary adaptors.

M2.50 Termination of Stacks

Soil and Waste ventilating pipes shall rise externally full bore terminating 450mm above roof level not within a horizontal distance of three metres or less than 900mm above the head of any openable window. The pipe shall be provided with a vent cowl. Where stacks terminate in ceiling voids they shall be fitted with an automatic air admittance valve.

Ventilation termination points shall comply with BS EN 12056-2:2000.

Where stub stacks are specified they shall terminate either with an access cap (cleaning eye) or automatic air admittance valve as indicated on the drawings.

M2.51 Access

Access doors shall be provided at 800mm from the base of each stack where they connect to the drainage system, at changes of direction, at the end of each horizontal run, and at all principle junctions on each floor level above the flood level of the highest fitting at that floor level.

Access panels to sanitary pipework and fittings will be identified on the drawings detailed by the Engineer/Architect.

M2.52 Connections to Water Closets

Connection between water closet spigot outlet and PVC-U float branch connection shall be made with WC manifold connectors manufactured by Geberit Limited or equal and approved.

M2.53 Traps to Sanitary Fittings

All traps to basins and sinks shall be white polypropylene bottle P/S trap as manufactured by Geberit Limited.

M2.54 Fire Protection for PVC-U and MUPVC Pipework

Where pipes penetrate through fire compartments, built in fire sleeves must be provided in accordance with BS 476 and Building Regulations part B. Fire protection to PVC-U and MUPVC Pipework sizes 56mm, 110mm and 160mm outside diameter, where it passes through a designated fire barrier, compartment walls or floors, to be Terrain 'FIREBRAKE' (Ref. No. 1725) intumescent fire sleeves. All Fire Sleeves to be tested to SIS 02 48 20, edition 2 and to hold an independent test certificate and have a fire rating ability of at least four hours, when built into the protected wall/floor.

The sleeve construction is to be of stainless steel, lined with a graphite based intumescent laminate. The one-piece shell is to be wrapped around the pipe and held in place by a locking tab. One end of the body is to have tabs with holes for fixing to the surface.

Fixing is to be in accordance with the manufacturer's recommendations.

M2.55 Vertical Fixing within Floor Slab

Vertical PVC-U Pipework of sizes 50mm, 110mm and 160mm outside diameter passing through a fire barrier to have a Fire-brake Sleeve, supplied by Geberit, positioned within the slab thickness, but exposed at the soffit. Following installation, all openings around the sleeve to be made good using material that will provide the necessary fire rating, i.e. concrete.

M2.56 Vertical Fixing to Soffit of Floor Slab

Vertical UPVc Pipework of sizes 50mm, 110mm and 160mm outside diameter passing through a fire barrier to have a 'Fire-brake' Sleeve, supplied by Geberit, fitted around the pipework and to be securely fixed flush with the soffit of the floor slab. Any imperfection between Fire-brake flange and mating surface to be filled with intumescent mastic (Terrain Intumescent Mastic Ref. No. 1727).

M2.57 Horizontal Fixing within Wall Thickness

Horizontal PVC-U pipework of sizes 50mm, 110mm and 160mm outside diameter passing through a fire barrier to have a Fire-brake Sleeve, supplied by Geberit, fitted around the pipework within the wall thickness with one face of the sleeve exposed. If wall is of sufficient thickness to accommodate two sleeves, each sleeve to have a face exposed.

M2.58 Horizontal Fixing to Surface of Wall

Horizontal PVC-U pipework of sizes 50mm, 110mm and 160mm outside diameter passing through a fire barrier to have a Fire-brake Sleeve, supplied by Geberit, fitted around the pipework on both sides of the barrier. Both sleeves to be securely fixed to the barrier and any imperfection in the joint between the Fire-brake flange and the barrier surface to be filled with an intumescent mastic (Terrain Intumescent Mastic Ref. No. 1727).

M2.59 Testing of Soil and Waste Pipelines

The Contractors shall inform the Consultant Engineer of the commencement of testing procedures giving at least 5 working days notice. The Engineer may attend and witness testing procedures at his own discretion.

The Contractor must allow for the pressure test of all soil, vent, and waste water systems.

General

Inspections and tests should be made during the installation of the discharge system as the work proceeds, to ensure that the pipework is properly secured and clear of obstructing debris and superfluous matter and that all work which is to be concealed is free from defects before it is finally enclosed.

Prefabricated units should be tested at the works or place of fabrication, and inspected on delivery at the site.

Final Inspection

On completion of the discharge system should be meticulously inspected to ensure that the recommendations of the code have been observed and that no cement droppings, rubble or other objects are left in the pipes and that no jointing material projects into the pipe bore. When this has been done, tests for soundness of the pipework and for performance should be made.

Soundness Test (Air Test)

Normally this test, to detect if all pipes and fittings are air-tight, should be completed in one operation.

Preparation

The water seals of all sanitary appliances should be fully charged and test plugs or bags inserted into the open ends of the pipework to be tested. To ensure that there is a satisfactory air seal at the base of the stack, or at the lowest plug or bag in the stack if only a section of the pipework is be tested, a small quantity of water sufficient to cover the plug or bag can be allowed to enter the system.

One of the remaining testing plugs should be fitted with a tee piece, with a cock on each branch, one branch being connected by means of a flexible tube to a manometer. Alternatively a flexible tube from a tee piece fitted with cocks on its other two branches, can be passed through the water seal of a sanitary appliance. Any water trapped in this tube should be removed and then a manometer can be connected to one of the branches as described above.

Application

Air is pumped into the system through the other branch of the tee piece until a pressure equal to 38mm water gauge is obtained. The air inlet cock is then closed and pressure in the system should remain constant for a period of not less than three minutes.

Leak Detection

Defects revealed by an air test may be located by the methods given below.

Smoke

Smoke testing of plastics pipework should be avoided due to naptha having a detrimental effect, particularly on ABS, PVC-U and MUPVC. Rubber jointing components can also be adversely affected.

Soap Solution

With the pipework subjected to an internal pressure using the smoke machine or the method described above, a soap solution can be applied to the pipes and joints. Leakage can be detected by the formation of bubbles.

Water Test

There is no justification for a water test to be applied to the whole of the above ground plumbing system. The part of the system mainly at risk is that below the lowest sanitary appliance and this may be tested by inserting a test plug in the lower end of the pipe and filling the pipe with water up to the flood level of the lowest sanitary appliance, provided that the static head does not exceed 6m.

M2.60 Performance Tests

General

All appliances, whether discharged singly or in groups, should drain speedily, quietly and completely.

To ensure that adequate water seals are retained during peak working conditions the tests described below should be carried out. After each test a minimum of 25mm of water seal should be retained in every trap. Each test should be repeated at least three times, the trap or traps being recharged before each test. The maximum loss of seal in any one test, measured by a dip stick or small diameter transparent tube, should be taken as the significant result.

Tests for self-siphonage and induced siphonage in branch discharge pipes

To test for the effect of self-siphonage the appliance should be filled to overflowing level and discharged by removing the plug; WC pans should be flushed. The seal remaining in the trap should be measured when the discharge has finished. Ranges of appliances, connected to a common discharge pipe should also be tested for induced siphonage in a similar way. The number of appliances which should be discharged together is given in the table below. The seal remaining in all the traps should be measured at the end of the discharge. The worst conditions usually occur when the appliances at the upstream end of the discharge pipe are discharged.

Number of Appliances of each kind on the stack	Number of appliances to be discharged simultaneously		
	WC	Wash basin	Kitchen sink
1 to 9	1	1	1
10 to 18	1	2	2
19 to 26	2	2	3
27 to 52	2	3	3
53 to 78	3	4	4
79 to 100	3	5	

M2.61 Test for Induced Siphonage & Back Pressure in Discharge Stacks

A selection of appliances connected to the stack should be discharged simultaneously and the trap and seal losses due to positive or negative pressures in the stack should be noted. These selected appliances should normally be close to the top of the stack and on adjacent floors, as this gives the worst pressure conditions. The above table shows the number of appliances which should be discharged simultaneously.

M2.62 Builderswork

The Contractor shall include for and carryout all builders work in connection with the mechanical engineering and associated electrical systems such as concrete bases, holes through walls and ceilings, boxing pipes.

Where the building construction necessitates bracket, supports, etc. being plugged and screwed to backgrounds, such work is to be included in the tender.

All builders work including construction of the formation of openings and/or recess, cutting away and making good, building in of pipe sleeves and brackets, fire and smoke dampers etc. will be carried out by the Contractor. The positions of all holes, chases etc. are to be approved by the Contract Administrator before any work is carried out.

Approval of any builders work drawings shall not exempt responsibility for accuracy of correctness. Any builders work carried out incorrectly due to faulty dimensions, details, setting out etc. shall be re-executed by arrangement without any further cost to the Employer.

The Contractor shall be responsible for the marking out and all associated builders work and shall supervise the work of all builders tradesmen detailed to execute it.

The works shall also include:-

Construction of holes for horizontal pipework and ventilation ducts through external and internal walls.

Construction of holes for horizontal pipework, ductwork and electrical conduit/trunking/trays in partitions.

The following schedule of items is not a definitive list but details the main elements of builders work.

1) Forming opening in walls and ceilings for services and sealing after installation.

2) Forming and casting reinforced mass concrete including the casting-in of suitable holding down bolts for the steel fluepipe mast foundation.

3) Boxing in all pipework with "LTJ Variaplan" Profile. All edges to be rounded at least 25mm.

4) Access panels in ceilings and low level service ducts (secure and tamper resistant) to be provided for all valves, air vents and drain cocks.

5) Sealing and making good openings for pipes and ducts.

6) The making good of all openings to a decorated standard to match the colour and natural finish of the fabric concerned.

7) Forming openings for the installation of air bricks and louvres.

Note: The Contractor shall use only diamond drilling to form new service holes.

The Contractor shall allow and be responsible for the replacement or repair of any areas damaged or stained as a result of works. Repairs shall be agreed prior with the Contract Administrator.

M2.63 Commissioning

The Contractor shall ensure that specialist commissioning of all plant and controls is carried out strictly in accordance with the particular manufacturer's instructions and/or recommendations in co-ordination with the overall commissioning programme.

All new gas services shall be subject to the requirements of gas safe and the Institute of Gas Engineers.

The testing, commissioning and inspection of all electrical services in connection with the installations shall be carried out strictly in accordance with of BS 7671:2001.

The Contractor shall at all times be responsible for the supervision of the commissioning specialist's work and shall ensure satisfactory

completion of commissioning and recording of result. Commissioning report and submitted to the Contract Administrator acceptance.

The Contract Administrator shall be given the opportunity to witness all commissioning with a minimum of 48 hours notice being given by the Contractor.

Any defects of workmanship, materials, performance, maladjustments, non-compliances with this specification or other irregularities which become apparent during the commissioning or testing process shall be rectified by the Contractor at his own expense until the works are free from defects and in full working order to the complete satisfaction of the Contract Administrator.

A Practical Completion Certificate will only be issued following satisfactory adherence to the above requirements.

M2.64 Seasonal Commissioning

In addition to the appointment of a commissioning specialist, the contractor shall allow for the monitoring of temperatures and humidity, air movement and lighting levels in the building at three, six and nine months after initial occupation. The contractor shall include for interviews with building occupants to identify any problems or concerns regarding the effectiveness of the systems.

The contractor shall allow for the cost of the higher of the monitoring equipment, the analysis of the results, interviews with occupants and the compilation and distribution of reports, all as required by BREEAM Credit M1.

M2.65 Demonstration at Hand Over

The Contractor shall include within the tender for the demonstration of all the new systems at completion, prior to hand over.

The Contractor shall ensure that sufficient competent personnel are provided to clearly demonstrate all aspects of each system and its operation, particularly in respect of automatic controls.

The Contractor shall employ the time of specialist manufacturers if his own staff are not conversant with the systems.

The operations staff of the Employer shall have the function and operation of the installations explained and demonstrated by the Contractor. This will include all items and procedures listed in the operating and maintenance manuals. The Contractor shall ensure that the manuals are available at the time for this purpose. Include for not less than one operating day for this purpose.

The Contractor shall include within the Tender price for the cost of an additional site visit by the specialist controls company to re-programme the control time function to suit the Client's particular requirements and to explain and provide training to the maintenance staff in the operation of the control unit. One full working day shall be included for this attendance.

M2.66 Documentation

The Contractor shall provide three sets of Operating and Maintenance Manuals and 'working drawings' showing all mechanical services such as boiler, pipework, heat emitters, valves etc, also controls and wiring diagrams for the approval of Contract Administrator at least two weeks prior to starting work on site. The drawings shall show actual valve positions.

At the time of completion of the works the Contractor shall provide the Contract Administrator with two (bound) "Log Books" as described in, and in accordance with the latest Building Regulations, which shall include but not be limited to copies of the following information :-

a. All manufacturer's operating, servicing and installation instructions for equipment installed.

b. Copies of all manufacturers' guarantees.

c. Hydraulic pressure test certificates, electrical test certificates and commissioning certificates.

d. Emergency procedures for plant and system isolation in the event of fire, flood or gas leak.

e. Telephone numbers for all emergency statutory suppliers' undertakings, gas, water and electricity.

f. The completed health and safety file.

g. Simplified descriptions and instructions for the heating and hot water system controls.

h. Gas Safety Certificate

M2.67 Users Guide

The contractor shall also supply a Building User's guide as required by BREEAM Credit M4. The guide shall in simple terms provide occupants and building managers with the information relevant to:-

- The operation, adjustment and environmental performance of the building's services, systems (including lifts).
- Emergency information (e.g. fire exit locations, muster points, alarm points and fire fighting systems).
- Energy and environmental strategy. (Available methods of saving energy, energy targets, metering etc.)
- Water Use. (Details of water saving features and their operation, recommendations for maintenance e.g. risk of Legionella).
- Transport facilities. (Details of parking and public transport).
- Materials and Waste policy. (Use and location of recyclable material storage areas).
- Re-fit/Rearrangement Considerations. (Limitations on alternative furniture layouts e.g. obstruction to radiators and vents, need for future changes to comply with BREEAM requirements; Provision made in the original design to accommodate future changes).

- Reporting Provision. (Contact details for maintenance and equipment suppliers details).
- Training. Details of where training in the use of the building systems can be obtained.
- Links and References. (Links to other information and web sites, publications and Organisations; in particular the Carbon Trust.
- General. (Technical details and references to the appropriate sections of the O & M manual).

Prior to the completion date, the operators' staff shall have the function and operation of the installations explained and demonstrated by the Contractor.

M2.68 Record Documentation

At full set of record drawings shall be supplied on CD ROM.

M2.69 Outstanding Items

At practical completion of the project, the Contract Administrator will prepare and submit to The Contractor a full and complete list of outstanding or snagging items.

All outstanding items shall be completed to the satisfaction of the Contract Administrator within 28 days of issue of the list of Contract Administrator reserves the right to have all outstanding items rectified by alternative Contractors and all fair and reasonable costs shall be deducted from the contract retention monies.

Appendix A

Drawing Schedule

Drawing Schedule

17312/100	BOOSTED COLD WATER SCHEMATIC
17312/101	ABOVE GROUND DRAINAGE SCHEMATIC
17312/102	UNVENTED WATER HEATERS SAFTEY DISCHARGE DRAINAGE SCHEMATIC
17312/103	ABOVE GROUND DRAINAGE GROUND FLOOR LEVEL
17312/104	ABOVE GROUND DRAINAGE FIRST FLOOR LEVEL
17312/105	ABOVE GROUND DRAINAGE SECOND FLOOR LEVEL
17312/106	ABOVE GROUND DRAINAGE THIRD FLOOR LEVEL
17312/107	ABOVE GROUND DRAINAGE FOURTHFLOOR LEVEL
17312/108	ABOVE GROUND DRAINAGE FIFTH FLOOR LEVEL
17312/109	ABOVE GROUND DRAINAGE SIXTH FLOOR LEVEL
17312/110	HOT & COLD WATER SERVICES GROUND FLOOR LEVEL
17312/111	HOT & COLD WATER SERVICES FIRST FLOOR LEVEL
17312/112	HOT & COLD WATER SERVICES SECOND FLOOR LEVEL
17312/113	HOT & COLD WATER SERVICES THIRD FLOOR LEVEL
17312/114	HOT & COLD WATER SERVICES FOURTH FLOOR LEVEL
17312/115	HOT & COLD WATER SERVICES FIFTH FLOOR LEVEL
17312/116	HOT & COLD WATER SERVICES SIXTH FLOOR LEVEL
17312/117	TYPICAL FLOOR LAYOUT AC AND HEATING.
17312/118	AC AND HEATING ROOF LEVEL UNITS
17312/119	BASEMENT HOT AND COLD WATER LAYOUT

Appendix B

Comfort Cooling and Heating Equipment Schedule

COMFORT COOLING AND HEATING EQUIPMENT SCHEDULE

Schedule of VRV Condensing Units

Reference	Make	Model	Nominal Cooling Capacity kW	Nominal Heating Capacity	Dims	Units served	Connected Index	MFA
CU1	Daikin	REYQ18T	50.4	50.4	1685 x 1240 x 765	1,3,5	570	40 Amp
CU2	Daikin	REYQ18T	50.4	50.4	1685 x 1240 x 765	7,9,11	570	40 Amp
CU3	Daikin	REYQ18T	50.4	50.4	1685 x 1240 x 765	2,4,6	570	40 Amp
CU4	Daikin	REYQ18T	50.4	50.4	1685 x 1240 x 765	8,10,12	570	40 Amp

Schedule of Refrigerant control devices

Reference	Make	Model	Conections	Dims	MCA	MFA	Notes
BSV 1	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.
BSV 2	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.
BSV 3	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.
BSV 4	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.
BSV 5	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.
BSV 6	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.
BSV 7	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.
BSV 8	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.
BSV 9	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.
BSV 10	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.
BSV 11	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.
BSV 12	Daikin	BS6Q14A	6 way	298 x 580 x 430	1A	15A	To be fitted with isolating valve option.

Schedule of VRV Fan Coil Units

Reference	Unit Served	Zone	VRV Condensing Unit	FCU Model	Nominal Air flow l/s	Total Cooling kW	Sensible Cooling kW	Nominal Heating kW	MCA	MFA
FCU 1/1	Unit 1	NW	CU1	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 1/2	Unit 1	NE	CU1	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 1/3	Unit 1	SW	CU1	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 1/4	Unit 1	SE	CU1	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 2/1	Unit 2	NW	CU3	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 2/2	Unit 2	NE	CU3	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 2/3	Unit 2	SW	CU3	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 2/4	Unit 2	SE	CU3	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 3/1	Unit 3	NW	CU1	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 3/2	Unit 3	NE	CU1	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 3/3	Unit 3	SW	CU1	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 3/4	Unit 3	SE	CU1	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 4/1	Unit 4	NW	CU3	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 4/2	Unit 4	NE	CU3	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 4/3	Unit 4	SW	CU3	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 4/4	Unit 4	SE	CU3	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 5/1	Unit 5	NW	CU1	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 5/2	Unit 5	NE	CU1	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 5/3	Unit 5	SW	CU1	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 5/4	Unit 5	SE	CU1	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 6/1	Unit 6	NW	CU3	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 6/2	Unit 6	NE	CU3	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 6/3	Unit 6	SW	CU3	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 6/4	Unit 6	SE	CU3	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 7/1	Unit 7	NW	CU2	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 7/2	Unit 7	NE	CU2	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 7/3	Unit 7	SW	CU2	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 7/4	Unit 7	SE	CU2	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A

Reference	Unit Served	Zone	VRV Condensing Unit	FCU Model	Nominal Air flow l/s	Total Cooling kW	Sensible Cooling kW	Nominal Heating kW	MCA	MFA
FCU 8/1	Unit 8	NW	CU4	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 8/2	Unit 8	NE	CU4	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 8/3	Unit 8	SW	CU4	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 8/4	Unit 8	SE	CU4	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 9/1	Unit 9	NW	CU2	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 9/2	Unit 9	NE	CU2	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 9/3	Unit 9	SW	CU2	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 9/4	Unit 9	SE	CU2	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 10/1	Unit 10	NW	CU4	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 10/2	Unit 10	NE	CU4	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 10/3	Unit 10	SW	CU4	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 10/4	Unit 10	SE	CU4	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 11/1	Unit 11	NW	CU2	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 11/2	Unit 11	NE	CU2	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 11/3	Unit 11	SW	CU2	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 11/4	Unit 11	SE	CU2	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 12/1	Unit 12	NW	CU4	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 12/2	Unit 12	NE	CU4	FXSQ40A	208	3.6	2.9	5.0	0.8A	16A
FCU 12/3	Unit 12	SW	CU4	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A
FCU 12/4	Unit 12	SE	CU4	FXSQ50A	208	4.5	3.6	6.3	0.8A	16A

NOTE: All FCU's fitted with attenuator, opposed blade damper and double deflection grille

Schedule of Heat Recovery Ventilation Units

	Unit served	Manufacturer	Model	Supply Air Flow rate l/s	Design Fan speed	MCA	MFA	Auxiliary Electric heater	Rating kW
HRV 1	1	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0
HRV 2	2	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0
HRV 3	3	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0
HRV 4	4	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0
HRV 5	5	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0
HRV 6	6	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0
HRV 7	7	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0
HRV 8	8	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0
HRV 9	9	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0
HRV 10	10	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0
HRV 11	11	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0
HRV 12	12	Daikin	VAM650F	120	Low	1.6A	16A	VH3B	1.0

Appendix C

Tender Summary

Tender Summary

The Contractor shall provide a breakdown of his quotation as set out below:

1.	Stripping out existing mechanical building services and removing from site comprising complete heating system, hot and cold water system and cold water storage tank from roof top tank room.	£……..
2.	Provision of New Comfort Cooling and Heating Systems.	£ …….
3.	Provision of New Cooling & Heating System Controls.	£……..
4.	Provision of boosted cold water services buffer tank & pump set.	£…….
5.	Boosted cold water distribution pipework.	£……..
6.	Hot water heaters and distribution pipework.	£ …….
7.	Provision of soil and waste water systems.	£ …….
8.	Builders work associated with mechanical engineering works including fire stopping.	£……..
9.	System Cleansing, Flushing and Chlorination.	£……..
10.	Commissioning and demonstration	£ …….
11.	O & M manual and record drawings	£……..
12.	Demonstrations	£……..
13.	Any other item not listed above (please state)	£……..
14.	12 Months Maintenance	£……..
15.	PS for AC to server room	£ 5,000.00
16.	Contingency Sum	£ 25,000.00
	Total Taken to Main Summary	**£**

Signed ……..

On behalf of ……

……

Dated ……