SPECIFICATION

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Queen Square House
18-21 Queen Square
Bristol
BS1 4NH

0117 238 0909

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Author:	Isabelle Ballinger
Reviewer:	Hugh Griffiths
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M1 OVERVIEW

M1.1 INTRODUCTION

The scope of works described in this specification is for the decarbonisation project at Chippenham Town Hall. Primarily, the works involve omitting mains gas services, replacing them with all electric systems, in the form of air-to-water heat pumps and DX split systems.

The works are across two building areas, the Town Hall and the Neeld.

The Town Hall is a Grade II listed building on the High Street in Chippenham. It was completed in 1834 and built in Ashlar stone. The Council Hall is at first floor level and is a double height space overlooking the high street. Works will also be undertaken within the adjoining bar, kitchen, loft and roof space. No works are proposed to other areas of the Town Hall building – with the exception of the removal of the gas supply and any spaces it passes through.

The Neeld is a masonry building constructed to the rear of the Town Hall between 1848 and 1850 and is also Grade II listed. The main hall is a double height space with a pitched roof and it is surrounded by several adjoined structures housing supporting spaces and toilets. The Neeld is used as a multipurpose community venue and has a stage and retractable bleacher seating. The existing Cheese Hall plant-room will be re-used, including the existing pipework routes. New equipment will be installed within the bar courtyard, with pipework passing through the bar space to connect into the Cheese Hall plantroom. No works are proposed to other areas of the Neeld building – with the exception of the removal of the gas supply and any spaces it passes through.

Reference should be made to the Architectural and Structural specifications and drawings which give important information to be read in conjunction with the services drawings and specifications, including information on below ground drainage, rainwater drainage, sanitary ware and fit out items.

In summary, the mechanical services installation is described below:

M1.2 HEATING AND COOLING SYSTEMS

M1.2.1 Town Hall – Existing

The main Town Hall is heated using a gas fired warm air system. There is an air handling unit at roof level which has a direct fired gas heat exchanger which distributes warm air to ceiling mounted diffusers in the Hall. Return passes through extract grilles in the ceiling and is ducted back to the enclosure housing the air handling unit. There are motorised dampers to allow the system to operate in recirculation mode, or introduce fresh air for ventilation.

Currently the system is not operational as it has ceased functioning. Instead of repairing it, it has been decided to use temporary electric heaters in the Hall.

Cooling to the hall is provided using three large DX fan coil units located in the roof void of the hall. They are ducted to supply grilles in the ceiling of the Hall, and return air is ducted from another grille to the fan coil units. They operate independently of the heating/ventilation system described earlier.

The outdoor units at roof level have labels implying the refrigerant used is R407C, which is due to be phased out through the F gas regulations.

Air distribution to the room is via a number of existing ceiling penetrations incorporated into the ceiling roses.

M1.2.2 Town Hall – Proposed

A new R32 DX multi-split system is to be installed which will provide both heating and cooling. Ducted fan coil units are to be located within the roof void. New outdoor units are to be located where the existing units are located, on the roof.

Air distribution is to be via swirl diffusers incorporated into the existing penetrations. Swirl diffusers are to have thermal actuators to direct air downwards in heating mode, and in a swirl pattern in cooling mode.

The fan coil unit system serving the bar will also be replaced, including all pipework and the external condensing unit.

The gas supply will be decommissioned and all pipework removed.

M1.2.3 Neeld Hall – Existing

A heating survey has been conducted by Larkhall Construction and the findings shared with E3.

There is a gas fired Low Temperature Hot Water (LTHW) system which serves radiators in the Neeld Hall, some adjacent stores and the WCs/kitchen. The zone serving the WCs/kitchen is currently not operational and the reason for this has been identified as a faulty valve during the survey. Additionally, the kitchen radiator valves were found to be seized.

Boilers are located at second floor level within the Cheese Hall. Levels 1 and 2 of the structure are unheated. The boiler room has a pair of floor standing boilers serving two pumped circuits. There is a feed and expansion tank located in the loft above pressurising the system. There is a constant temperature circuit serving all radiators described above, and a variable temperature circuit serving underfloor heating in the Foyer. The underfloor heating system has been decommissioned and pump turned off as it is redundant.

A record drawing on the plant room wall indicates that the system dates from 1996. It was also designed for a future phase, and for heating the 1st and 2nd floors of the Cheese Hall.

M1.2.4 Neeld Hall – Proposed

There is to be a low pressure hot water (LPHW) heating system that will serve radiators throughout the hall, WCs, kitchen and associated circulation – all of the areas currently served by the boilers.

A low-temperature ASHP system will be provided in the bar courtyard, with a single unit serving an internal buffer vessel, located in the Cheese Hall plantroom.

The existing feed and expansion tank system is to be decommissioned and removed, and a new pressurisation unit and expansion vessel to be installed.

As a baseline, existing pipework between the plantroom and the radiators is to be retained. The pipes are to be fully flushed and a chemical inhibitor introduced into the system, as well as a sidestream filtration system. The sizes are believed to be sufficient for the new system. This is to be verified by the contractor on site. A commissioning set is to be installed on each major branch, to allow balancing of the system.

Additionally, the contractor is to provide the client with a cost for all pipework to be replaced with new, following the existing routes wherever possible to minimise impact on the building. A single secondary circuit is to be installed, using temperature compensation on the ASHP to achieve maximum efficiency. This will serve the Neeld Hall radiators and radiators in the WCs, corridor and kitchen, to match the current arrangement – with the addition of a new radiator in the corridor. Commissioning sets are to be installed on each major branch to allow balancing of the system.

All radiators are to be replaced with larger radiators due to the lower system temperature proposed for the heat pump system.

M1.3 VENTILATION SYSTEMS

M1.3.1 Town Hall – Existing

Mechanical ventilation is provided via the heating system as described in section M1.2. The unit has ceased working.

Although the windows in the Town Hall are openable, client feedback indicates that they are rarely used.

M1.3.2 Town Hall – Proposed

A new air handling unit is to be installed on the roof, to serve the town hall. This will provide supply and extract ventilation with heat recovery. It will be sized for an average occupancy of 40 people and controlled on CO2 to ramp down when fewer people are using the space. When occupancy exceeds 40 people for a sustained period of time, the windows should be opened to supplement the mechanical ventilation system.

The existing air handling unit is to be disconnected and removed. The new air handling unit is to be located outside of the existing AHU enclosure, with the enclosure itself maintained.

A pair of supply and extract ducts will enter the roof void via the existing enclosure and penetration. Supply to the space is to be via swirl diffusers incorporated into the existing penetrations, described in section M1.2. Extract is to be via a plenum duct, combined with the return air circulation for the fan coil units.

M1.3.3 Neeld Hall – Existing

The Neeld Hall is generally unventilated currently, relying on infiltration through the structure. This is supplemented by 2No penthouse louvres on the roof, linked to the hall space via openings covered with timber panel, one movable and one with permanent penetrations. The client has conducted CO2 monitoring during periods of high occupancy in the hall, results indicated that the indoor air quality is within legal limits but poorer than what would be considered "good practice".

M1.3.4 Neeld Hall – Proposed

Works to install a mechanical ventilation system to serve the Neeld hall are not included in the scope of this project.

M1.4 DOMESTIC WATER SERVICES

The existing redundant domestic hot water cylinder in the Cheese hall plant room is to be stripped out, along with associated pipework.

No other works to domestic water services are proposed.

M1.5 ABOVE GROUND DRAINAGE

Condensate drainage will be collected from relevant equipment, and distributed to existing above ground drainage systems local to the equipment.

No other works to above ground drainage services are proposed.

Existing drainage stacks will be reused for the new systems, therefore no below ground drainage works are anticipated. Any below ground drainage is to be to the structural engineer's details, installed by others.

No changes to the existing rainwater drainage systems are anticipated as part of the works. Any rainwater drainage is to be to the architect's details, installed by others.

M1.6 FUEL SYSTEMS

The existing gas supplies are to be decommissioned and stripped out. No new gas services are to be provided. Further information is provided in M2 to describe requirements of the strip out works.

M1.7 THERMAL INSULATION

Pipework, ductwork and water storage vessels are all to be insulated to prevent heat loss and to reduce the risk of condensation forming on pipework. All pipework where not exposed to accommodation is to be fully

insulated and is to provide a continuous insulation layer. No exposed pipe or fittings will be acceptable in plantrooms, risers, ceiling voids and ducts for all pipe carrying services. In addition all valves and pumps are to be provided with insulating jackets or boxes.

M1.8 AUTOMATIC CONTROLS

No BMS is proposed for the works.

M1.9 SCOPE OF WORKS

The foregoing introduction serves to provide an overview of the scheme. It does not comprise a complete description of the scope of works for the mechanical services. The full scope of works is described through the contract documents, written and specified.

Attention is drawn to the General Specification, and in particular the requirements for design development, production of installation drawings, technical submissions and record documents.

M2 STRIP-OUT WORKS

This section of the specification describes the mechanical, public health and electrical works required for the strip out of the existing systems, in preparation for the future works.

Services to the rest of the building areas are to be maintained throughout the strip out process. No interruption to their supplies is to be allowed during the works, unless with the agreement with the client asked for in good time.

The document should be read in conjunction with the following documentation:

- All associated drawings and details produced by the Consulting Engineer.
- All other tender and contract issue drawings, including but not limited to drawings produced by any other consultants forming part of the design team.

Existing site services information available and included:

Information	Date
4887 REP01 Chippenham Town Hall Decarbonisation Feasibility Report r1 13 Feb 25 Note: revised versions of the existing services diagrams are included, updated to include information received throughout the design process.	13/02/25
Electrical test certificates provided by client to E3 26/11/24	29/06/21
Neeld Hall heating system condition survey results.	09/07/25

M2.1 SCOPE OF WORKS

In brief, the Contractors works comprise:

- Make safe and isolate incoming fuel services, including agreement with any meter or supply providers.
- Strip out of the selected parts of existing mechanical services installation from both buildings including heating, cooling, ventilation, above ground foul drainage and water services as described in more detail below.
- Safe disposal of all refrigerants, chilled water fluids, heating water fluids, domestic water fluids, and all lubrication and other liquids contained in the existing mechanical and public health installations, in accordance with the recognised standards are disposal or recovery.
- The cleaning of oil or gas service pipework prior to removal, taking appropriate measures.
- Certification of all recycled material or material that has been sent to waste.
- Certification of all fluids and liquids disposed recovered from the building.
- Produce record drawings detailing the works done, the precise location of terminations and the operational state of the systems.
- Remove all redundant materials from site.

M2.1.1 Heating and Cooling Systems

Town Hall

The gas fired air handling unit, located on the roof, is to be decommissioned, disconnected and removed, including all associated ductwork and fittings.

The fan coil units in the roof void above the main Town Hall and bar are to be decommissioned, disconnected and removed from site, including all refrigerant pipework, external condensing units and associated ductwork and fittings.

Neeld Hall
The boilers are to be disconnected and removed from site. Including all associated pipework, fittings and pumps. The plant room is to be completely stripped out.

The existing feed and expansion tank in the loft above is to be decommissioned and stripped out.

The existing boiler flues are to be stripped out.

Pipework serving the redundant underfloor heating manifold in the Foyer is to be removed throughout the building.

For tender purposes, pipework outside of the plant room serving the Neeld Hall and WCs radiators is to be assumed to be retained. The client is also to be provided with an optional cost to replace all pipework, as noted in Clause M1.

M2.1.2 Ventilation Systems

Town Hall

The gas fired air handling unit is to be removed as discussed in section M2.1.1. The extract fan serving the space is also to be removed, along with any associated ductwork and fittings.

All ductwork is to be removed from the roof void, ie both ventilation systems and fan coil unit systems.

Neeld Hall

No works to the ventilation system are required.

M2.1.3 Domestic Water Services

Town Hall

No works to the domestic water system are required.

Neeld Hall

The decommissioned hot water cylinder in the Cheese hall plant room is to be disconnected and removed from site, including any associated pipework and fittings. No dead legs are to remain.

M2.1.4 Soils, Wastes, Condensate Drains and Sanitaryware

Town Hall

Condensate drainage pipework associated with the existing heating, cooling and ventilation systems serving the Town Hall space are to be dismantled. The location of the main SVP (or discharge point to the roof) is to be identified, for re-use for the new system.

Neeld Hall

Drainage pipework in the Cheese Hall plantroom serving the existing boiler and decommissioned domestic hot water system are to be dismantled, with the exception of any floor gulleys which are to remain. The location of the main SVP is to be identified, for re-use for the new system.

M2.1.5 Fuel Systems

Town Hall and Neeld Hall

The gas supply is to be isolated and removed from both the Town Hall and Neeld Hall.

The Contractor is to remove all redundant pipework and associated equipment, including the meter. Any live pipes are to be terminated at the site boundary with a suitable stop-end. The Contractor is to ensure that any gas pipework on the consumer side of the system is to be fully purged of all residual gas and dismantled and removed from site.

If any sections of pipework are inaccessible (eg in risers/voids) they are to be capped at both ends and clearly labelled "Redundant gas pipework", after being properly purged.

The Contractor is to liaise with the contracted fuel supplier regarding all works on the live main. Prior to carrying out the works, the contractor shall ensure that all pipework is isolated, purged and free of all gases and fluids.

M2.1.6 Thermal Insulation

All insulation associated with any of the systems described in sections M2.1.1-M2.1.5 is to be removed. The contractor is to allow for working with friable and deleterious materials, and is to take into account the age, condition and type of insulation accordingly.

The Contractor is to refer to all asbestos reports and is to ensure that any suspicious materials are identified and notified to the main contractor immediately.

M2.1.7 Controls

All control systems associated with any of the systems described in sections M2.1.1-M2.1.5 are to be dismantled and removed from site. The installations include, but not limited to, motor control panels, field devices, valves, control wiring, power wiring where relevant and all other associated installations. No controls or controls interfaces are to be retained.

M3 STANDARD MECHANICAL SERVICES REQUIREMENTS

This Section describes the procedure and/or the methods of installation of plant, equipment, materials etc., to the Standard Requirements of the Consulting Engineers, and is to apply to this Contract, where appropriate, in extension and amplification of the general intent and meaning of the basic descriptions given elsewhere in this Specification and the associated Drawings.

M3.1 STEEL PIPEWORK AND FITTINGS

SPECIAL NOTE – refer to G3.5 regarding requirement for permits for hot works.

Where specified, all steel pipework is to be medium grade steel pipe with joints, whether screwed, welded or flanged, as stipulated, all to BS EN 10255. Unless otherwise later specified, pipework of size 50 mm or less to which there is easy access is to be screwed. Other pipework is to be welded.

Connectors 50 mm bore and under on pipework and adjacent to screwed valves and equipment to be malleable iron with bronze seats, B.S.P.T. connections. Screwed joints are to be of British Standard pipe thread, clean threaded and pulled up tight. Joints are to be made with an approved graphite compound and fine threaded hemp or P.T.F.E. tape only. Red lead will not be allowed.

Welded joints are to be in accordance with the requirements laid out in the relevant section of this specification.

Flanged joints are to be made by screwing on screwed pipework or welding on welding pipework to the ends of the pipes drilled flanges, the flanges to be turned on edge faced full across. The ends of the pipes are to be flush with the face of the flanges.

The two flanges forming a joint are to be flush with one another all round when in position, with all bolt holes in alignment. The joints are to be made with Klingerite or other equal jointing materials, full faced, specially stamped and not cut from sheets on Site, arranged to fit concentrically with the bore of the pipe, and in no way to obstruct the bore of the pipe.

Connectors 65 mm bore and above in Plant Rooms, ducts, ceiling voids, etc., to be steel flange, slip-on pattern to BS EN 10255 with carbon steel bright hexagon bolt and nut to suit flange, or to suit the valve and equipment flanges where these are not PN6.

At the Mechanical Sub Contractor's option, pipework 100 mm bore or over, excepting pipework in plantrooms, may be connected using Victaulic fittings. Where used, the manufacturer's representative must first give written advice regarding anchors and provision for absorbing expansion, and anchor loads must be calculated and agreed with the Structural Engineers, whose acceptance is essential before the use of Victaulic couplings will be approved. The manufacturer's recommendations for all aspects of the installation of their products must be followed. (Note that primary chilled water pipework, where inaccessible in the duct under the road, must be fully welded, but the fittings at either end may be Victaulic).

All branch connections from mains to be made by using either welded swept tees or welded "shoes".

All pipework on view above floor level in the corridors, stair areas, toilets, etc., is to be installed utilising medium grade steel tube, fittings and cover plates.

The tube to be as manufactured by:

Stewarts & Lloyds Ltd

Wellington Tube Supplies.

or equal and approved.

M3.1.1 Screwed Pipework

Malleable iron long and easy sweep, beaded or banded fittings are to be used for screwed and socketed work.

Square tees will not be used except where open vents are taken off, or for non-circulatory branches. Eccentric reducing sockets are to be used where changes in pipe sizes occur. Unions are to consist of two screwed halves, with ground spherical faced joints between the two faces, and one of the two faces is to be of bronze.

In screwed pipework of 50 mm nominal bore and under, unions are to be provided in all cases where they may be required to enable sections of pipework to be subsequently dismantled and refixed without disturbing the building fabric and in any event at intervals not exceeding 12 metres on straight runs. All pipework larger than 50 mm nominal bore/ 54 mm O.D. and all flanged pipework of 50 mm nominal bore and below is to be provided with flanges for the connection of valves, expansion joints, fittings etc., and pairs of flanges in all cases where they may be required, to enable sections of pipework to be subsequently dismantled and refixed without disturbing the building fabric and in any event at intervals not exceeding 12 metres on straight runs.

M3.1.2 Welded Pipework

Tee branches of smaller bore than the bore of the main are to be welded on site, generally, but not without exception, with a "lead" in the direction of the flow, while branches of equal bore to that of the main are to be prefabricated with ends for butt welding to the appropriate British Standard.

Bends are to be purpose made, seamless steel, of the same grade as the line, with ends for butt welding, while springs and sets are to be purpose made on the Site, cold drawn to a radius of not less than six times the nominal bore of pipes of 50 mm nominal bore and under, and hot bent to a radius of not less than three times the nominal bore of pipes of 65 mm nominal bore and over. In pipes of 80 mm nominal bore and under, the seams are to be arranged along the sides of the springs and sets where possible, or where not possible along the inside radii of springs and sets.

Reducing pieces may either be prefabricated or cut, swaged and welded on Site, with the pieces in either case butt welded into the lines.

Steel flanges are to be used for flanged pipework, with welded bosses. Particular care is to be taken to ensure that branch pipes do not protrude into the bore of the main, and that no welding material projects into either of the tubes. The Consulting Engineers may require to inspect any or all of such pipework before it is installed to ensure that these conditions have been complied with.

Sample tests of welds are to be carried out. To be not less than 1% of the welds on the project, nor less than 3 per welder. Results are to be recorded, and submitted to the Consulting Engineers.

M3.2 COPPER PIPEWORK AND FITTINGS

Where specified, all copper pipework is to be run in the quality of tubing specified, with the joints, whether soldered, screwed, brazed, bronze welded or flanged, as stipulated, all to the relevant British Standard.

SPECIAL NOTE – refer to G3.5 regarding requirement for permits for hot works.

Copper tube is to be to BS EN 1057 as follows:

- For sizes up to 42mm, R250 "half hard"
- For sizes of 54mm and above, R290 "hard"

M3.2.1 Domestic Water and Heating Pipework

Fittings for copper pipework of sizes 42 mm and larger are to be the heavy duty capillary type fittings. All joints are to be made using a silver soldering process. Fittings on smaller sizes are to be of the capillary type.

Flanged joints are to be made by brazing insert-type flanges, with copper alloy inserts and loose steel locking rings, to the ends of the pipe, otherwise as for steel flanged joints except that brass bolts are to be used.

Joints in the run of pipes of 54 mm O.D. and over, in closed-circuit systems only, may be made by bronze welded butt joints in accordance with the requirements of Clause M3.10.

Fittings may alternatively be Yorkshire "Press Fit", if installed in strict accordance with the manufacturer's instructions, using their special tools, and by tradesmen, who have been trained in the method of installation.

All fittings, valves, etc., must be of the type NOT subject to DEZINCIFICATION.

Bends, sets and springs are to be either prefabricated or cold drawn on Site by machine to a radius of not less than six times the nominal bore of the pipe, while branches are to be connected to gunmetal tees. All bends whether prefabricated or made on Site are to be annealed before fixing in place.

Light gauge copper tubes and fittings are to be installed in accordance with the Manufacturer's directions and using any special tools or fluxes etc., recommended.

The use of old or re-drawn copper tube will not be permitted.

Where it is necessary to connect light gauge tube to iron or gunmetal valves or apparatus, straight through adaptors are to be used where the valve or apparatus is screwed and flanged adaptors are to be used where the valve or apparatus is flanged. Flanges are to be to the relevant B.S. Table, installed as described elsewhere.

M3.2.2 Refrigeration Pipework

Generally all internal pipework is to be supported by continuous galvanised steel tray. Where in the horizontal inside the building, or external to the building, it is to be complete with galvanised steel cover, as produced by the tray manufacturer and designed to suit. This is to provide an effective barrier between the pipework installation against damage and the external environment. The installation of all refrigerant pipework is to be compliant with the latest version of BS EN 378.

Refrigeration pipework is to be installed in standard sizes stipulated by the manufacturer for the hot gas discharge lines, liquid lines and suction gas lines.

Internal pipework, at high level or above ceilings, shall be laid on suitably supported and sized galvanised basket, insulated and held in position with plastic coated steel banding. Due care and attention shall be taken at all times to allow pipework to freely expand and contract naturally.

All pipework to be labelled with ID number (condensing unit's ref.) at 3 metre intervals.

The interconnecting refrigerant piping shall be manufactured from seamless quality phosphorous dioxide soft/medium drawn copper to BS 2781 Part II ASTM, DIN 1754/8905, fully tested by the eddy current method, dehydrated and capped. The copper tubing shall be of a suitable thickness to be capable of withstanding pressure test as detailed in the current revision of BS EN 378.

The copper tubing shall be suitably selected with a wall thickness capable of withstanding the system operating pressures of the refrigerant specified in section M4, all as described within the outdoor units' installation manual.

All in-line shut off valves are to be of the ball type, constructed in brass and copper and are to meet the requirements of ANSI Code B16-35.

Pipework shall be installed by the manufacturer approved installer in accordance with the current revision of BS EN 378 and in accordance with manufacturer's design and installation instructions and the relevant equipment's installation manual. Brazing shall be carried out by skilled operatives, in accordance with the BESA Code of Practice – Brazing and Bronze Welding of Copper Pipe and Sheet.

During brazing, oxygen free nitrogen shall be passed through the pipework to displace oxygen and ensure that oxidisation does not occur. Longest possible lengths of copper pipe shall be utilised to minimise joints on site. Appropriate refrigerant tools shall be utilised at all times. The use of hacksaw or any tool that creates filings is prohibited.

Pipework shall remain capped at all times other than when actually being installed to prevent the ingress of moisture and contaminants. The longest possible lengths of copper pipe is to be utilised to minimise joints on site.

All Refrigerant pipework to be insulated with slip-on close cell elastomeric pipe insulation, with a fire performance rating class "O" of the 1985 Building Regulations, having a wall thickness of not less than 13 mm. After commissioning, all joints to be properly sealed to provide an adequate seal and clearly marked for ease of identification. The insulation shall have the following:

- Surface spread flame to B.S.476 : Part 5
- Fire propagation to B.S.476 : Part 7
- Water vapour permeability to B.S.4370 : Part 2
- Ozone resistance ASTM-D-1171
- High resistance to oil and grease.

Where exposed externally, insulation shall be protected with a suitable enclosure to encase the piping, as to reduce the effects of Bird, Vermin and Environmental attack, as outlined above.

Before being insulated, completed pipework is to be pressure tested using oxygen-free nitrogen. Pressurised pipework is to stand for 24 hours and pressure is to be checked. If pressure has held, pipework is then to be evacuated for 24 hours, after which the vacuum is to be broken using the refrigerant specified for the system, as defined in section M4. Systems are then to be left with a positive pressure, ready for commissioning.

The wall thickness of the insulation is to be in line with the clauses in section M7.

Refrigerant charge weight must be calculated, to the actual installed length of pipework in accordance with manufacturer's recommendations.

The charging should be carried out using appropriate charging scales. Once completed the F-Gas label on the outdoor unit should be completed to show factory charge, additional charge and total charge.

M3.2.3 Multi-Layer Plastic Pipework

Where there may be a difficulty in installing longer lengths of copper/steel pipework in joist zones, the use of a multi-layer plastic pipework system such as Geberit Flowfit may be permitted subject to technical submittal. Up to 32mm OD, this pipework comes to site in coils and can be bent to overcome the installation issue between the joists.

The following criteria should be adhered to if this solution is used:

- All installers should undertake manufacturer (Geberit) approved training before installation.
- A detail for fixing pipework through the joists should be submitted for design team approval before installation.
- Manufacturer (Geberit) site approval of the installation should be obtained.
- The installation should take full account the potential for thermal expansion, as specified elsewhere in this specification.

M3.3 PIPEWORK GENERALLY

All pipework is to be delivered to Site in manufacturers' random lengths and straight runs are to incorporate full lengths. No piecings of short cuttings or the use of long screw connections and backnuts will be permitted. All pipework will be left free from excessive tool marks, distortion of section, or other defects.

Pipe jointing is to be non-toxic used with the minimum of P.T.F.E. tape or hemp. All surplus hemp jointing is to be cleaned off threads and fittings before it hardens.

Reducing pieces are to be eccentric unless otherwise specified, and welded or screwed in the lines as applicable.

All ends of pipe are to be reamed before fixing to remove the burr. Particular care is to be taken to ensure

that all vertical pipework is parallel with the adjacent walls and at right angles to the walls and ceilings. Any pipes which, in the opinion of the Consulting Engineers, are not fixed in accordance with the above are to be removed and refixed at the Contractor's expense. Generally, pipes are not to be fixed at less than 75 mm clear from ceilings and floors without written sanction to do so from the Consulting Engineers.

The Contractor is to take special care to prevent dirt or rubbish entering the open ends of pipework during erection. Appropriate metal or plastic screwed caps or wood plugs only are to be used to prevent this occurring; plugs of waste or wool are under no circumstances to be used. Should any stoppage in the circulation occur, after the various systems have been put into operation, the Contractor is to attend and rectify the matter at their own expense.

Pipework which is to be insulated is to be fixed in such a manner as to allow each pipe to be insulated around its full circumference, leaving 25 mm minimum between the insulation of any pipe and the finished surfaces of the building or any other pipework, insulation, or other services. Any such pipework incorrectly fixed is to be removed and refixed correctly at the Contractor's expense.

Wherever it is possible to do so, pipework is to be fixed in such a manner that subsequent access to any pipe can be made without disturbing the other pipes. No joints of any kind are to be made within the thickness of walls, floors, or ceilings, or in a vertical duct without permanent access.

All pipework and fittings are to be installed at least 150 mm clear from electric conduits and wiring, after allowing for the thickness of any insulation.

M3.4 ANTI-ELECTROLYTIC COUPLINGS

The Contractor is to provide and fix, between copper pipe and all galvanized steel and steel pipework and vessels, non-ferrous couplings of an approved type to inhibit electrolytic action.

M3.5 PROTECTION OF PIPES

All tubes delivered to the site by the Contractor are to be unpainted and are to be given one coat of an approved preservative before despatch. While stored on site care is to be taken to prevent the tubes from rusting and they are to be properly racked and covered, the necessary racks and covers being supplied by the Contractor.

No installed tubing showing evidence of corrosion will be permitted to be put into service.

M3.6 PIPE SLEEVES

In all cases where pipes of any service pass through walls, floors or ceilings, the pipes are to be enclosed by sleeves of similar metal to the pipe concerned, and such sleeves are to be of a size to permit free movement of the pipe and carefully cut to length. The Contractor is to acquaint themselves with the nature of the wall finishes, and is to co-ordinate their work with the Main Contractor. A neat finished appearance is required.

Where the wall is fire-resisting, refer to the general specification for requirements. The M&E contractor is to cooperate in full with the Specialist Subcontractor carrying out fire stopping.

Where the wall is acoustically rated, the penetration is additionally to be sealed to the Acoustic Consultant's requirements. As a minimum the annular gap is to be filled with densely packed mineral fibre insulation of 30kg/m^3 packed to a density of 80kg/m^3. In addition a washer shaped collar is to be installed around the penetration using a fire resisting board of minimum surface mass 10 kg/m^2. A small gap is to be left around the pipe or duct which is to be sealed airtight with a non-hardening sealant. The detail is to be approved by the Acoustic Consultant.

M3.7 PIPE GRADING, AIR RELEASE AND DRAINING

All pipes are to be carefully graded to a rise or fall to facilitate the removal of air and for the complete draining of lines for maintenance purposes, and otherwise as specified.

Wherever high points or other air traps occur, the Contractor is to supply and fix an air release unit or 'bottle' comprising a 75 mm length of 32 mm nominal bore pipe with 6 mm nominal bore tube to an air cock fitted in an accessible manner, so that all sections are efficiently vented. In all plant rooms and wherever else specifically noted, air vents are to be of the automatic float type, with lockshield isolating valve, discharging to the nearest drain or to atmosphere through a 15 mm copper drip pipe terminated with mitred end.

Automatic air vents are not to be fitted to pipework which may be at negative pressure under certain conditions of service, or at a negative static pressure with all pumps and any pressurising devices turned off. Air 'bottles' as described above are to be provided instead in these locations.

At all low points and on the downstream side of all isolating valves and wherever else shown on the drawings, and elsewhere as necessary to ensure that all sections which may be isolated may also be drained, the Contractor is to provide and fix a 15 mm nominal bore gunmetal drain valve on pipe services of 80 mm nominal bore or less, and 20 mm nominal bore elsewhere except in Plant Rooms where a 25 mm nominal bore gunmetal drain valve is to be fitted.

Drain valves are to be fully in accordance with B.S.2879 and be made by:

Hattersley Ltd.,

or other equal and approved.

M3.8 PIPE SUPPORTS

The contractor is to consider carefully the structural loading capacity of the building structure and is to work closely with the specialist frame contractors to ensure that adequate supports are provided where it is a requirement of the frame. Notwithstanding the above, all pipes are to be supported where shown on the drawings and elsewhere as necessary particularly within 150 mm on each side of all changes in direction and everywhere at intervals not exceeding the following:

Steel Pipes

Nominal Bore	Vertically Fixed (Metres)	Horizontally Fixed (Metres)
15 mm	2.5	1.8
20 mm	3.0	1.8
25 mm	3.0	2.1
32 mm	3.0	2.4
40 mm	3.5	2.7
50 mm	3.5	3.0
65 mm	4.5	3.4
80 mm	4.5	4.0
100 mm and above	4.5	4.0

Copper Pipes

Diameter (O.D.)	Vertically Fixed (Metres)	Horizontally Fixed (Metres)
15 mm	1.2	1.0
22 mm	1.2	1.0
28 mm	1.8	1.2
35 mm	1.8	1.2
42 mm	2.5	1.8
54 mm	2.5	1.8
76 mm and above	3.0	2.5

Plastic Pipes

Diameter (O.D.)	Vertically Fixed (Metres)	Horizontally Fixed (Metres)
Up to 50 mm nominal	1.2	1.1

Or in accordance with the manufacturer's recommendations, whichever is more frequent.

M3.8.1 General

Steel pipes of 80 mm nominal bore and under, and copper pipes of 76 mm O.D. and under, having an operating temperature less than 95°C, running singly or in pairs, vertically or horizontally, where exposed to view are to be supported by screw-on-type brackets. Where concealed, and in plantrooms, Unistrut or approved equal may be used.

Build-in brackets are to be of the long shank type while screw-on type brackets are to have a minimum of two fixing screws. In either case the half hoop to pass round the pipe is to be secured by a single screw.

Brackets are to be of malleable iron for steel pipes, galvanized for galvanized pipes and chromium plated for chromium plated pipes. Brackets for copper pipes are to be of cast and not stamped brass.

Steel pipes larger than 80 mm nominal bore, and copper pipes larger than 76 mm O.D., and all multiple runs of pipe are to be supported on angle iron or equal bearers.

All vertical pipes in vertical ducts are to be supported on specially fabricated steel brackets supported from the back wall of the ducts. The detail of the brackets proposed to be forwarded to the Consulting Engineers for comment/approval. All copper pipes supported by this type of bracket to be protected from contact with ferrous metal by 'asbestos-free' ring tape 25 mm wide x 6 mm thick.

All pipes likely to operate at 40°C or over and supported by bearer brackets are to be supported from their undersides with cast iron or non-ferrous chairs and rollers. The Contractor may propose alternative sliding support arrangements for consideration.

Wherever hangers or bolts are to be suspended from the soffit where no insert is provided, the hanger or bolt is to be taken through the concrete slab to a 100 mm square backplate with nuts and washers, except in the case of single steel pipes of 65 mm nominal bore and under, and in the case of single copper pipes of 54 mm O.D. and under.

In occupied areas, where pipework is on view, the appearance of brackets and supports is critical, and the Contractor must submit their proposals to the Architect and Consulting Engineers for comment and approval before proceeding.

M3.9 PIPE EXPANSION AND ANCHORING

In the pipework of any service likely to operate at 40°C or over, arrangements are to be made for thermal expansion to be taken up by change of direction or by the installation of expansion joints.

In all cases, free guided movement of pipes is to be maintained and static points are to be arranged between joints by the installation of suitable anchors.

Expansion at changes of direction, expansion joints and anchors are to meet with the following requirements:

The Contractor must ensure that expansion movements do not give rise to noise. Pipes, heat emitters, etc., must be supported on Teflon skids, or hung on swivelling suspension rods, or by other effective means, to eliminate expansion/ contraction noises.

M3.9.1 Expansion at changes of direction

Wherever this is possible bends are to be opened during erection to the full extent of their cold draw.

Where expansion is planned to take place through a change in the direction of the line of the pipe, 'U' bolt guides are to be omitted on the pipe supporting brackets immediately around the bend, in order to permit lateral movement of the pipe.

M3.9.2 Expansion Joints General Provision

Where natural flexing of the pipework is not practicable thermal expansion and building movement shall be accommodated by the use of expansion joints.

Expansion joints may be of the restrained or unrestrained type and shall be provided with welded, screwed or flanged ends as appropriate.

Expansion joint convolutions shall be of a thick wall spirally wound, multi-ply construction with a corrosion resistant inner ply in AISI 316L stainless steel. Units should be fitted with stainless steel inner sleeves, in compliance with EMJA.

For critical services such as MTHW, HTHW and steam, the bellows must have a weep hole as a fail-safe device.

Expansion joints shall be capable of not less than 5000 complete reversals of movement at the given working conditions and the manufacturer shall be able to produce calculations to that effect, in full compliance with EJMA (Expansion Joint Manufacturers Association).

Expansion joints shall be capable of withstanding a test pressure 1.5 times their design pressure without deformation.

Expansion joints and their corresponding anchors and guides shall be indicated on the drawings.

Prior to commencement of the installation, the contractor must agree with the expansion joint manufacturer to visit site to ensure their guidelines for selection and installation are adhered to. And that the anchors and guides are correctly positioned to ensure that the expansion joints function as intended. During system installation and just prior to application of heat onto the systems, the expansion joint manufacturer is to visit site to check that the installation is installed as designed and a Certificate of Compliance issued. All the above to be agreed with the bellows manufacturer prior to placing an order.

The expansion joint manufacturer shall submit calculations for anchor loadings for onward transmission to the Structural Engineer for approval.

M3.9.3 Unrestrained Expansion Joints

Axial expansion joints shall only be used in positions where pressure thrust can be contained by adequate anchor points contained by the building fabric. Recommended guide spacing and tolerances as described in Engineering Appliances "Guide to the use of Expansion joints" are critical and must be strictly adhered to.

M3.9.4 Restrained Expansion Joints

Restrained expansion joints shall be used as an offset type either by using lateral or angular expansion joints to compensate for thermal expansion or building movement. The expansion joint restraints shall be designed to absorb the full pressure thrust of the expansion joint convolutions.

Lateral expansion joints shall be of the thick wall spirally wound multi-ply construction and fitted with threaded tie bars and low friction self-lubricating hemispherical nuts, allowing movement in two planes.

Angular expansion joints shall be of the thick wall spirally wound multi-ply construction and be used in pairs or threes. All hinge pins shall be PTFE coated to reduce friction and prevent corrosion.

For movement in two planes Gimbal Expansion joints shall be used in pairs or in combination with one Angular Expansion joint. All hinge pins shall be PTFE coated to reduce friction and prevent corrosion.

M3.9.5 Anchors

Rigid anchors are to be generally similar to the supporting bearers previously specified with the exception that the rollers are to be replaced by a small piece of RS channel shorter in length than the diameter of the pipe and cut to the radius of the outside surface of the pipe.

This RS channel is to be fixed to the supporting brackets and the pipe rigidly anchored by means of 'U' bolts bent to the radius of the outside surface of the pipe and clamped in position with a locknut on the underside of the flange of the supporting bracket. The supporting bracket is to be suitably braced and fixed to the structure so as to withstand rigidly the maximum load imposed upon it. The Contractor is to supply the Structural Engineer with details of the loads on each anchor bracket, and obtain approval to the design and location of each bracket.

The anchor is to be located approximately mid-way between the points at which provision for expansion is made.

To be provided by:

BOA Flexible Solutions Ltd., www.boafsl.co.uk

or equal and approved

M3.10 WELDING AND BRAZING

Site welding may only take place where specifically agreed with the Main Contractor and Client. For tender purposes assume it is not permitted. Site welding shall be carried out by means of the oxy-acetylene process or by means of the electric metal-arc process as appropriate. Brazing shall be carried out using a gas torch, and not with oxy-acetylene equipment.

SPECIAL NOTE – refer to G3.5 regarding requirement for permits for hot works.

All equipment required for operation of either process will be provided by each Contractor, and in the case of metal-arc work, where no suitable electricity supply is available for the Contractor's use on Site, this is to include suitable generator plant. Where a suitable electricity supply is available to the Contractor they will be entitled to make use of it, but will be fully responsible for the supply and fitment of necessary wiring, controls etc., from the point of supply. They will also be responsible for ensuring compliance with all relevant regulations and safety precautions and for paying for all electricity consumed.

'Cut and shut' bends and sets are not acceptable.

All welded work is to be painted with one coat of Red oxide paint immediately it has been completed.
All welding of steel pipework is to comply with the H.V.C.A. Code of Practice TR/5 entitled "Welding of Carbon Steel Pipework".

Welding outside the scope of TR/5 is to be in accordance with the appropriate British Standard or other nationally recognised Code of Practice.

Bronze welding is permissible only on closed-circuit systems. Where permitted, it must be carried out in accordance with the H.V.C.A. Code of Practice TR/3 referred to below.

Brazing of copper pipework and sheet is to comply with the H.V.C.A. Code of Practice TR/3 entitled "Brazing and Bronze Welding of Copper Pipework". Filler metals are to be types AG1, AG2, CP1, CP2, or CP, selected to suit the application and latest code of practice. Copper-zinc alloys, and silver alloys with less than 40% silver content, are not to be used. Flanges are to be of the insert type.

The Contractor is to adhere to hot working practices as appropriate at all times, and as required by the Main Contractor.

M3.11 PAINTING AND CORROSION PROTECTION

The Contractor is only to apply paint to specified items but will be required to leave all other pipework, heating equipment etc., in a reasonably dust and dirt free condition for cleaning down and painting by the Main Contractor.

Generally, the Contractor is to apply paint to the items listed below and wherever else specifically mentioned later in this Specification and/or on the Drawings:

To all steel pipework, wire brush, and apply two coats of primer.

To all plant, fan casings, heater batteries, pumps and motors etc., unless the painting has been completed by the manufacturer, and is undamaged.

To all ductwork (with special paint) to prevent rusting where the galvanizing has been damaged.

To all supporting steelwork supplied by the Contractor or their Sub-Contractors.

To all buried metallic pipework the Contractor is to employ a paint and corrosion specialist to specify an appropriate corrosion protection package, and to include the application of Denso tape and Petrolatum products as a minimum level of protection. All corrosion protection to be fully continuous and applied to all metallic surfaces.

The specification for painting carried out by the Contractor is to be as follows:

- Plant and Equipment to be painted is to be thoroughly de-scaled and cleaned by wire brushing and then to be painted one coat of Red or Grey oxide paint before erection and a further coat after erection.
- Where no insulation is to be applied, the primary coats are to be followed with one undercoat and one top coat of suitable flat oil paint, of a colour to be selected by the Architect. Paint to be heat-resisting where necessary.
- Where insulation is to be applied, the primary coats are to be heat resisting and be followed by the application of the insulation.
- Pipework and steelwork to be painted by the Contractor is to be thoroughly de-scaled and cleaned by wire brushing, followed by two coats of Red or Grey oxide paint, one coat being before erection, and the other after.
- Sherardised, or approved equal, steelwork need not be painted.
- External steelwork (except where otherwise stated) and all associated fixtures and fittings is to be galvanised. Any steelwork permitted to be ungalvanised is be prepared and painted as above, followed by two undercoats and one topcoat of oil-based paint to an approved colour.
- All bright steel and chromium plated parts and small bore copper tube connections to gauge and instruments are to be burnished and polished.
- All junctions and joints in conduit work and all areas of conduit where there is evidence of enamelling or galvanizing being damaged shall also have one application of red lead paint (or, in the floor screeds only, bitumastic paint), directly after installations.

M3.12 PUMPS

M3.12.1 General

The Contractor is to supply, install and commission pumps as scheduled in the equipment schedule.

All moving parts are to be guarded.

100 mm dial altitude gauges are to be supplied and installed in all suction and discharge connections of all pumps. They are to be installed at the same height throughout, at least 2 pipe diameters away from the nearest pipe fittings and pump flanges, if possible. Gauges each to be complete with siphon and gauge cock. The face of each gauge is to be marked with a Red line indicating the normal static head as measured on site.

Isolation valves and flexible connections are to be installed on both suction and discharge of each pump or twinpump.

Self-sealing test plugs, (as specified elsewhere) are to be installed on the side of the pipe at the suction and discharge of each pump set, again at least 2 pipe diameters from the nearest pipe fittings and pump flanges, if possible.

All pumps must be installed strictly in accordance with the manufacturer's recommendations. Anti-vibration measures are to be provided for each of the pumps, as specified later.

Impellers to be gunmetal, casings to be cast iron, shafts to be stainless steel and to be complete with self-adjusting mechanical seals. All parts in contact with the water or solution to be suitable for the fluid concerned.

The Contractor is to obtain from the manufacturer, and pass on to the Consulting Engineers for approval, at the start of the Contract, the head/flowrate curves for the actual pumps to be provided. The curves are to show the performance from zero flow to the maximum obtainable from each pump, showing also the power consumption/flowrate curve over the same range of flowrates.

Motors are to be totally-enclosed fan-cooled squirrel cage induction type, sized so as to be non-overloading at any point on the pump curve, and are to have a 25% margin of spare power.

On any belt-drive pumps, the Contractor is to include for changing pulleys and belts after proportional balancing of the circuits, to achieve the required flowrate with minimum throttling of valves on the index circuit.

Where scheduled, twin-head pumpsets are to be of the close-coupled in-line centrifugal type and are to act as duty/standby.

For each pumpset, the motor and pump are to be mounted on a common baseplate. Each of the pumpsets is to be supported on an appropriate vibration isolated unistrut frame designed to suit the installation requirements.

All the foregoing pumps are to be equipped with integral variable speed drive via inverter drives, to enable speed control. For pumps with constant volume control, the circulatory systems served by those pumps are to be commissioned by adjusting the speed of pumps in preference to closing double regulating valves.

All pumps are to be provided with a manufacturer standard insulation box, or alternatively a proprietary jacket approved by the manufacturer. Un-insulated pumps will not be accepted.

A handheld controller is to be provided to allow diagnosis and commissioning of all pumps.

To be as manufactured by:

Grundfos Pumps Ltd., www.grundfos.com/uk

or equal and approved.

M3.13 ALTITUDE GAUGES AND SAFETY VALVES

The Contractor is to provide and fix to all main flow and return pipes in plantrooms and to hydraulic equipment where specified, and wherever else specified or shown on the Drawings, altitude gauges having a Red line marked on to the scale at the normal static head valve. Scale to be easily visible. Connection to pipework is to be via a gauge cock and syphon.

Where safety valves are specified to be provided in hydraulic systems, the valves are to be of an approved type and be set to relieve all pressure in excess of 1.5 metres head (150 mbar) more than the normal maximum static head.

All static heads are to be determined by site measurement prior to setting altitude gauges and safety valves.

M3.14 THERMOMETERS

The Contractor is to provide and fix 100 mm diameter brass-cased thermometers in the locations listed below, and wherever else indicated on the Drawings or in other clauses of this Specification. Each thermometer is to have a sensing element fitted into a pocket in the pipework, extending at least 50 mm into the pipe. The pocket is to be filled with thermally conductive material and located so as to give a true reading of water temperature. To be manufactured by Rototherm or equal and approved. Scale range to be suitable for the fluid concerned, graduated in degrees C.

To be installed, where possible, between 6 and 10 pipe diameters from the associated equipment or point where water flows mix, and with the scale easily visible.

Locations to be:

- Main flow and return on heating systems in the main plantroom.
- Mixed temperature flow and return in pumped secondary circuits.
- In heating flow mains at the point of entry to each plantroom containing plant served by those mains.
- Wherever else also shown on the Drawings.

M3.15 TEST PLUGS

To assist with commissioning, self-sealing pressure/temperature test plugs are to be fitted in the locations listed below, and wherever else shown on the Drawings or called for in other Sections of this Specification. Each is to be fitted to the side of the pipe to prevent collection of air or scale. Each is to be complete with a screw-on brass cap, and is to be suitable for the fluid in the pipe throughout its range of operating temperatures and pressures.

Locations of test plugs to be:

- Immediately adjacent to all thermostats, temperature sensors, pressure switches and pressure sensors.
- Adjacent to each port of every automatic control valve, including those fitted to fan-coil units, etc.
- On the flow side of each self-actuating differential pressure control valve.
- To measure the mixed flow temperature in every pumped secondary circuit.
  (Note that this will normally be achieved by the test plug adjacent to the temperature sensor for automatic controls associated with the circuit).
- Adjacent to both ports of any characterised valve which is to be used for flow measurement, but which does not have integral test plugs.
- On the flow and return connections to each heating coil, in each air-handling unit, (immediately adjacent to the coil itself).
- On the suction and delivery connections of every pump.
- On the flow and return connections of each boiler.

- Wherever else also shown on the Drawings.

Locations are to be at least 2 pipe diameters from the nearest pump flange, valve, or fitting, whenever space allows.

From the time that the systems are put to work, until acceptance of all systems and plant, the Contractor is to keep on site, for use by all parties, thermometers and pressure gauges, all designed for use with the test plugs, in sufficient numbers for commissioning purposes, and not less than two of each.

Thermometers are to be dial type with stainless steel probe, and pressure gauges are to be complete with suitable adaptor probes. This equipment is to be handed to the Employer's Engineer, in good condition, on completion of the project.

M3.16 LABELS AND IDENTIFICATION

All pipes and items of equipment, except those on view in occupied areas, are to be identified in strict accordance with the established Colour Code or with B.S.1710 and are to be further marked for direction of flow. Such identification is to be applied at intervals not exceeding 15 metres, and more frequently as necessary for clarity where any confusion might otherwise exist, including plantrooms (where identification is to be applied to each straight length). Identification is to be applied wherever there is an access panel into a wall or ceiling. All colour engraving is to be in colours to the colour code and code letters shall agree with the Record Drawings and a Schedule to be included in the Maintenance Instructions.

All valves in plantrooms and in ducts and crawlways and wherever else specifically mentioned later in the Specification and/or on drawings, are to be labelled by an engraved Traffolyte disc, drilled in the centre to fit on the top of the valve spindle and secured by the valve handwheel locknut. Where this method will result in the label being difficult to read, it is to be attached to the valve by a short length of brass chain.

As-built schematic drawings and valve charts for each system are to be provided, on the wall in a suitable location in the plantroom. A suitable clear plastic folder is to be provided to contain the diagrams. The contractor is to ensure that all item references align between drawings and physical labels.

M3.17 VIBRATION PRECAUTIONS

M3.17.1 Anti-Vibration Pads

Except where higher performance anti-vibration measures are specified, or are necessary to meet the noise limitations specified, the Contractor is to supply only a 25 mm thick 'Ticopad' or equal and approved anti-vibration pad for each pump, air handling unit, fan, chiller or any other machine which the Contractor is supplying under this Contract including any system which is to be erected on a concrete base. Where a concrete or inertia base is provided, the pads are to be incorporated into the base by the Main Contractor.

Each base is to have dimensions to suit the equipment, complete with 4 No. spring isolators with minimum static deflection as scheduled below. Isolators are to have a restraining or positioning device, and anti-vibration pads to prevent the transmission of higher frequencies. The gap under the base is to be at least 40 mm.

External condenser units shall be positioned on the secondary steelwork with acoustic isolation mat inserted between the unit and the steel supports. The matting shall be type Pyramat-30 as manufactured by Allaway Acoustics, and the hardness shall be to suit the weight distribution and as advised by Allaway Acoustics. Or alternative approved approach.

M3.17.2 Pumps in the Plantroom

Each pump is to have flexible connections on suction and discharge, as specified earlier.
#Specifier note, some pumps do not require flexible connections, seek manufacturer’s advice on case by case basis.

Supporting steelwork is to be painted as specified for support steelwork generally. The vibration isolators are to have a minimum static deflection of 25 mm.

Bases are to be type CPF by:

Industrial Acoustics Ltd., www.iac-noisecontrol.com/uk

or equal and approved.

M3.17.3 Pipework

All flow and return heating water pipework within 15 metres (measured along the pipe) of any pump and all pipework within a chiller compound, is to be supported on or from spring vibration isolators, with rubber pads for isolation of high frequencies.

To be installed strictly in accordance with the Manufacturer's recommendations. Springs are to have a minimum static deflection equal to that of the pump(s) and/or chillers (i.e. 25 mm).

Care is to be taken to avoid any bridging of the vibration isolation by hard contact between pipework and the building at any point over the 15 metre lengths of pipework.

Pipework which passes through plantroom walls or soffits is to be provided with a specially-packed sleeve with mineral wool. The mineral wool is to be at least 25 mm thick, 150 kg/ms density.

Care is to be taken to ensure that all gaps are sealed with heavy grout, and the whole should be finished with a liberal application of dense, soft, non-setting mastic.

On all pipes, the sleeve is to project 25 mm above and below the slab, (or 25 mm to either side of a wall). On refrigeration pipes, the sleeve is to form part of the vapour barrier, and the vapour barrier material over the insulation on either side is to overlap, and be vapour-tight to, the sleeve.

M3.17.4 Generally

The manufacturer is to check the suitability of their products for the application. Any changes are to be discussed with the Consulting Engineers.

The foregoing anti-vibration bases and supports are to be supplied by:

Industrial Acoustic Co. Ltd., www.iac-noisecontrol.com/uk

or equal and approved.

The design of the vibration precautions must be upgraded, without additional cost, if necessary to achieve the overall noise design target. (See Clause M4.2).

M3.18 GUARDS

Moving parts of all machines installed by any Contractor are to be protected by guards in accordance with Health and Safety regulations, including all parts fixed at high level to which there is no permanent means of access and all exposed centrifugal fan spindles.

Guards are to have access covers to enable shaft speeds to be measured by a tachometer in line with the shaft.

Guards for fan drives are to be so constructed that the motor can be positioned at any point on the slide rails, and either pulley can be reasonably increased in size, without being fouled by the guard.

M3.19 TESTING AND SCOURING

Upon completion, and before insulation, burying or encasing of each section of pipework on all pipework systems, the Contractor is to subject the section to pressure testing and demonstrate to the satisfaction of the

Consulting Engineers or other approved witness that the section is sound.

The testing procedures are to be in accordance with the "BESA Guide to Good Practice – Site Pressure Testing of Pipework", TR6.

Each witnessed test is to be for a duration of one hour, or such longer time as is necessary to inspect all valves and joints on the section being tested. The decision as to whether or not the section is sound being governed by the rate at which the pressure fails, together with visual inspection of all joints.

All faults discovered during such tests are at once to be remedied by the Contractor at their own cost and expense, and the test re-applied until the Consulting Engineers are satisfied that the section under test is sound.

On completion of the test, the water is to be released and drained completely away as rapidly as possible, the section being then thoroughly sluiced through to ensure the removal of as much dirt and dross as possible before being refilled and put into service.

On lines in which filling points, air release points and drains have not been specified as a permanent feature, they are to be provided by the Contractor to enable the lines to be tested. In these cases, the Contractor is to weld into the crowns and the inverts of the lines at appropriate points 15 mm wrought steel sockets which, on completion of the test, are to be plugged and sealed by welding around the plug.

The Contractor is to include for all temporary works necessary to flush out sections of systems, thus ensuring that the flushing process is effective through all parts of a section of a system. This work will be deemed to include "looping" of flow and return pipework where heat emitters, equipment, etc., are not installed.

The test pressure to be applied all-metal metal pipework systems is to be at least 1.5 times the maximum working pressure.

For systems containing plastic or composite pipes, the test pressure is to be 1.5 times the maximum working pressure and maintain this over a period of 2 hours. The manufacturer's recommended test pressure is not to be exceeded and is to take precedent. Other pipework is to be tested to the pressures recommended in the BESA Guide referred to above.

Each isolating valve on the system is to be tested for tightness immediately prior to installation. Any valve not found tight is to be dismantled, cleaned and faced as necessary until complete tightness is obtained.

The Contractor is to issue to the Consulting Engineers a Certificate of Test for each section tested, signed by all test witnesses.

The Contractor is to supply and fix as necessary all testing equipment, including the air compressor where relevant and is also to supply all necessary water for testing. The Contractor is responsible for checking whether any components of the system are unsuitable for the full test pressure, and for temporarily blanking off the pipes at the points of connection to those components for the duration of the test.

M3.20 OPERATION TESTING AND COMMISSIONING

In addition to sectional and installation testing, the Contractor is to be responsible for carrying out operation testing of all sections of the contract works; for undertaking associated cleaning, setting, calibrating, adjusting, fully commissioning, demonstrating the commissioning results, and handing over the entire Contract Works in a thoroughly complete and operational state to the Consulting Engineers and the Employer.

Procedure is to be generally as follows:

Ventilation Systems, Heating System, Chilled Water System, Run-around System

The systems are to be commissioned in accordance with the relevant CIBSE Commissioning Codes and all BSRIA guidance. All control equipment is to be calibrated, set and adjusted to the entire satisfaction of the Consulting Engineers.

Domestic Water Systems

All hot and cold water services before regular use, are to be sterilized generally in accordance with the procedure detailed in BS EN 806, or as required by the Local Authority or Water Company.

All draw-off points are to be inspected to ensure efficient operation.

Water temperatures are to be measured at draw-off points to confirm compliance with anti-Legionella recommendations of CIBSE TM13.

Plant and Equipment

All plant and equipment is to be commissioned and handed over in a fully operational state, all in accordance with the Manufacturer's recommendations.

Instruments and Control Equipment

All instruments are to be cleaned, inspected and tested under operative conditions and, where necessary or requested by the Consulting Engineers, the Contractor is to call in the Manufacturer of the equipment to ensure that all settings and adjustments are properly effected.

All control equipment whether electrical or otherwise installed as part of the Contract Works is to be commissioned in accordance with the CIBSE Commissioning Code, Series 'C', tested under operating conditions by the Contractor, being set, adjusted, calibrated etc., as necessary, and handed over by the Contractor in first class working order.

Where any such equipment is installed, wired, connected etc., by other Contractors, it is nevertheless the Mechanical Engineering Contractor's responsibility to ensure its satisfactory completion and operation and to make any necessary arrangements with other Contractors concerned for the completion of their work and responsibilities.

Where equipment is of special or proprietary nature, the Contractor is to arrange for setting, adjusting, calibrating etc., to be carried out by the Manufacturers and is to include for this work in their Tender Sum.

Other Services

Any other services installed under the contract are to be commissioned as called for in the Section of the Specification in which they are specified or as requested by the Consulting Engineers during the course of the contract.

M4 HEATING AND COOLING SYSTEMS

M4.1 GENERAL DESCRIPTION

Refer to section M1 for a general description of the heating and cooling systems.

M4.2 PERFORMANCE CRITERIA

M4.2.1 Preface

The design of the systems is to meet the following criteria; if necessary to achieve the criteria, the sizes of plant, emitters, pipework, etc., are to be increased from those specified and/or shown on the drawings. The sizes specified and/or shown on the drawings must not be reduced.

M4.2.2 Heating

The systems are to be capable of maintaining the internal dry bulb temperature in all areas at the temperatures outlined below when the external dry bulb temperature is -4ºC. The systems are to be capable of raising the internal dry bulb temperature to the design temperature in not more than 4 hours after a period during which the building has been maintained at a setback temperature where appropriate of 10ºC, with a constant external dry bulb temperature of -2ºC. (More severe external temperatures will require a longer warm-up period).

Design dry bulb temperatures are to be:

Space	Temperature (°C)
Town Hall	21
Neeld Hall*	N/A see below
WCs*	N/A see below
Kitchen*	N/A see below
Circulation	19

*For these areas the output of the radiators at the lower system temperatures is to match the output of the existing radiators, assuming the existing system operates at 80°C flow and 60°C return. This is the basis of the radiator schedule included in the tender documents.

LPHW conditions are to be as follows:

System	LPHW flow (°C)	LPHW return (°C)
Primary circuit	55	45
Radiators & convector heaters	55	45

Heat loss calculations are to assume a rate of infiltration of external air of not less than:

Space	Infiltration rate (ACH)
Perimeter areas (within 4.5m of external walls)	½
Externally accessed high use areas (entrance areas, corridors etc)	1
Other areas	½

It is stressed that these effectively allow part of the margin for warm-up and for ventilation air, and the Main Contractor should not allow facades, etc., to admit outdoor air at these rates. The Main Contractor should refer to the Architect's specification for the required airtightness of the building and requirements for airtightness testing.

An allowance is to be made for ventilation air, whether mechanical or natural, and also for heat recovery ventilation systems when calculating heating loads.

Heat loss calculations are to assess the U-Values of the construction, based on best practice assumptions and

information about the existing build-ups and systems. Feedback from the client has confirmed that, when operational, the existing systems are able to maintain comfortable temperatures in heating seasons.

In the sizing of the heating system, internal heat gains are to be ignored.

M4.2.3 Noise

The noise level in any occupied area generated by all heating and cooling systems (but excluding ventilation systems) is not to exceed the values outlined in section M4, assuming that windows and natural ventilation louvres/dampers are open. It is anticipated that inertia bases, anti-vibration pipe supports, resilient sleeves through structure, and careful choice of plant will be amongst the measures which will need to be adopted.

Noise to outside from all Mechanical and Electrical Services plant and Lift Equipment operating simultaneously (including ventilation systems) is not to exceed the existing conditions.

Noise to outside must also comply with the Local Authority's requirements in any respect wherein they are more stringent than the foregoing paragraph.

The Contractor must include for the acoustic aspects of the design to be checked, and certified as meeting the criteria, by an independent expert with relevant experience and qualifications. This applies to all acoustic matters, including those specified elsewhere in this Specification. The expert must not be one of the manufacturers of acoustic products used on the project, unless specifically agreed with the Consulting Engineers.

M4.2.4 Pipe Sizing

Pipes must be selected:

- To be not less than the sizes indicated on the drawings
- To limit the necessary pump motor powers (including any specified margins) to those scheduled in the equipment schedule.
- To limit friction to 200 Pa/m maximum
- To limit velocities to 1.0 m/s maximum, or such lower velocities as are necessary to avoid noise generation (see above).

M4.3 BUFFER VESSEL

The Contractor is to supply and install a low pressure hot water buffer vessel for the heating primary circuit. The vessel is to be of stainless steel construction, to meet the following performance criteria.

Volume:	Contractor to determine. The size shall be the smallest recommended by the manufacturer.
Connections:	3 x Primary Flow / Return 1 x Secondary Flow / Return 1 x Vent 1 x Drain
Instruments:	1 x Sensor pockets 2 x Thermometer 1 x Pressure gauge

It is to be fully pre-insulated.

M4.4 PACKAGED AIR TO WATER HEAT PUMPS

Heat pump ASHP1 shall have the following performance criteria, and be controlled by the manufacturer's controller:

Location:	Neeld Bar Courtyard, as indicated on drawings
LPHW water flow temp:	55°C
LPHW water return temp:	45°C
Nominal output:	40 kW (TBC by contractor)
Minimum nominal COP:	2.5
Refrigerant:	R454C*
Preferred Manufacturer:	Mitsubishi or Samsung or equal and approved

*the contractor is to review the installation with the manufacturer to confirm compliance with recommended installation arrangements, prior to placing an order, including avoiding short-circuiting of exhaust and intake air and management of refrigerant leaks. The arrangement indicated in the drawings has been discussed with Mitsubishi by E3.

The contractor is to measure full dimensions of all doors and other openings along the installation access route to the courtyard to confirm that the method of installation is feasible, prior to placing an order.

The machine is to be the manufacturers low noise unit to limit the total sound power level at source per heat pump from the compressors and fans to 45dBA pressure level at 1m, 58dBA power level.

- Exposed metalwork is to be stainless steel.
- Shall be provided as a complete package, and shall include the following integral equipment:
  - Manometer, shut off valves, safety valve, purge and filling valve.
  - Drainage valve, maintenance and compensation valve.
- Shall be installed in strict accordance with the manufacturer's recommendations.
- Shall be supported on purpose made frames (a minimum of 200mm clear off FFL) via anti-vibration mountings as detailed elsewhere in this specification. The purpose made frames shall be supported on anti-vibration mountings onto the structural slab / wall as described earlier in this document.
- Shall be provided as a complete package requiring no external controls.
- Shall be provided with anti freeze valves to protect against freezing. There shall also be a frost protection regime integral to the controls.
- Shall be capable of weather compensation via flow temperature modulation. Outdoor air sensors to be included as part of heat pump package.
- Shall be provided with galvanised welded mesh guards to protect the condenser coils' fins from damage.
- Shall be provided with any valves or other features necessary to enable the refrigerant to be recovered during maintenance, and not released to atmosphere.
- Shall be enabled by its integral controls according to the demand from each zone. The controls system shall carry out sequencing of the heat pumps operating in a cascade arrangement, to include duty cycling.
- Shall have low ambient temperature lock out and freeze protection systems.
- Shall be provided with soft start incorporated.
- Shall be provided with pressure switches and transducers installed to suit the above criteria.
- Shall have integral weather compensation control and timeclock control

In addition to the features above the controls system shall:

- Be wifi connection and allow the capability of remote monitoring via an app.
- Have a room temperature sensor in the Neeld hall.
- Control all primary pumps and the secondary pump.
- Allow adjustment of the set point on a predetermined timeclock basis.

The air-cooled condensers are to have direct-driven fans of the low noise/low speed type (for no loss in capacity). The heat pump is to be suitable for continuous operation, at any heating load up to 100% at any ambient dry bulb temperature from -18°C to 50°C.

All moving parts are to be suitably protected. All electrical work is to be in accordance with the I.E.E. Regulations.

Each machine is to be commissioned by the manufacturers. All refrigerant and other consumables necessary to hand over the machine in perfect working order are to be included. Additionally, the manufacturers are to include for two servicing visits, the first at 3 months after Practical Completion of the Contract, and the second 6 months after the first.

The performance as specified is to be achieved with the heat pump having the clearances from the enclosing walls and pipework, all as shown on the layout drawings.

Manufacturer:

Mitsubushi Electric, les.mitsubishielectric.co.uk

OR

Samsung, samsung-climatesolutions.com

or equal and approved.

M4.5 DX HEATING & COOLING SYSTEMS

The Town hall is to be heated and cooled by 3No DX fan coil units. They are to be arranged in a split or multi-split system. An additional DX fan coil unit system is to replace the existing bar system, to match the load of the existing system, specification below.

The Mechanical Contractor is to supply and install all refrigerant pipework in copper, of sizes to suit the system design and loads. All pipework is to be installed and insulated as detailed elsewhere in this specification. The system is to allow for all connection boxes, Y joints etc. to provide a complete and working installation.

The Electrical Contractor is to provide a fused isolator to the outdoor condensing unit. Wiring to the keypads controllers, and between units is to be installed by the Mechanical Contractor.

The Town Hall system is to be as follows:

Internal ducted units (ref. FCU1, FCU2 & FCU3). Location: Town Hall roof void

- Ducted unit.
- Heating capacity: 4.4kW
- Total cooling capacity: 5.2kW
- The unit is to achieve the stated heating and cooling capacity at low fan speed.
- The sound pressure level for the unit is not to exceed 35 dBA at its rated output.
- The refrigerant is to be R32.
- Dimensions are not to exceed 900 x 732 x 250 mm.

External unit (ref. OU1)

- The external unit(s) are to be capable of delivering the duties stated above for the internal units.
- The sound pressure level in operation is not to exceed 47 dBA at its rated output.
- Dimensions are not to exceed 1100 x 460 x 870 mm.
- To be located externally, adjacent to roof void entrance, as shown on the drawings.

Note – dependent on selected manufacturer, 3No external units may be required (1No per internal unit).

The system is to be provided with a wall mounted control panel as shown on the drawings which is to control all 3 fan coil units. It is to be located in the kitchen, as shown on the drawings, and also have a remote temperature sensor which is to be a thimble type, and discretely positioned near the cupboard where the existing controls are located. The control panel is to allow 7 day time clock control, mode selection, set point adjustment (that can be limited to within adjustable parameters) and fan speed adjustment.

The system is to have a total refrigerant charge not to exceed 2kg.

The Town Hall bar system is to be as follows:

Internal ducted unit (ref. FCU4). Location: Town Hall bar

- Ducted unit.
- Heating capacity: to match existing
- Total cooling capacity: to match existing
- The unit is to achieve the stated heating and cooling capacity at low fan speed.
- The sound pressure level for the unit is not to exceed 35 dBA at its rated output.
- The refrigerant is to be R32.
- Dimensions are not to exceed dimensions of existing unit.

External unit (ref. OU1)

- The external unit is to be capable of delivering the duties stated above for the internal units.
- The sound pressure level in operation is not to exceed 47 dBA at its rated output.
- Dimensions are not to exceed 1100 x 460 x 870 mm.
- To be located externally, adjacent to roof void entrance, as shown on the drawings.

The system is to be provided with a wall mounted control panel, in the same location as the current control panel, and also have a remote temperature sensor which is to be a thimble type, and discretely positioned nearby. The control panel is to allow 7 day time clock control, mode selection, set point adjustment (that can be limited to within adjustable parameters) and fan speed adjustment.

The system is to have a total refrigerant charge not to exceed 2kg.

Condensate drainage for both systems is to be run in copper tube as indicated in the drawings. It is to include a HEPv0 waterless trap.

The system is to be manufactured by:

Mitsubushi Electric, les.mitsubishielectric.co.uk

OR

Samsung, samsung-climatesolutions.com

or equal and approved.

M4.6 COMBINED DEAERATOR & DIRT SEPARATOR

The LPHW and CHW systems are to have a combined temperature differential deaerator and dirt separator. This unit is to be installed at the hottest point in the system. The static head of the system is not to exceed 15m. The unit is to be of mild steel construction. The drain shall be fitted with a quarter-turn ball valve to drain off the collected dirt particles. The whole assembly must have a minimum 5year guarantee.

The unit is to be provided with a proprietary insulation jacket approved by the manufacturer, to be securely fixed to the unit.

To be as manufactured by:

Spirotech UK Ltd, www.spirotech.co.uk

or equal and approved

M4.7 SYSTEM PRESSURISING UNITS

All LPHW and CHW systems are to be of the sealed type. Constant pressure in the heating systems is to be provided by separate packaged pressurisation unit and associated expansion vessel(s). The expansion vessels are to be selected to suit the operational characteristics of the system. Details for tender purposes are given below. The Contractor is to select the units based on the final system water content and operating parameters.

The make-up units are to have the following components:

- Unit pressure, and system pressure gauge
- Mains supply pressure switch.
- System high and low pressure switch.
- Volt free contacts for system failure, low system pressure and high system pressure.
- Backflow protection devices compliant with WRAS regulations and suitable for category 4.
- Digital display showing system pressure.
- Suitable for 230 volts electrical supply

A quickfill connection is not required.

Units as follows:

Ref	PU1
System	LPHW heating system
Approximate Water Content (for tender purposes)	550 litres
Flow Temperature (for pressure calculation purposes)	55°C
Highest Point of system (above the base of the unit)	12 m
Fill Pressure	1 Bar
Assumed ambient temperature of water when non-operational	5ºC minimum
Maximum system pressure under normal operation of the unit at the point of connection to the system	2 Bar
Expansion vessel volume, for tender purposes only	40 litres

The Contractor is to calculate the actual system water content (including radiators and any buffer vessels), and size the expansion vessel accordingly, advising the Consulting Engineers of the details.

To be manufactured by:

Mikrofill Systems Ltd., www.mikrofill.com

Type: refer to equipment schedule

or equal and approved

M4.8 RADIATORS

The Contractor is to supply and install radiators in the positions indicated on the Contract Drawings, of sizes and types as detailed in the Radiator Schedules.

As described above the radiators are to have a total output at the reduced temperature of the heat pump system which matches the output of the existing radiators at a higher system temperature.

The Contractor, prior to placing any order, is to check the space available for each unit, making due allowance for valves and fittings, so that the radiators may be logically accommodated and will not obstruct any access or protrude above window sills, etc. and that positions can accommodate the existing adjacent plug sockets.

The Contractor is to include for removing radiators after fixing, for decoration, and subsequently refixing them.

Radiators to be constructed of not less than 2.0 mm front plate thickness and 1.25 mm rear plate thickness.

Each radiator is to be fitted with an air vent and (if wall-mounted) supported by means of concealed screw-on type wall fixing brackets and spacers at both top and bottom of the radiator. The number of brackets and spacers per radiator is to be strictly in accordance with the manufacturer's recommendation. To be fitted to the walls with screws of minimum length of 50 mm supplied and fixed by the Contractor.

Radiators are to be constructed of steel to withstand a working pressure of 6.0 bar gauge and a test pressure of 9.0 bar gauge. The radiators are to be finished in epoxy polyester powder paint, or approved equal, to RAL colour(s) selected by the Architect.

Where low surface temperature (LST) radiators are specified it is to be designed such that the surface temperature does not exceed 43°C. LST radiators with thermostatic radiator valves are to have the temperature adjustment dial mounted on the outside of the casing.

M4.9 THERMOSTATIC RADIATOR VALVES (TRV)

Each radiator is to be fitted with a tamperproof thermostatic radiator valve on the flow connection and a lockshield valve on the return connection, angle or straight through pattern as required.

Thermostatic radiator valves mounted on low surface temperature radiators are to have their adjustment dials fixed to the outside of the radiator casing.

Thermostatic valves are to have facilities for limiting and locking the temperature set point.

Thermostatic and lockshield valves to have matching finish, either chrome or nickel plated.

The valves are to be in accordance with BS EN 215.

To be as manufactured by:

Danfoss Randall Ltd., www.danfoss.com

Type: RA 2920, with facililities for limiting and locking and temperatures set point.

or equal and approved.

M4.10 PIPEWORK AND FITTINGS

Refer to section M3 for materials and workmanship requirements for each pipework material type.

M4.10.1 Steel Pipework

L.P.H.W. pipework is to be run in steel tube, medium grade to BS EN 10255 with plain ends, or B.S.P.T. up to 50 mm as applicable, unless otherwise shown on the drawings.

M4.10.2 Copper Pipework

All other above-ground LPHW and refrigerant pipework is to be installed in copper tube as specified in section M3.

M4.10.3 Generally

General pipework and fittings installation requirements are to be in accordance with the relevant clauses of Section M3, particularly with respect to welding.

Exact arrangements for the various sections of the services are to be as called for in the Specification and/or shown on the Drawings.

M4.11 ISOLATING VALVES (IV)

M4.11.1 Gate Valves

The following valves are to be provided and fixed as required by the Specification and/or shown on the Drawings. Generally isolating valves are to be provided with handwheels whilst regulating valves are to be of the same pattern but of the lockshield type.

Flanges are to be to BS EN 1092, wherever the manufacturer's standard range allows, whilst screw threads are to be to BSPT. Where valves are bolted to other items, the Mechanical Sub Contractor is to ensure that flanges are compatible.

Types as follows:

Valves 50 mm and under:	Gunmetal or bronze fullway screwed body inside screw. Hattersley Fig. No. 33X, or other equal and approved, for use on steel tube in Plantrooms, ceiling voids, floor voids, service ducts, etc. Hattersley Fig. No. 2402, or other equal and approved, for use where the valve will be on view in user areas.
Valves 65 mm and above	Cast-iron body, gunmetal or bronze fullway inside screw and working parts Hattersley Fig. No. M549PN6, or other equal and approved.

All valves to be as manufactured by:

Pegler Yorkshire (for capillary ends)

Hattersley (for screwed and flanged ends)

or equal and approved.

M4.11.2 Butterfly Valves

At the Mechanical Sub Contractor's option, isolating valves of size 65 mm and larger may be butterfly valves instead of gate valves.

Construction to be: Cast-iron wafer pattern body, aluminium bronze disc, stainless steel shaft, EPDM liner. To be installed between BS EN 1092 flanges. Sizes up to 150 mm to have 'wrench' handle operation with latch to hold the valve's disc in the fully open and fully closed (and intermediate) positions. Sizes over 150 mm are to have worm gear operation to reduce torque and hold any desired disc position from fully closed to fully open. To give tight shut-off when closed against 10 bar pressure, with low-pressure side drained.

All valves to be as manufactured by:

Hattersley

or equal and approved.

Metering Stations are to be provided adjacent to every double-regulating valve (except those with integral flow measurement tappings and those in the by-pass connections of 3-port valves), and in any other locations required by the Specification and/or shown on the Contract Drawings, for measuring water flow rates. Each metering station is to be supplied with two test plugs, complete with captive blank safety caps, to obtain a pressure drop signal. The pressure drop/flow curves are to be provided for all metering stations installed.

Metering Stations 50 mm and under	Gunmetal screwed body. Hattersley Fig. No. 1000 as scheduled (or with compression connectors for 15 mm copper tube where relevant)
Metering Stations 65 mm and over	Cast iron flanged to BS EN 1092 Hattersley Fig. No. M2000 PN.16

To be as manufactured by:

Hattersley.

or equal and approved.

For tendering purposes, sizes of any metering stations which are not scheduled, or stated on the Drawings, are to be assumed to be the same as the pipe in which they are fitted. Sizes are to be confirmed by the Mechanical Contractor to suit the flow rate through the valve, to ensure that the valve operates within the manufacturers recommended parameters.

The Mechanical Sub Contractor is to ensure that straight lengths of steel copper tube, as appropriate, of the same size as the valve, are provided upstream and downstream of each metering station, to the distances recommended by the manufacturer.

M4.12 NON-RETURN VALVES (NRV)

Non-return valves fitted to pump discharge pipes are to be of the swinging-disc type, suitable for installation in horizontal or vertically upward pipes. Body to be of cast iron, and internals to be suitable for the fluid concerned. The disc hinge mechanism is to be suitably trimmed to avoid any metal to metal 'clatter'. Body to have bolted-on cover giving access to disc. To be flanged to BS EN 1092 and suitable for working pressures up to 6.0 bar. Horizontally-mounted valves to have an air-vent in the cover.

All valves to be as manufactured by:

Hattersley. Their Fig. No. M651 PN6

or equal and approved.

M4.13 STRAINERS

Where indicated in this Specification and/or on the Contract Drawings, the Mechanical Sub Contractor is to supply and install 'Y' type strainers with BSPT connections and gunmetal body on sizes up to 50 mm, and flanged cast iron body on sizes 65 mm and above. All units to include stainless steel strainer element and have integral tapped test points either side of the element plus gland cock (for draining purposes) in the cap/cover. Flanged strainers also to incorporate a magnetic core element in the cover plate. Screwed strainers to incorporate a hose-connection gland cock in the plug.

To be as manufactured by:

Hattersley.

Their types:

Up to 50 mm	Fig. No. 907, with screen having 0.75 mm diameter holes
65 mm and above	Fig. No. 920, with screen having 1.5 mm diameter holes

or equal and approved.

M4.14 ANTI-FREEZE VALVES

Anti-freeze valves are to be installed on the flow and return pipes to the heat pump, outdoors where the lowest temperature would be reached if the heat pump is not operating. To be installed in a location protectd from rain, snow and direct sunlight.

The valve is to allow the circuit medium to be drained when it's temperature drops below 3°C, preventing the formation of ice and avoiding potential damage to the system or equipment. The valve is to close upon the temperature returning to 4°C.

The valve is to be constructed from brass and stainless steel, to BS EN 12164 and BS EN 10270-3 as appropriate. It is to have an operating range of 0-65°C and a maximum working pressure of 10bar.

They are to be installed in a vertical position, with the outlet facing downwards to allow the draining water to flow out and free from obstructions. The valve is to be installed to suit the manufacturer's minimum clearances from the ground to avoid the formation of ice.

The location of the valve is to be selected such that heat sources cannot interfere with their function.

The system is to be kept under pressure at all times to maintain function of the valve.

The shape of the connection pipes are to be such that there is no potential to create a trap effect.

To be manufactured by:

Altecnic

or equal and approved.

M4.15 THERMAL EXPANSION

The Contractor is responsible for thermal expansion, including design and provision of equipment. Expansion joints, together with associated anchors and guides, are required to limit expansion. The Contractor is to allow for all such installations. Where possible, provision for expansion is to be provided by expansion loops or changes in direction.

Where space allows, underfloor pipework to trench heaters, etc., is to be arranged with offsets as necessary to absorb expansion movement, but certain runs, do not permit the use of offsets. On these runs, expansion bellows, with associated guides and anchors are to be incorporated.

Guides are to be located at 4 pipe diameters and a further 14 pipe diameters from the bellows' ends, in both directions. Additional guides thereafter are to be at the spacings recommended by the bellows' manufacturer and by the relevant British Standard. Guides are to have PTFE sliding surfaces.

Radiator or trench heater run-out pipes which are underfloor, (i.e. those pipes to which the final radiator or trench heater branch pipes are connected), are to be supported, at the intervals required by Section M3, on skids which have PTFE sliding surfaces.

Suitable skids and guides are obtainable from:

BOA Flexible Solutions Ltd.

or equal and approved.

Run-out pipes are to be located side-by-side in floor voids, as low down as insulation/ skids/guides/bellows permit, to maximise the lengths of final branches up to radiators or trench heaters.

M4.16 WATER TREATMENT

The Contractor MUST employ the services of a water treatment specialist at the start of the Contractor's design development work. The role of the specialist is to safeguard the systems against future problems associated with corrosion, erosion, general fouling, and microbiological fouling. The water treatment specialist shall:

- Review the components and materials, and operating conditions of all heating, chilled water and run around systems proposed.
- Take a sample of mains cold water locally and test it for pH, total hardness, alkalinity, conductivity/total dissolved solids, chlorides, soluble iron.
- Produce a report to include a method statement for an appropriate system cleaning regime. This may include the following activities: flushing, degreasing, biocide wash, removal of surface oxides, final flushing, neutralisation, passivation, and the addition of a corrosion inhibitor and biocide dosing.
- The report recommendations for a suitable chemical cleaning agent for the system, and for a suitable corrosion inhibitor, and a suitable biocide for the systems and any other agents required.
- To include recommendations for future monitoring, testing and maintenance of the system chemistry by the client in the O&M manuals.

Attention is drawn to BSRIA Guide BG 50/2013 "Water Treatment for Closed Heating and Cooling Systems", and BSRIA Application Guide BG 29/2012 "Pre-Commission Cleaning of Pipework Systems". These are to be strictly followed.

M4.16.1 Dosing Pot

The LPHW systems are each to be equipped for manual dosing of the water in the system. A steel dosing pot of 9.0 litre capacity for each system is to be mounted in each plantroom. The dosing pot is to be complete with a 25 mm fill plug (fitted with a suitable tundish), a 15 mm drain plug, and 15 mm N.B. flow and return connections. Both the flow and return connections are to be fitted with 15 mm gate valves.

The flow connection of the dosing pot is to be connected to the flow pipework and the return connection is to be connected to the return pipework, as indicated on the Schematic Drawings.

The connections are to be in 15 mm nominal bore steel tube, insulated as necessary to prevent condensation.

or equal and approved.

M4.16.2 Pre commissioning clean

Before commissioning the chilled water and LPHW systems, the Contractor is to introduce into the systems the chemical cleaning agent as recommended by the water treatment specialist, with solvent at the rate recommended by them, and circulate it for at least one week before draining to waste and flushing with fresh water. Any equipment or plant with an aluminium content should be by-passed during the solvent flushing period.

M4.16.3 Chemical inhibitor

On the final fill, the water specialist's recommended inhibitor and biocide are to be introduced manually at the rate recommended by them to achieve a pH value between 7 and 9. The inhibitor and biocide are to be introduced to all LPHW, Chilled Water and run-around systems.

M4.16.4 Side-Stream Filtration

A side-stream filtration system is unit is to be installed to capture magnetic and non-magnetic particulates from the system.

To be manufactured by:

ADEY, product: MagnaClean CMX

or equal and approved.

M4.17 PSEUDOMONAS

Before filling the system for pressure testing, or subsequently for operation, the Contractor MUST acquaint themselves with the precautions necessary to prevent Pseudomonas from colonising the system.

At the start of the Contractor's design development work, the Mechanical Contractor MUST engage a suitably qualified water treatment company to advise as to installation features and procedures necessary to achieve good water conditions for the life of the systems, and to supervise all flushing and water treatment.

Through that company, the Mechanical Contractor MUST arrange for a suitably qualified laboratory to test all the systems for water quality as frequently and extensively as necessary, and particularly Pseudomonas, and submit the results complete with the Water Treatment Company's commentary on them to the Consulting Engineers. Should Pseudomonas be present, the Mechanical Contractor will be responsible for all subsequent costs in eradicating them.

Attention is drawn to BSRIA Application Guide AG1/2001.1 "Pre Commission Cleaning of Pipework Systems"

M4.18 BS EN 378 COMPLIANCE

The contractor is responsible for verifying that the refrigerant system and leak detection design are compliant with BS EN 378 and that any equipment required for compliance is provided. The leak detection system must be demonstrated to meet the requirements of the system refrigerant, refrigerant volume and room types. They are to request any details necessary to complete that calculation via an RFI if the information is not already available.

A written report demonstrating the system's compliance with BS EN 378 is to be provided to the designer to accompany the technical submissions for any refrigerant system. This is to be carried out in advance of first fix pipework installation.

M4.19 PRESSURE TESTS

All the L.P.H.W. pipework, prior to the application of insulation, boxing-in, erection of ceilings, etc., is to be hydraulically pressure tested as specified in Section M3.

M4.20 PIPEWORK INSULATION

The L.P.H.W. pipework must, after satisfactory pressure testing, be insulated in accordance with the requirements specified in a later section.

M4.21 COMMISSIONING OF CIRCULATORY SYSTEMS

The entire L.P.H.W. system is to be commissioned in accordance with the CIBSE Commissioning Code, Series W, for Water Distribution Systems. Contractors should note that the system is not sectionalized for flushing, and that while there is a widespread provision of commissioning aids such as flow measuring valves, they have been omitted where they have been considered to be of only marginal benefit to the commissioning process.

The procedures in the Code will therefore need modification, but only to the extent that the design of the system varies from the typical design assumed by the Code. The following particular requirements are also to be incorporated:

M4.21.1 Adjustment of Pump Duties

When balancing the LPHW and CHW systems, the speed of the pumps is to be altered so as to achieve the required flowrates in all areas of each system with all the valves on the index circuit of each system fully open.

The system is initially to be balanced with all motorised isolating valves open, i.e. with all heating and cooling loads connected. It will then be necessary for the Water Systems Commissioning Engineer and the Controls Systems Commissioning Engineer to co-ordinate their activities to ensure that the control of pump speeds, as loads are connected/disconnected, is functioning properly, i.e. that the correct water flowrates are delivered to suit the connected loads. When the systems are being demonstrated, the Consulting Engineers will select several combinations of loads for each pumped system, and ask for the flowrates at the pumps, and at sample branches around the building, to be measured and shown to be satisfactory.

M4.21.2 Generally

When the Mechanical Engineering Contractor is satisfied that all systems are working satisfactorily, and the commissioning records are available, they are to offer the systems for witnessing and acceptance. Any system found to be at variance with the Specification are to be re-adjusted and corrected before being offered again for acceptance. The Employer and the Consulting Engineers reserve the right to charge the Mechanical Engineering Contractor at their normal hourly rates for the time abortively spent in witnessing systems that prove to be unacceptable.

M4.22 RADIATOR SCHEDULE

Ref	Location	Output (kW)	Dims in mm (L x H x D)	Type	Notes
R.1	Neeld Main Hall	2.142	1400 x 900	T33	
R.2	Neeld Main Hall	2.754	1800 x 900	T33	
R.3	Neeld Main Hall	2.754	1800 x 900	T33	
R.4	Neeld Main Hall	2.754	1800 x 900	T33	
R.5	Neeld Main Hall	2.754	1800 x 900	T33	
R.6	Neeld Main Hall	2.488	1200 x 900	T33	
R.7	Neeld Main Hall	2.488	1200 x 900	T33	
R.8	Neeld Main Hall	2.488	1800 x 900	T33	
R.9	Neeld Main Hall	2.488	1800 x 900	T33	
R.10	Neeld Main Hall	2.488	800 x 900	T33	
R.11	Neeld Store Room	1.683	1100 x 900	T33	
R.12	Neeld Store Room	1.683	1100 x 900	T33	
R.13	Neeld Male WC	0.573	700 x 600	T22	
R.14	Neeld Female WC	0.427	600 x 500	T22	
R.15	Neeld Kitchen	0.918	600 x 900	T33	
R.16	Neeld Main Hall	2.488	1000 x 2200	T33 V	
R.17	Neeld Main Hall	2.488	1200 x 900	T33	
R.18	Neeld Main Hall	2.488	1800 x 900	T33	
R.19	Neeld WC Corridor	1.377	1600 x 700	T22	

Notes to schedule:

1. This schedule is preliminary, subject to design validation and site measurement by the Contractor.
2. All radiators to be white in colour, to be confirmed with client prior to placing order. Samples are to be provided as required by the client.
3. Locations of radiators are to be coordinated with existing plug sockets. Proposed dimensions of radiators are to be verified on site alongside plug socket locations prior to an order being placed.
4. Outputs are at the design LPHW flow and return conditions of 55/45°

5. Type T33 to be Plan radiator, triple panel horizontal radiator.
6. Type T22 to be Plan radiator, double panel horizontal radiator.
7. Type T33 V to be Plan XV radiator, triple panel vertical radiator.
8. Tapping locations to suit installation proposals.

Manufacturer:

Hudevad, hudevad.com

or equal and approved.

M5 VENTILATION

M5.1 GENERAL DESCRIPTION

Refer to Section M1 for an overview of the ventilation systems proposed for the building.

M5.2 PERFORMANCE CRITERIA

M5.2.1 Preface

The design of the systems is to meet the following criteria; if necessary to achieve the criteria, the sizes of plant, ductwork, etc., are to be increased from those specified and/or shown on the drawings. The sizes specified and/or shown on the drawings must not be reduced.

M5.2.2 Ventilation Rates

Unless otherwise specified, adequate ventilation to be provided to comply with the following, where applicable

- Building Regulations
- CIBSE Guide B

It is the responsibility of the Mechanical Contractor to issue a schedule of proposed ventilation rates to the Consulting Engineer for comment prior to progressing the system design.

The design occupancy for each space is outlined in section M1. Design flow rates are to be 10l/s per occupant.

M5.2.3 Duct Sizing

Ducts must be selected:

- To be not less than the sizes indicated on the drawings
- To limit the necessary fan motor powers (including any specified margins) to those scheduled in the equipment schedule, and the requirements of building regulations, whichever is lower.
- To limit friction to 1 Pa/m maximum
- To limit duct velocities to the recommendations of BESA DW144 and DW172
- To limit velocities to as are necessary to avoid noise generation (see noise control section). The table below (adapted from CIBSE guide B) is to be used as a guide, see CIBSE Guide B for original and further information. Project Acoustician's recommendations are to take precedence over the values given in the table below.

Noise Rating (NR)	Velocity (m/s)		
	Main Ducts	Branch	Runouts
25	3	2.5	<2
30	4	3.5	<2
35	6	5.5	3
40	7.5	6	3.5

M5.3 NOISE CONTROL

M5.3.1 Internal Noise Levels

The maximum internal noise levels for the project are as follows:

Room	**Maximum NR level**
Function spaces	30
Circulation	40

Toilets	40

The noise level is the maximum permissible served by the ventilation system of which the attenuator forms part of the air route (whether the route is ductwork, or ceiling voids, or a combination of the two). It is to take into account any other mechanical engineering systems which might contribute to the noise level in the spaces concerned. All routes by which noise reaches the spaces are to be taken into account, including breakout and structure-borne noise. The individual criteria stated in other clauses are minima, which must be upgraded if necessary.

Where no NR level is scheduled, for a room or area, the NR level is to be NR40 maximum.

M5.3.2 External Noise Levels

Attenuators are to be provided on all air intake and exhaust ducts to limit the external noise level to the minimum of 45dB(A) at 3m from any item of plant or air intake / exhaust, or any conditions provided by planning.

M5.3.3 Crosstalk Attenuators

Crosstalk attenuators are to limit the intelligibility of sound passing between rooms. The sound level of intruding speech is to be 5 - 10dB lower than the design sound level in the receiving room.

Speech sound power levels are to be used as follows:

Frequency (Hz)	63	125	250	500	1000	2000	4000
Sound Power Level (dB)	69	72	77	80	80	75	76

Performances are for the attenuators alone, and are not to take into account the additional attenuating effect of ceiling voids, ductwork, etc.

The manufacturer shall be:

Caice www.caice.co.uk

Or

Allaway Acoustics www.allawayacoustics.co.uk

or equal and approved.

M5.3.4 Attenuators

The Contractor is to design and provide attenuators to meet the acoustic requirements of the project. Pressure drops are to be kept to a minimum such that the specific fan power of the air handling units is compliant with Building Regulations.

The attenuator sizes shown on the Drawings are indicative. It is the responsibility of the Mechanical Engineering Contractor to ensure that attenuators are selected to meet the specified room noise limits (taking into account noise from ALL sources). The design NR figure for each room is not for the ventilation system alone, but for the total noise. If the attenuator sizes deviate from those indicated then the Mechanical Engineering Contractor is to ensure that they can be accommodated into the design and at no additional contract costs from Ductwork Sub-Contractors.

The successful Contractor is to arrange for their attenuator supplier to fill in details of octave band insertion losses in the columns of the attenuator schedule, and for the Contractor's acoustic expert to confirm that they are adequate to achieve the specified NR levels with all plant operating, before the attenuators are manufactured. The figures and the expert's written confirmation are to be forwarded promptly to the Consulting Engineers.

Attenuators in kitchen extract systems are to be Melinex lined.

Particular attention is to be paid to installing attenuators to avoid turbulent flow conditions through the attenuator. Appropriate distance between attenuators and fans, branches, louvres, and other fittings are to be provided. Transitions onto attenuators are to be gradual.

The manufacturer shall be:

Caice www.caice.co.uk

Or

Allaway Acoustics www.allawayacoustics.co.uk

or equal and approved.

M5.3.5 Generally

All noise and vibration control measures are to be independently verified by an acoustic expert, employed by the Contractor, at an early stage in the Contract, to ensure that suitable plant, equipment, attenuators, etc., are ordered. A detailed report is to be obtained from the expert, and forwarded to the Consulting Engineers.

Particular attention must be paid to the packing of sleeves around pipes and ducts where they pass through structure which is being relied upon for sound attenuation.

For the avoidance of doubt, it is stressed that the provision of suitable plant, equipment, attenuators, supports, etc., to meet the performance criteria, and the verification by an acoustic expert are the responsibility of the Contractor, and no variation in the Contract Sum will be allowed in respect of these items.

The sizes shown in the schedules and drawings are to be considered minimum permissible sizes. They are not to be reduced without agreement with the Consulting Engineer. They are to be increased if required to meet the acoustic performance requirements described above.

M5.4 AIR HANDLING UNITS

The Air-Handling Units are to be designed and supplied, complete with all necessary accessories, by the Manufacturer. Individual requirements for air handling units are scheduled in the air handling unit schedule. This section describes general requirements.

Refer to section M3 for details of anti-vibration measures required.

M5.4.1 General Construction

The construction of the units is to be generally double-skinned, with inner and outer steel sheets, all pre-galvanised; the void between the skins is to be filled with thermal and acoustic insulation. This insulation is to be completely isolated from the airstream. The structure is to be rigid, and is to be designed to prevent any drumming of the panels. The unit, when assembled in its final location, is to be completely airtight. Each unit is to be complete with rolled steel support channels along its full length on both sides, and (if the manufacturer deems it necessary) in intermediate locations. Those units which are to be externally mounted are to be completely weatherproof, with a 'roof' designed to shed water, and to prevent ponding. A watertight skirt is to be provided around all four sides of the base of each unit, to shed water outside the support piers so that no water penetrates beneath the air-handling units.

Every unit is to be designed to be bolted together without access to the underside.

The overall dimensions of each AHU are not to exceed those stated in the following clauses. Each unit is to be delivered to site in sections as necessary to suit the limited access routes, hoisting requirements, etc. These sections are to be bolted together in situ, using the manufacturer's standard jointing frames and gaskets.

When in transit, sections are to be protected from the weather with heavy-duty polythene; this covering is to be maintained in good repair until the units are finally assembled.

Each unit is to be provided, at the manufacturer's works, with plugged test holes to enable the static pressure differential to be measured across each fan, filter, attenuator, diffusing screen, cooling coil, eliminator, heating coil, and both the supply and extract airways in each heat exchanger.

"Left" and "Right", as used in the detailed description of individual air handling units in the following Clause, mean the side of the item as seen looking in the direction of airflow through the air handling unit. "Access" side means the side on which access doors are to be located, and (unless otherwise stated) the side to which coils are to be withdrawable, (which may differ from the side on which coils are connected).

SPECIAL NOTE – AHU to be Anthracite in colour, to be confirmed with the client prior to placing an order. Samples to be provided to the client as required.

M5.4.2 Fan Sections

This section is to be read in conjunction with the requirements for fans generally, specified later.

The fan in each unit is to be capable of providing the specified airflow when the static pressure external to the ductwork installed under this Contract is as specified, and when the filters within the unit have a resistance halfway between their 'Clean' resistance and their 'Dirty' resistance.

The Contractor is to include for changing pulleys and belts after balancing the systems, to obtain the required total airflow with minimum regulation of dampers, (At the normal motor speed, in the case of variable speed fans).

A hinged access door is to be provided on the Access Side of each fan section. Every fan section is to be designed to enable the fan within it to be completely replaced, in sections if necessary, through the access door.

Each fan is to be wired to an external isolator on the side of the AHU. The isolator is to have an auxiliary contact which opens before the main power contacts open. Motors for belt-driven centrifugal fans are to have a margin of available power of 25%, at the rated airflow, with half-dirty filters.

The fan motors are to be 4-pole unless stated otherwise. Where stated, they are to be suitable for speed control via inverter drives. For variable speed fans (both direct drive and belt driven) the fan and motor is to be selected to meet the required duty at an inverter frequency of no greater than 45Hz. No fan is to have a Fan Static Efficiency of less than 65%.

Where belt-driven centrifugal fans are provided, they are to be mounted on a common base frame with the motor, which is to be complete with slide rails to allow adjustment of the motor location and changing of pulley sizes. The fans are to be sized to operate near to their maximum efficiency. The Contractor is to allow for changing the belt drive to achieve the required airflow during commissioning.

Each AHU is to be sized, and the fan selected, so that the input power to the fan motor, when the AHU is operating against the specified external resistance, does not exceed the maximum specified. If this requires any relaxation of the specified maximum dimensions, the manufacturer is to state exactly what relaxation is required when tendering and also what the input power would be, with the most efficient fan obtainable, if the maximum dimensions are observed.

Vibration entering the structure must be minimized and to this end:

- Every fan's base frame is to be mounted on high-deflection spring anti-vibration mounts, each anti-vibration mount also having a 'resilient' pad to minimize the transmission of the higher frequency vibrations.

- The flexible discharge connections on each fan are to be selected and installed so as to avoid by-passing of the anti-vibration mounts.

- All fans are to be statically and dynamically balanced to the highest standard obtainable.

M5.4.3 Filters

Supply air is to be filtered by a bank of bag filter units, grade F6 or better, and/or a bank of panel filters, grade G4 or better, or as specified for each unit. Each bank is to be installed in an airtight holding frame; these frames are to be assembled into a rigid bank. Filters to be side-withdrawal unless otherwise stated. All necessary rivets, compound, and stiffening bars are to be supplied and installed in accordance with the filter manufacturer's recommendations. The whole filter housing is to form an integral part of the supply air-handling unit. The face velocity across the filter bank is not to exceed 2.0 m/s.

Filters are to be removable for maintenance and are not to be obstructed by pipework or other equipment.

The pressure drop across each bank of filters is to be indicated on an inclined gauge manometer, which is to be fitted on the outside of the section enclosing the filter, and tubed to the upstream and downstream sides of the filter. Each filter is to be fitted with an inclined tube manometer marked 'Dirty' at the pressure differential included in the fan performance calculations. At the contractor's option, a different method may be proposed to better suit the selected unit.

Filters are to be clean at the time of handover, and a spare set of filters is to be provided. No variation is to be allowed for replacement of dirty filters resulting in ventilation systems commissioned prior to the building being clean of dust.

M5.4.4 Dampers

Where dampers are fitted in mixing chambers or otherwise, they are to be complete with linkage and suitable for operation by the number of actuators specified. Each damper is to have its own actuator(s); for example, fresh air and recirculation dampers in mixing sections are not to be interlinked. Damper spindle bearings are to be designed to give low resistance to rotation, are to be sealed-for-life, and are to be suitable for perpetual actuation of dampers.

M5.4.5 Spacer Plenums

To be incorporated where considered necessary by the manufacturer, in addition to any specified location.

M5.4.6 Roof mounting

The contractor is to allow for suitable roof mounting system for the AHU to suit the type and fall of the roof area where the AHU is to be located. Any additional mounting fittings as recommended by the AHU manufacturer are to be included in the AHU package.

M5.4.7 Automatic Controls

Air handling units are to be provided complete with their own controls installation, to include sensors, actuators, inverter drives, control panel, and user interface, and any other components necessary to achieve the specified operation. These are to be factory-installed by the AHU manufacturer. Suitable wireways are to be provided to all items through the access side of the AHU, to external weatherproof conduit boxes. All items are to be located so as to be accessible for maintenance.

Valves are to be fitted on site by the Mechanical Engineering Contractor. Damper actuators are to be factory-installed inside the AHU.

A weatherproof emergency stop button is to be provided and installed adjacent to the access door to the fan chamber, for site wiring to the control panel.

M5.5 AIR HANDLING UNIT DETAILS

AHU1: Town Hall Air Handling Unit

General requirements

Location	External
Support	Floor mounted
Configuration	Supply and extract, inline, end connections, supply below extract
Access	Adjacent, as shown on drawings
Specific fan power (W/l/s)	1.58
Maximum length (mm)	2295
Maximum depth (mm	1025
Maximum height (mm), excluding support channels / base.	1096
Heat recovery	Type: thermal wheel Temperature efficiency: 80.5%
Passivhaus certified	No
Frost protection	The unit is to operate down to an outdoor air temperature of -10°C without suffering frost damage to any component, and without the need for a frost coil.

Supply section

Atmosphere side connection	Ducted
Motorised damper	Parallel action. Multi-position. Blade seals to minimise leakage when closed.
Atmosphere side attenuator	External to unit
Bag filter	Yes
Panel filter	No
Fan	Type: EC motor Flow rate: 400l/s External resistance: 200Pa Single phase motor Inverter controlled: Yes Motor power: 0.35kW
Room side attenuator	External to unit

Extract section

Room side connection	Ducted
Room side attenuator	External to unit
Bag filter	Yes
Panel filter	No
Fan	Type: EC motor Flow rate: 400l/s External resistance: 200Pa Single phase motor Inverter controlled: Yes Motor power: 0.35kW
Motorised damper	Parallel action. Multi-position. Blade seals to minimise leakage when closed.
Atmosphere side attenuator	External to unit

Acoustics

The sound power levels of the unit are not to exceed dB:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k	Total (dBA)
Supply air	75	71	68	68	69	67	63	60	73
Fresh air intake	69	66	59	58	47	45	39	38	58
Surroundings	67	60	48	50	39	37	32	32	50
Extract air	69	66	60	58	47	46	43	42	58
Exhaust air	75	71	68	68	69	67	63	60	73

Controls

Refer to equipment schedule

Manufacturer and Model

Unit to be as Swegon Type Gold Size 50.

Swegon Limited, www.swegon.co.uk
Contact: Edward Sweet

or equal and approved.

M5.6 DUCTWORK

Ductwork manufacturing drawings must be submitted for approval prior to installation.

Unless otherwise specifically stated in this Specification, or noted on the drawings, ductwork is to be in accordance with the requirements of the Heating and Ventilating Contractors Association's Standard Specification for Sheet Metal Ductwork, DW/144, published in 1998.

SPECIAL NOTE – Ductwork to be clad in grey cladding, to be confirmed with the client prior to placing an order. Samples to be provided to the client as required.

The information required in Part 1 of DW/144 is as follows:

2.1: Pressure Classification

All ductwork: Low (Class A)

2.2: Leakage Classification

All ducts: Class A

Note that joints to terminal units, attenuators, etc., are to be to the same standards. Any leaks giving an audible noise in occupied areas are to be stopped.

2.3: Positive and Negative Pressures

Within limits of Table 1 of DW/144

2.4: Materials

Unless otherwise noted on the drawings, or stated in this Specification, all ductwork is to be made from hot-dipped galvanised sheet, to HVCA DW/144.

3.1: Access Inspection Openings

To be as Section 20 of DW/144, except as modified by the following requirements:

Note that the term "Access Door", or "Access Panel", "A.D." or "A.P.", as used on the drawings is synonymous with the term "Access Panel" as used in DW/144, unless the Drawings or this Specification require the Access Door to be hinged. Hinged Access Doors are to be similar, but with hinges on one vertical side, wedge-type latches, and a compressible gasket all round so as to be airtight. Any openings required beyond those called for by DW/144 are to be as shown on the drawings. Access openings in insulated ducts are themselves to be of insulated double-skin construction.

Additionally, access panels are required, for cleaning and inspection purposes, at intervals of not more than 6 metres on all header ductwork, and in each branch duct (unless it has an open end). All access panels unless otherwise noted on the drawings, are to be 450 mm x 375 mm, or as near to these dimensions as the duct size and location permits.

Where access openings are used by personnel for entering the duct, the duct's floor is to be reinforced to take the weight of a person.

The Contractor is to ensure that access openings are carefully located to co-ordinate with associated builderswork access apertures, ceiling grids, etc.

Access is to be provided in accordance with BESA TR19 "Internal Cleanliness of Ventilation Systems".

Test holes for pressure measurement are required in the locations given in Clause 20.6 of DW/144, and also:

- upstream and downstream of every fan.
- upstream and downstream of every filter, (in addition to the points of connection of the filter's manometer).

Test holes for velocity scans, (and similar holes for velocity/temperature scans), are required to enable all the following to be measured:

- the total airflow handled by each fan.
- the total airflow in each branch.
- the total airflow and temperature profile entering and leaving any heating or cooling coil.

Test holes for velocity measurement are to be in accordance with Clause A3.1.6 of the C.I.B.S.E. Commissioning Code, Series A. Exact locations of test holes are to be determined by the Contractor's Commissioning Engineer, to achieve the most accurate readings.

3.2: Cleaning Access

See 3.1 above

3.3: Regulating Dampers

As called for by this Specification, and/or the Drawings.

3.4: Fire Dampers

As called for by this Specification, and/or the Drawings.

3.5: Smoke Dampers/Combination Smoke and Fire Dampers

As called for by this Specification and/or the Drawings.

3.6: Bendable/Flexible Ducts

As called for by this Specification and/or the Drawings.

3.7: Flexible Joints

At all connections to fans and as called for by this Specification and/or the Drawings, in accordance with

Section 26 of DW/144, (except where higher requirements are indicated on the Drawings).

4.1: Air Leakage Testing

All ductwork in accordance with DW/144 Appendix 'A' for the leakage class(es) stated in item 2.2 above. (Except final circular fresh air supply branches to individual fan-coil units, or to local groups of fan-coil units from the rectangular ductwork, and except fan-coil unit discharge ducts, which need not be tested).

Additionally all ductwork as required by Building Regulations Approved Documents L2A and L2B on systems served by fans with a design flow rate greater than 1000l/s.

The Contractor is to provide results of air leakage testing to the building control officer as required by Part L of the building regulations.

4.2: Protective Finishes

All extract ductwork exposed to weather, and all Kitchen Exhaust ductwork from the outlet of the fan's discharge attenuator, to the roof termination, is to be galvanised after manufacture. To be in accordance with DW/144 Appendix 'E', and BS EN ISO 1461:2009.

Damaged areas of any galvanising, if acceptable to the Consulting Engineers, shall be made good in accordance with Clause 27.3.1 of DW/144. If not acceptable, the ductwork section shall be replaced.

4.3: Fire-Rated and Smoke Extract Ductwork

Where ductwork is specified or shown on the Drawings as being constructed or enclosed so as to be fire-resistant, it is to be encased by the Mechanical Engineering Contractor (unless the Drawings state that the fire-rated enclosure is to be by the Main Contractor or Builder). The fire-rated encasement is to comprise 'Conlit' or other approved proprietary materials, applied in full accordance with the manufacturer's recommendations, to achieve the required fire resistance, and the finished result is to be to the satisfaction of the Local Authority's Building Control Officer. Access panels are to be formed, to give similarly fire-rated access through the Conlit to duct access panels, etc., as necessary.

4.4: Internal Thermal/Acoustic Lining

Refer to detailed Specification clauses.

4.5: Thermal Insulation

To be supplied and fitted, in accordance with a later Section of this Specification.

Insulation with inherent vapour seal must be provided on all supply ductwork, fresh air intake ductwork, and fan-coil units' discharge ducts and plenums.

Ductwork conveying cooled air must have the vapour seal continuous through brackets and supports, using hardwood bearers equal in thickness to the insulation, with the vapour barrier between the bearer and the support/bracket.

4.6: Special Supports

As specified elsewhere in this Specification and/or shown on the Drawings.

4.7: Attachment to Building Structure

As specified elsewhere in this Specification and/or shown on the Drawings.

4.8: Air Terminal Units

Air Terminal Units are to be required by this Specification and/or as shown on the Drawings.

If not otherwise specified or indicated on the Drawings, it is to be assumed that ceiling-mounted extract grilles or diffusers which are rectangular or circular, and which will fit into a nominal 600 mm x 600 mm aperture in the ceiling grid, will be supported by the ceiling grid, but all supply diffusers and ductwork (whether rigid, bendable, or flexible) must be independently supported. All other types of grilles must be provided with independent supports.

The borders of all grilles and diffusers must be designed to integrate with the type of ceiling, and avoid unnecessary cutting of ceiling tiles and components.

4.9: Ductwork Layout Drawings

No special requirements, but the Drawings must give sufficient details to allow the Mechanical Engineering Contractor to ensure co-ordination of services.

4.10: Other Requirements

Turning vanes are to be provided in rectangular ductwork wherever the duct direction changes by 30º or more by means of a square bend. For changes of direction between 30º and 80º, single-skin blades shall be used. For 81º to 90º changes of direction, double-skin proprietary vanes shall be used. In all cases, the leading and trailing edges of the turning vanes are to be parallel to the duct as it enters and leaves the bend. Vanes shall be free from sharp edges or other sources of noise.

Unless otherwise specifically shown on the drawings, radius bends without splitters are in all cases to have a 1D throat radius. 0.5D throat radius fittings are not to be used without the express agreement of the Consulting Engineers, and then only where lack of space renders a 1D throat radius impractical.

All ducts except those on view in occupied areas, are to be identified with symbols complying with Appendix "B" of DW/144. Symbols are to be at intervals not exceeding 6 metres, and more frequently as necessary for clarity where confusion might otherwise exist.

Ductwork is to be run generally parallel with walls and ceilings with not less than 100 mm space between wall, ceiling or floor and finished face of duct. During fabrication and installation the ductwork is to be kept free of debris, rodents, etc., with all openings sealed with strong plastic sheet or similar at all times when work is not in progress. On completion it shall be cleaned down both outside and inside (where practicable) by brushing, vacuum cleaning, use of grease and oil remover, etc., before commissioning.

Any ductwork with an aspect ratio of more than 3:1 is to be constructed of 1.6 mm thick sheet (or thicker, if required by DW/144).

All branches are to have a 'shoe' (unless coned branches are specifically shown on the Drawings).

Transitions are to be as gradual as possible within the physical limitations.

Where the requirements of this Mechanical Engineering Specification exceed those of DW/144, this Mechanical Engineering Specification is to prevail.

M5.7 DUCTWORK AIR LEAKAGE TESTING

Part L2 of the Building Regulations has requirements for air leakage testing of ductwork. The Mechanical Contractor is to familiarise themselves with these requirements and carry out testing as required. Written test results are to be provided to the building control officer no less than 1 week before practical completion.

M5.8 FLEXIBLE AND BENDABLE DUCTS

Flexible or bendable ducts are to be used only as described below.

M5.8.1 General Requirements

Where flexible or bendable ducts are installed, they are to comply with the insulation, airtightness, and

pressure testing requirements that apply to the rigid ductwork system of which they form a part. Flexible and bendable ducts must be stored and handled with care to prevent distortion or damage. Any bends in the ducts as installed must have a minimum throat radius of one duct diameter.

Lengths of flexible ducts are not to exceed 250 mm in accordance with DW/144. Supports are to be so spaced as to prevent sagging or vibration of the ducts. Ducts are to be installed so they are taught – no sags, restrictions or tight bends will be allowable. Ductwork sizes are to be the same as the nominal spigot sizes scheduled (but of a diameter to give a close overlapping fit to the spigot).

Flexible and bendable ducts are to have a Class 0 spread of flame and a fire integrity of 15 minutes.

They are not permissible on kitchen extract systems.

Joints to ductwork and equipment are to be made with sealant and blind rivets in accordance with the manufacturer's instructions, ensuring that no sharp edges are presented to the airstream.

To be supported with the manufacturer's type OBO brackets, complete with neoprene liners. Support spacings not to exceed 1.0 metre.

At the Contractor's option, bendable/flexible ducts may be factory-insulated to the standards specified later. If so, joints at ends must be carefully close-butted and vapour-sealed, and the finished thickness of the insulation is to meet the thicknesses specified.

M5.8.2 Flexible Ducts

As a general rule flexible ducts are forbidden. They are only to be used where specifically agreed with the Consultant. Flexible ducts are to be made from multi-ply aluminium for maximum flexibility consistent with the fire resistance.

Where used, flexible ducts to be Regaduct type AL, or equal and approved. Note budget alternative flexible ducts are NOT likely to be approved.

M5.8.3 Bendable Ducts

Locations of bendable ducts are at interconnections between:

- Fan-coil units and linear diffusers (except where acoustic flexible ducts are required, as scheduled below).
- Hard ducts on either side of a hole through a beam, where an offset is necessary.
- Any other non-rigid lengths between fixed-position ducts or spigots (where specifically agreed with the Consulting Engineer in advance of installation).

No other flexible ducts are to be used, except in cases where the Contractor considers they cannot fit a bendable duct. In these cases approval from the Consulting Engineer is to be received before installation of flexible ductwork can commence.

Bendable ducts are to be made from spirally-wound aluminium strip. They are to be Regaduct type PAK, or equal and approved. Note budget alternative flexible ducts are NOT likely to be approved.

Manufacturer

To be as manufactured by:

Rega Metal Products Ltd., www.rega-uk.com/

or equal and approved.

M5.9 DAMPERS GENERALLY

Except as stated below, Volume Control Dampers, (generally denoted "VCD" on the drawings), are to be opposed-blade, multi-leaf dampers, with spindles horizontal (unless this would result in the damper being awkward to operate). Wherever possible, dampers are to be prefabricated, with aerofoil section blades, which have a resistance to airflow not exceeding 5 Pa when the blades are fully open and the air velocity across the full face of the damper is 5.0 m/s. Blades are to be made of stainless steel with spindles supported in free-running long-life bearings.

Linkages are to be outside the airstream. Degree of opening of damper to be indicated, and damper position to be lockable. Damper frame to be airtight and robust. Connections to square or rectangular ducts to be flanged. Connections to circular or flat-oval ducts to be spigotted.

Where ducts incorporate separate dampers on either side of a mid-feather, or if the location of the duct precludes the incorporation of a pre-fabricated damper, custom made dampers are to be installed. These are to have double-skinned galvanised steel blades and are to be in accordance with DW/144.

Any Isolating Dampers, (generally denoted 'I.D.' on the drawings), are to have aerofoil section stainless steel blades, which have a resistance to airflow not exceeding 8 Pa when the blades are fully open and the air velocity across the full face of the damper is 5.0 m/s. Seals are to be provided as necessary to ensure that air leakage when the damper is closed does not exceed 20 litres/sec/m² damper face area when the pressure differential across the damper is 1000 Pa. In other respects to be as specified for Balancing Dampers.

To be manufactured by:

Actionair Equipment Ltd., www.actionair.co.uk/

Advanced Air (UK) Ltd., www.advancedair.co.uk/

Gilberts Ltd., www.gilbertsblackpool.com

or equal and approved.

M5.10 FIRE DAMPERS

Fire Dampers are to be installed wherever a duct passes through a fire resisting wall, floor or roof, whether shown on the drawings or not, except:

- In kitchen extract systems.
- Where the ductwork on one side of the wall is shown as fire clad.

SPECIAL NOTE: The Contractor is to obtain the fire strategy drawings from the client during the detailed design stage. In the absence of this information, fire dampers are to be installed wherever ductwork passes through a wall or floor.

Fire Dampers, (generally denoted FD on the drawings), are to be of the curtain type, with shutter blades constructed of stainless steel, and are to provide a 2-hour fire resistance. The shutter is to be spring-loaded to ensure positive closure, and the fire damper is to be operated by an integral fusible link, rated at 68ºC - 74ºC. The damper casing is to be completely airtight. When closed, the ends of the shutter blades are to be sealed with a flexible stainless steel gasket on the inside face of the frame.

Unless otherwise specified or noted on the drawings, all fire dampers are to have their blades clear of the airstream when open, and are to have no projections into the airstream.

To be Actionair type 201, 301, or 401, as appropriate (or the other manufacturers' equivalent, if equal and approved).

Each fire damper is to be complete with the manufacturer's installation frame, which is to comply with DW/144. Where no ductwork is to be connected, the dampers are not to be fitted with ductwork spigot connections on the side(s) on which ductwork is not required.

To be manufactured by:

Actionair Equipment Ltd., www.actionair.co.uk/

Advanced Air (UK) Ltd., www.advancedair.co.uk/

Gilberts Ltd., www.gilbertsblackpool.com

or equal and approved.

Any Fire dampers which allow the passage of air through cavity barriers in ceiling or floor voids are to be installed by the Mechanical Engineering Contractor, with rigid support from the soffit, before the cavity barriers are installed by the Main Contractor. These fire dampers do not need installation frames where no ductwork is connected.

Fire Dampers in apertures greater than 1 metre wide are to consist of an assembly of two fire dampers, the joint being fitted with the manufacturer's closure strips on both sides, (unless the manufacturer has certificated tested fire-dampers of greater width).

Fire Dampers in walls and floors which are relied on for acoustic separation are to be installed as shown on the typical detail on the Drawings. The mineral wool is to be close-packed to avoid any paths through which noise can leak through. The steel frame and angle are to be provided by the Mechanical Engineering Contractor.

M5.11 ROOF COWLS

All roof cowls are to be provided by the Mechanical Contractor and the air pressure drop is not to exceed 5 Pa at the rated airflow.

M5.12 DUCTWORK SUPPORTS AND BRACKETS

Ductwork throughout the building is generally to be equipped with supports in accordance with DW/144.

Tenderers are advised to inspect the Architectural and Structural drawings, to ensure that they obtain sufficient knowledge of any trimmer steels, etc., that they may need to provide in order to support the ductwork. Attention is drawn to further requirements in the general specification.

It should be particularly noted that wherever supply ductwork has vapour-proof insulation, supports for that ductwork must accommodate the vapour barrier, as previously specified.

The Mechanical Engineering Contractor is to pay particular attention to neatness of appearance in the case of any ductwork which is exposed to occupants' view.

Particularly attention should be made to the requirements of DW 154 for the support of plastic ductwork, to ensure the system is fully supported throughout its entire length.

M5.13 DIFFUSERS AND GRILLES

Diffusers and grilles are to be provided where shown on the Tender Drawings, and as scheduled. General requirements are described in this section.

M5.13.1 Adjustable Swirl Diffusers

Adjustable Swirl Diffusers, and their associated plenums, are to be similar in all respects to the Fixed Swirl Diffusers, except that the angle of swirl-inducing blades is to be automatically adjusted by a concealed thermoscopic element. The blades are to deliver air horizontally, except when the supply air temperature exceeds a given value. This value is to be adjustable between 18ºC and 25ºC, and is to be set during commissioning to 24ºC initially. Above the set value, the air is to be projected downwards.

M5.13.2 Generally

Unless otherwise stated, all diffusers and grilles for which there are no individual balancing dampers in their branches off the ductwork, are to have integral balancing dampers. Additionally, integral dampers are to be included where required by the Specification and/or Drawings, irrespective of there being branch dampers. (Dampers are not required in grilles and diffusers which are connected to fan-coil units).

Except where stated otherwise, all grilles and diffusers to be finished in a stove enamel to a standard B.S. colour to be agreed with the Architect.

All plenum boxes are to be internally lined, over all surfaces, with Armaflex insulation, not less than 12 mm thick, and having a Class 'O' surface. This requirement is to provide acoustic and thermal benefits, and additionally is to prevent the plenum box being visible through the face of the grille.

Noise generated at grilles and diffusers is to cause a noise level (direct and reverberant combined) in the rooms concerned which is at least 5 dB below the noise design target NR spectrum, (see Clauses M5.2).

The fixing method of all grilles and diffusers is to be concealed from view. Visible screws through the faces of flanges are especially to be avoided, unless specifically agreed with the Architect.

The Contractor is to check the details of each type of suspended ceiling, and is to provide those details to the manufacturer of the grilles and diffusers to ensure that the grilles/diffusers are manufactured with suitable borders, and to dimensions that suit the particular ceilings.

All as manufactured by

Gilberts Ltd., www.gilbertsblackpool.com

or equal and approved.

M5.14 GRILLE SCHEDULE

Ref	Location	Type	Size (mm)	Quantity	Airflow(l/s)	Pressure (Pa)	Horizontal Throw (m)	Vertical Throw (m)	Notes
SG1	Town Hall	GSJ	400	3	266	<10	3.8	1.8	
SG2	Town Hall	GSJ	400	2	200	<10	3.8	1.8	
EG1	Town Hall	GSJ	400	1	300	<10	-	-	Option to omit and replace with perforated plate only, as EG2.
EG2	Town Hall	Mesh finish only	595	3	300	<10	-	-	Optional alternative – as noted on drawings.

Where,

- SG = Supply Grille
- EG = Extract Grille
- Type GSJ, is a thermally adjustable swirl diffuser as Price Engineering DVE-3-T. Or equal and approved.
- All grilles to be RAL colour as selected by client.

All as manufactured by

Price Engineering, priceengineering.co.uk
OR
Gilberts Ltd., www.gilbertsblackpool.com

or equal and approved.

M5.15 ATTENUATOR SCHEDULE

Ref	Type	Minimum Size (mm), L x W x H	Airflow(l/s)	Pressure (Pa)	63	125	250	500	1000	2000	4000	Notes
ATT1	A	600 x 450Ø	400	<10	To achieve noise levels stated in M5.3							AHU1 exhaust
ATT2	A	600 x 450Ø	400	<10								AHU1 intake
ATT3	B	1220 x 450 x 450	400	<10								AHU1 extract
ATT4	B	1220 x 450 x 450	400	<10								AHU1 supply

Where type A is a circular attenuator, and type B is a rectangular attenuator.

The manufacturer shall be:

Caice www.caice.co.uk

Or equal and approved

Notes

1. Refer to earlier in this specification for acoustic design criteria and requirements for attenuators.

2. The attenuator resistance figures indicated are the figures used in the overall system resistance calculations and are therefore maxima.

3. The design parameter for cross-talk attenuators is as specified earlier.

4. The dimensions in the above schedule are the minimum allowable and are not to be reduced. If necessary to achieve the acoustic requirements the attenuators are to be lengthened at no cost to the contract.

M6 SOILS, WASTES, CONDENSATE DRAINS AND SANITARY WARE

M6.1 GENERAL DESCRIPTION

See Section M1 for a general description.

No works are anticipated to the below ground drainage or rainwater systems. The underground drainage and rainwater systems, and also above-ground rainwater systems, will be provided and installed by others under a separate sub-contract.

M6.2 PAYMENT OF FEES

Where necessary the Contractor is to give all notices to the Environmental Health Officer's Department at the Local Authority and pay all fees arising there under in connection with testing of the installations.

M6.3 COMPLIANCE WITH REGULATIONS

Every installation is to comply in all respects with and give notices required by: the Current Editions of the British Standard Specifications, the Local Authority Bye-Laws, the Water Supply (Water Fittings) Regulations 1999, and the Factory Acts Regulations in force at the time of tendering.

The Contract is to include for all fees payable under this heading and ensure that all fittings etc. are tested and stamped before delivery to the site.

M6.4 LAYOUT OF WORK

The Contractor is to exercise care and consideration when installing the Contract Works and is to plan all pipe runs to fit into their surroundings as neatly and unobtrusively as possible. The Contractor is to position all pipework so that it does not clash or interfere with other units, equipment, or services.

The exact position of pipe runs, equipment, etc., may require to be adjusted from the positions shown on the Contract Drawings to suit final arrangements of room layouts, architectural features, etc. The Contractor is to be responsible for checking details with the Main Contractor, and where a pipe run or equipment position appears to be incorrect, to immediately notify the Consulting Engineers who will agree details and confirm to the Contractor in writing.

The workmanship is to be in accordance with the best accepted practice and the installation work and configuration of pipework, etc., is to be carried out in accordance with current Code of Practice BS EN 12056.

Any pipe or fitting or item of equipment which the Consulting Engineers considers to be incorrectly installed is to be removed and correctly refixed at the expense of the Contractor.

M6.5 GENERAL REQUIREMENTS FOR PIPEWORK

Pipes and fittings are to be of smooth bore, sound and free from defects.

All joints made in pipework and to appliances are to be airtight and watertight, and are to remain so during use. Care must be taken to ensure that no jointing material projects inside the bore of the pipe. Some flexibility is desirable where there is a possibility of movement in a pipeline or between the pipe and appliance and provision is to be made in the assembly of the pipework to accommodate and control thermal movement.

Where pipes pass through walls or solid floors, they are to be accommodated in sleeves of inert material which are to extend through the full finished thickness of the floor or wall and be secured against movement. Where necessary sleeves are to be fireproofed and intumescent collars are to be provided. Refer to the general specification for requirements.

M6.6 CONDENSATE DRAINAGE

All heat exchangers capable of effecting latent cooling are to be provided with condensate drain lines in copper pipework, which include:

- Air handling unit and fan coil units cooling coils (both chilled water and DX).
- Heat recovery air handling units' condensate trays and associated equipment.

Pipework is to be sized so as to be able satisfactorily to drain at least twice the calculated peak flowrate at any point. Additionally, no condensate pipe is to be smaller than 22 mm.

All drain lines are to be designed and installed so as to enable free flow to the point of discharge, by gravity fall.

Drain lines from all heating, cooling or heat recovery coils are to incorporate a water trap of sufficient depth to withstand maximum surge in pressure due to fan start-run operation, and to incorporate an air break, i.e. open drain or tundish. As an alternative to the air break, the drain lines can incorporate a Hep_vO trap instead.

Rodding eyes and suitable access are to be provided for all condensate drainage pipework.

Drain lines from fan coil units are to have an air break formed by the units' extended drain tray. All drain connections after the air break are to incorporate a suitable running trap prior to connection into the building's drainage system. A means of keeping this trap sealed must be incorporated, e.g. drain from drinking fountain, hand basin or similar, not WCs or urinals. As an alternative to this running trap, the condensate drain may discharge, with a suitable air-break, over a trapped gully, or may incorporate a Hep_vO trap as outlined above.

All connections into the building systems are to comply with BS EN 12056 and the Building Regulations.

Traps directly connected to plate heat exchangers are to be constructed from transparent material to enable any build-up of sediment or debris to be monitored and easily removed. VRV room unit drains are excluded from this requirement; their drainage prior to the air break is to be integral with the unit.

M6.7 OVERFLOW PIPES

Overflow pipes and warning pipes are all generally to be as described in Section M4 of this Specification.

M6.8 TRAPS

All traps to the sanitary fittings within this Specification are to be supplied and fitted within the Mechanical Engineering Contract. All traps to have a minimum 75 mm seal. Wash hand basin traps (unless otherwise noted) are to be of the anti-syphon type. Other traps are only to be of the anti-syphon type where noted as such on the Drawings.

Condensate drains (excluding those from flues) should have Hep_vO traps, in line, in order to prevent smells from the stacks entering the room via the condensate pipework.

M6.9 PROTECTION DURING BUILDING CONSTRUCTION

Every care should be taken to protect the work and to prevent the entry of foreign matter into any part of the system during construction. Openings should, therefore, be kept sealed with purpose made fittings.

Special care should be taken with pipe systems having ring seal joints to prevent deflection of the joint after the pipework is assembled. Pipework should not be allowed to carry any external load either during or after construction.

All access covers and cleaning eyes should be fitted at the time of installation and be finally fixed and sealed after testing.

M6.10 GRADIENTS

The gradient of branch discharge pipes must be uniform and adequate to drain the pipe efficiently. Pipe sizes,

gradients, and pipe capacities are all inter-related but generally minimum gradients of 20 mm/m should be achieved, with 10 mm/m minimum for fan-coil units. Gradients must be steeper where stipulated on the Drawings. Any runs requiring shallower gradients are to be discussed with the Consulting Engineers in good time before the relevant pipework is installed.

Particular care must be given to discharge pipes from wash hand basins, to ensure that they comply with the recommendations in the British Standard.

M6.11 ACCESS FOR MAINTENANCE

Access covers and cleaning eyes are to be positioned wherever necessary to allow cleaning and maintenance equipment to be easily inserted into the pipework and to permit cleaning or clearing all parts of the systems. Any access covers or cleaning eyes shown on the drawings are also to be incorporated as required.

All soil, waste, and vent stacks are to have access doors, 500 mm above the lowest slab level to enable the rodding of drains and stack or, where necessary, at a higher distance above the slab, to make rodding practicable.

All cleaning access points on copper wastes to be of the screwed type, comprising a Conex blank cap with rubber washer. Equivalent provision is to be provided on polypropylene and PVC pipework.

All cleaning access plugs at ends of cast iron pipes and 100 mm copper pipes to comprise a cast iron Ferrule with brass Screw Cap caulked into a soil pipe socket.

All wire balloons at termination of ventilating pipes to be of copper to dimensions given in B.S.416 Part 1, 1990.

M6.12 TESTING

On completion of all works, the installations are to be tested by the Contractor. Tests are to be carried out in accordance with the procedure detailed in BS EN 12056. The Contractor is to provide a written certificate of the installation having been fully and satisfactorily tested.

The Contractor is also to carry out any testing required by the Local Authority's representative.

M7 THERMAL INSULATION

M7.1 GENERAL DESCRIPTION

See Section M1 for a general description.

M7.2 GENERAL REQUIREMENTS

As a general rule there shall be no bare un-insulated pipe, duct, fitting or item of equipment anywhere on any of the systems, unless specifically indicated in this specification.

An insulation wherever used in the complete installations shall have a Green Guide Rating of A or A+. The following material types are to be used:

- Pipework: rigid phenolic foam insulation, as Kingspan Tarec or equal and approved, including insulated pipe supports. Density 37kg/m3, thermal conductivity 0.025W/m/K at 10°C (for pipework up to 120°C operating temperature). For other applications refer to manufacturer's recommendations. SPECIAL NOTE: mineral wool/mineral fibre or other insulation materials will not be accepted as an alternative.
- Ductwork: glass fibre mineral wool not to exceed 48kgm/3.
- Water tanks: glass fibre mineral wool not to exceed 80kg/m3.

All insulation is to be installed in accordance with:
- B.S.5422:2023
- Building Regulations Approved Document L 2021, Volume 1 or 2, as applicable.
- WRAS guidelines.

Insulation thicknesses are to be as required by the above documents.

M7.3 INSULATION AND CLADDING SPECIFIC REQUIREMENTS

The insulation and cladding shall be applied as scheduled below:

Heating and chilled water services

Situation	Insulation	Cladding
Plant rooms	Yes	Ventureclad, natural aluminium colour, up to 2.5m above floor level only.
Risers	Yes	Ventureclad, natural aluminium colour, up to 2.5m above floor level only.
Store rooms, cleaner's cupboards, and other spaces ordinarily concealed from public view.	Yes	Ventureclad, natural aluminium colour, up to 2.5m above floor level only.
Ceiling voids and floor voids	Yes	No
Externally above ground	Yes	Ventureclad, black colour
On view to occupants – public "front of house" areas	Yes	Ventureclad, colour to Client's choice
Heating pipework view to occupants – public "front of house" areas, final 15mm branch runs to radiators, only where explicitly agreed with the Consulting Engineer.	No	No
Where exposed on view in rooms with LST radiators	Yes	Ventureclad, colour to Client's choice

Ductwork

All ductwork inside the Town Hall roof void is to be fully insulated as below.

External ductwork on the building side of the air handling unit shall be insulated.

External ductwork on the intake/exhaust side of the air handing unit may be uninsulated.

Situation	Insulation	Cladding
Plant rooms	Yes	Ventureclad, natural aluminium colour, up to 2.5m above floor level only.
Risers	Yes	Ventureclad, natural aluminium colour, up to 2.5m above floor level only.
Store rooms	Yes	Ventureclad, natural aluminium colour, up to 2.5m above floor level only.
Ceiling voids and floor voids	Yes	No
Externally	Yes	Ventureclad, black colour
Attenuators in insulated ductwork	Yes	(as ductwork)
On view to occupants – public "front of house" areas	Yes	Ventureclad, natural aluminium colour
On view to occupants – public "front of house" areas, where explicitly agreed with the Consulting Engineer, and there is no risk of condensation.	No	No

Other services

Service	Insulation	Cladding
Drainage pipework	No	No
Fuel gas pipework	No	No
Overflow / warning pipework	No	No
Refrigerant pipework	Yes	Specified later

M7.4 WORKMANSHIP GENERAL REQUIREMENTS

Insulation is to be installed in a neat manner, and particular attention to neatness is required in Plant rooms and other areas where it is exposed to view. The method of installation of each type of insulation is to be strictly in accordance with the manufacturer's recommendations.

All insulation is to be self-finish, and where a Class '0' surface is required the Contractor is to be responsible for ensuring that no paint or other covering is applied to the surface of any portion of the insulation.

All pipes and ducts are to be insulated individually, and not in groups of two or more, and there is to be a minimum of 25 mm clearance between finished surfaces, and 25 mm finished clearance from any building surfaces unless otherwise specified. The Mechanical Engineering Contractor is to ensure that all pipes and ducts are installed so as to meet this requirement. Any variation from this requirement must have the approval of the Consulting Engineers prior to the installation of the pipework or ductwork.

Care is to be taken that no insulation or cladding by-passes or interferes with any vibration isolation provisions.

The Mechanical Engineering Contractor will be responsible for the protection of all equipment during the application of insulation and is promptly to remove all waste, surplus material, and packaging from the Site. All uninsulated plant and equipment is to be thoroughly cleaned and left clear of fouling by insulating materials.

No thermal insulation work is to be put in hand until after the satisfactory completion of leakage testing, as specified elsewhere.

The Mechanical Engineering Contractor is to state on the Summary of Tender the name of the firm or firms to whom the insulation work will be sub-contracted. The firm selected must be of good repute, and a member of the Thermal Insulation Contractors Association.

M7.5 PIPEWORK INSULATION

Heating pipework, hot water services pipework, and all types of cold water service pipework are to be insulated as specified earlier. Finish to be Class 0 as required by the Building Regulations, Part E, to the satisfaction of the Local Authority's Building Control Officer. Sections are to be clog butted, and all longitudinal and circumferential joints are to have an overlap of facing material of not less than 50 mm. Overlaps to be well sealed with an adhesive approved by the insulation manufacturer and conforming to the Class 0 requirements. Sections are to be taped into mitred lengths to run in uniform thickness around all bends, sets, and tees.

M7.5.1 Pipework cladding

Where specified as having cladding applied, the sheeting is to be installed in accordance with the manufacturers recommendations. Proprietary elbow and tee pieces are to be used.

M7.5.2 Exposed Externally

Pipework externally is to be insulated as for external services as described in M8.3.

M7.5.3 Wall / floor penetrations

Where water pipes pass through walls and floors, the Contractor is to supply and install an insulated sleeve in each hole which:

- Provides fire separation between the rooms or floors, where the wall or floor is fire-resistant. Refer to the General Specification regarding fire sealing of penetrations. The detail of the sleeve is to be agreed with the fire sealing Specialist Subcontractor.
- Does not diminish the acoustic attenuation of the wall or floor.
- Provides insulation which complies with B.S.5422, for the appropriate table.
- In the case of cold or chilled water, maintains the vapour barrier on the outer surface of the insulation, resisting any abrasion during insertion of the sleeve.

M7.5.4 Flanges and fittings

All flanges and fittings on insulated pipework are to be fully insulated, irrespective of size.

M7.5.5 Valve jackets

All valves, and other fittings in insulated pipework which require access for maintenance are to be enclosed in removable insulated jackets. All jackets are to have mineral fibre insulation, and heavy duty Velcro.

The jackets are to be as:

Advanced Industrial Solutions

Their "Standard" jacket (for internal use). Their “Weather pro” jacket, in black, (for external use)

At the Contractor’s option, valves and fittings may alternatively be enclosed in insulation (and cladding) as specified earlier, with handles and other elements required for maintenance purposes protruding from the insulation.

M7.5.6 Pipe supports

Where pipes are insulated, the insulation manufacturer’s insulated pipe supports are required. This applies to all services including domestic hot and cold water, chilled water and LPHW.

M7.5.7 Pumps

Pumps are to be insulated by installing the pump manufacturer's proprietary insulation casing. Alternatively if this is not available the Contractor is to provide a purpose made insulated case or jacket.

M7.5.8 Prevention of Pinhole corrosion

Pipework insulation shall have inherent corrosion resistance and shall not cause or encourage pinhole corrosion in pipework of any material, and particularly copper, carbon steel and stainless steel.

Insulation shall include passivated, impregnated liners with passivating foam additives producing a fully bore coated product. Cutting and use of fittings shall not adversely affect the performance of the passivating/bore coating properties of the insulation. The Contractor is to obtain confirmation in writing from the manufacturer that the insulation does not necessitate the use of a protective coating on copper or steel pipework and does not present and enhanced corrosions risk in comparison with other insulation materials. Before applying insulation all pipework shall be cleaned and prepared in line with the requirements of the insulation manufacturer. It shall be clean, dry, free of corrosive substances and building debris. A complete vapour barrier is required, fully sealed at all joints with aluminium foil tape. All insulation shall be installed strictly in accordance with the manufacturer's instructions.

M7.5.9 Insulation thickness

Phenolic foam insulation thicknesses are to be compliant with the documents referred to in section M7.2, to provide protection against heat loss, heat gain, condensation and freezing. Additionally thicknesses are to be no less than the following (for pipework with silver cladding, emissivity factor = 0.05):

Steel pipework nominal bore (mm)	LPHW Heating (75°C)	Domestic Hot water (60°C)	Cold water and chilled water - internally	Cold water and chilled water - externally
15	20 mm	20 mm	20 mm	45 mm
20	20 mm	20 mm	20 mm	30 mm
25	25 mm	25 mm	25 mm	25 mm
32	25 mm	25 mm	25 mm	25 mm
40	30 mm	25 mm	25 mm	25 mm
50	30 mm	30 mm	25 mm	25 mm
65	35 mm	30 mm	30 mm	30 mm
80	35 mm	30 mm	30 mm	30 mm
100	35 mm	35 mm	35 mm	35 mm

Copper pipework – round up to the next higher steel size, except for 15 mm, where 15 mm steel size should be used.

Pipework with low emissivity cladding (i.e. matt black) – insulation thicknesses to be increased accordingly to match the heat loss from low emissivity cladding in the table above.

If alternative insulation products are provided with a different thermal conductivity, the thickness is to be altered to match the performance in the table above.

M7.6 REFRIGERATION PIPEWORK INSULATION

All refrigeration copper pipework is to be insulated with Armaflex closed-cell elastomeric insulation with a Class '0' finish, with thermal conductivity not exceeding 0.037 W/m°K at 20°C, 19 mm thickness. The insulation is to be unsplit and continuous and with no butt joints between the mains and the units except as necessary for valves. Alternatively should the Armaflex section be split the insulation must be glued using the manufacturer's non-flammable grade of adhesive, and the joint is also to be continuously sealed by a Class '0' adhesive tape, all as recommended by the manufacturer. The ends of the insulation are to be neatly finished at a minimum distance from the appliance served.

For the refrigeration pipework, attention is to be given to forming a continuous vapour barrier using the closed cell insulation type. Any valves and fittings are to be insulated with oversize sections, cut and shaped as detailed in the manufacturer's installation manual.

The manufacturer's insulated pipe supports are to be used. Pipes are to be supported using pipe clamps or saddles. Cable ties are not to be used.

Where external, the insulation is to be resistant to UV degradation and be robust against bird and vermin attack as Armaflex Tuffcoat or equal and approved.

Where exposed in areas with a high risk of physical damage, cable trays carrying refrigerant pipework are to have an inverted lid installed, to completely enclose the pipework, to provide additional mechanical protection. This includes external pipework on the roof.

M7.7 DUCTWORK INSULATION

All ductwork insulation is to be supplied and installed under this Contract. Ductwork to be insulated is as stated in the Description of Work in Clause M7.1 and general description in Clause M1. All ductwork insulation thickness is to be to BS 5422.

The material to be used is glass mineral wool duct insulation, faced with a strong, glass-reinforced aluminium foil/kraft laminate, conforming to Class 0 of the Building Regulations, Part E, to the satisfaction of the Local Authority's Building Control Officer.

The surface is to provide a vapour seal. To be fixed with the adhesives recommended by the insulation manufacturers, and all joints are to be carefully sealed with adhesive tape, as recommended by the insulation manufacturers. The finished result is to comply with the Class 0 requirements just specified.

Rectangular duct insulation is to be rigid, cut to fit on site so that the top and bottom pieces overlap the sides. Insulation beneath the duct is to be additionally supported as recommended by the manufacturers. Insulation density to be 48 kg/m^3, giving a thermal conductivity of 0.032 W/m°K at 10°C mean temperature.

Circular and flat oval rigid and bendable ducts are to receive flexible insulation. Insulation density to be no less than 24 kg/m^3, giving a thermal conductivity of 0.038 W/m°K at 10°C mean temperature. Galvanised wire mesh is to be applied overall, to all flexible insulation, around the full circumference, for additional support and reinforcement of the insulation. Bendable ducts may be insulated by the duct manufacturers, in which case the wire mesh may be omitted.

Wherever possible, ducts are to be installed so as to enable the insulation to be applied without being permanently compressed. Any exceptions to this requirement must have the prior approval of the Consulting Engineers.

It may be necessary for thinner insulation to be used on ducts wherever they pass through or close under beams, pipes or other obstructions. The thinner insulation is not to extend more than 100 mm either side of the obstruction. The surface is to be made good to the surface of the adjacent thicker insulation, so as to maintain the vapour seal throughout. Great care is to be taken to avoid damage to insulation where ducts pass through or under beams.

All joints are to be close-butted.

M7.7.1 Ductwork cladding

Where specified as having cladding applied, the sheeting is to be installed in accordance with the manufacturers recommendations.

M7.7.2 Ductwork Acoustic Insulation

Where indicated on the drawings, ductwork acoustic insulation is to comprise a minimum of 50 mm medium density (45 kg/m^3) mineral wood covered by continuous sound barrier material of surface weight not less than

10 kg/m^2. The barrier material is to be completely isolated from the duct wall, form a completely sealed envelope around the duct and be non-resonant.

M7.7.3 Insulated Ductwork Brackets

The Contractor is to draw the Ductwork Sub-Contractor's particular attention to the types of support for insulated ductwork with a vapour barrier. The method required is indicated in Section M5 of this Specification. Any insulator supporting the duct must comply with the Class 0 requirements of the Building Regulations.

M7.8 PAINTING OF PIPEWORK BEFORE APPLICATION OF INSULATION

As stated in the Section M3.11.

M7.9 IDENTIFICATION

All pipes and ductwork are to be identified in strict accordance with BS 1710, with colours to BS 4800 and are to be further marked with the direction of flow. Such identification is to be applied at intervals not exceeding 15 metres, and more frequently as necessary for clarity where any confusion might otherwise exist.

APPENDIX A

The following schedule is appended:

- Equipment schedule

Project: Chippenham Town Hall
Subject: Equipment Schedule
Doc Ref: 4887 MSC01
Revision: T01
Date: 14/11/2025

General notes

1. All manufactureres quoted are equal and approved. All selections are preliminary selections at RIBA Stage 3.
2. "Power requirements" column denotes electrical power wiring by E contractor
3. All controls wiring by controls specialist
4. Refer to detailed description of operation for controls.
5. ."Metered" denotes submeter required on final circuit serving plant item

Equipment specification						Power requirements						Control requirements	
Ref	**Description**	**Location**	**Dimensions in mm**	**Duty / Rating**	**Specification notes**	**Phase**	**Power**	**SC**	**FLC**	**Wired to**	**Meter-ed**	**Manufacturers control scope**	**BMS control scope**
HEATING													
FCU1	Fan Coil Unit	Town Hall Roof Void	900 x 732 x 250	4.4kW heating, 5.2kW cooling Nominal COP = 4.4 Nominal EER = 4.2	Mitsubishi PEAD-M50JA2	Fed by external unit						Local wall mounted room controller. To include timeclock. One controller serves all 3 indoor units.	None
FCU2	Fan Coil Unit	Town Hall Roof Void	900 x 732 x 250	4.4kW heating, 5.2kW cooling Nominal COP = 4.4 Nominal EER = 4.2	Mitsubishi PEAD-M50JA2	Fed by external unit						Local wall mounted room controller. To include timeclock. One controller serves all 3 indoor units.	None
FCU3	Fan Coil Unit	Town Hall Roof Void	900 x 732 x 250	4.4kW heating, 5.2kW cooling Nominal COP = 4.4 Nominal EER = 4.2	Mitsubishi PEAD-M50JA2	Fed by external unit						Local wall mounted room controller. To include timeclock. One controller serves all 3 indoor units.	None
CU1	Condensing Unit	Town Hall Roof	1100 x 460 x 870	To serve FCU1-3	Mitsubishi PUZ-ZM140VDA R32	1	4.1kW	11.9A	18.98A	DB	Yes	Controlled via indoor controller.	None
FCU4	Fan Coil Unit	Town Hall - bar	TBC	To match existing	As manufactured by Mitsubishi or Samsung or equal and approved	Fed by external unit						Local wall mounted room controller. To include timeclock.	None
CU2	Condensing Unit	Town Hall Roof	TBC	To match existing, to suit FCU4	As manufactured by Mitsubishi or Samsung or equal and approved	1	TBC	TBC	TBC	DB	Yes	Controlled via indoor controller.	None
ASHP1	Air Source Heat Pump	Needd external	1750 x 740 x 1710	40kW Nominal COP = 2.85	Mitsubishi CAHV	1	14.03kW	44.0A	23.7A	DB	Yes	Manufacturers control scope. To include weather compensation controls and timeclock.	None
P1	ASHP1 heating primary circulation pump, single head	Cheese hall plant room	TBC	Contractor to size	Manufactured by Grundfos or equal and approved	1	TBC	TBC	TBC	DB	No	Controlled via heat pump controller	None
P2	Heating secondary circulation pump, twin head	Cheese hall plant room	TBC	Contractor to size	Manufactured by Grundfos or equal and approved	1	TBC	TBC	TBC	DB	No	Controlled via heat pump controller	None
PU1	Pressurisation unit	Cheese hall plant room	270 x 250 x 112	14l/min	Mikrofill 3	1	30W peak	1A	1A	DB	No	Complete with manufacturer's controls	None
VENTILATION													
AHU1	Air Handling Unit	Town Hall Roof	2295 x 1096 x 1025	400l/s @ 200Pa HR eff = 80.5% SFP = 1.58W/l/s	Swegon Gold F RX 005	1, 3-wire	0.8kW	10A	3.5A	DB	Yes	Base level ventilation, boost on CO2. Monitoring via return air sensor. PIR sensor in room to start unit. Fire alarm interface to be included.	None