

QODA

Accor Tribe Hotel

Mechanical Technical Specification – Rev T2

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50-10-00/120 Internal gravity rainwater drainage system

System outline

50-10-00/120 Internal gravity rainwater drainage system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the Internal Gravity rainwater drainage system, including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Design and Installation of flat roof rainwater outlets and rainwater down pipes to level 8 and level 9 roof areas.

Rainwater from the roofs shall be collected by a network of vertical pipework starting at the roof outlets at each roof level, falling internal in dedicated vertical risers to connect to underground rainwater drainage as designed and specified by the Civil Engineer.

There shall be sufficient rainwater outlets to adequately drain the roofs with additional provision for overflow in the event of blocked outlets or extreme rainfall events.

All horizontal pipework shall be designed to maintain a self cleansing velocity.

All Rainwater pipework and roof outlets shall be designed in accordance with BS EN 12056-3

Access shall be provided at all horizontal changes of direction, pipe size or gradient. Access doors shall be provided on the vertical rainwater pipes above any offsets, at connection to drain and at every three floor levels.

All rainwater pipe shall be acoustically insulated as required in accordance with the recommendations of the acoustician

All rainwater pipework shall installed in Cast Iron except where installed over sensitive areas, where the pipework shall be provided with prefabricated drip trays as described on the drawings, and the pipework shall be HDPE jointed with electro-fusion jointing sleeves

- **System performance:** 50-10-00/210 Design of gravity rainwater drainage system.
- **System manufacturer:** Submit proposals.
- **Rainwater outlets:** 90-10-20/302 Gravity rainwater outlets.
- **Internal rainwater pipework:**
 - **Rainwater downpipes:**

Downpipe types: 90-10-20/348 High density polyethylene (HDPE) above ground drainage pipelines and 90-10-20/344 Cast iron above ground drainage pipelines to BS EN 877.

Jointing: As recommended by pipework manufacturer and Electrofusion sleeve weld.
 - **Supports:**

Brackets and clips: 90-10-20/340 Brackets and clips for above ground drainage pipelines.

Fixings: Contractor's design.

- **Insulation:** 90-90-40/330 Mineral wool pipe section insulation.
- **Warning pipes:** Required.
- **System accessories:** 90-10-60/405 Pipe sleeves and 90-90-55/430 Identifying pipework.
- **Execution:** 50-10-00/610 Installation of rainwater drainage generally and 50-10-00/658 Installing rainwater pipe identification.
- **System completion:** 50-10-00/812 Rainwater drainage internal pipework test – England, Wales, Ireland and Northern Ireland;
50-10-00/810 Testing rainwater drainage generally;
and 50-10-00/830 Documentation.

System performance

50-10-00/210 Design of gravity rainwater drainage system

- **Design:** Complete the design of the rainwater drainage system.
- **Standards:** In accordance with E&W Building Regulations Approved Document H, H3, Section 1;
In accordance with Ireland Building Regulations Technical Guidance Document H, Sub-section 1.5, clauses 1.5.1–1.5.2;
In accordance with NI Building Regulations Technical Booklet N, Section 3, clauses 3.1–3.7;
and To BS EN 12056-3, clauses 3–7, Annex A and National Annexes.
- **Design parameters:**
 - **Roof and gutter construction and finish:** Refer to Architectural Specification
 - **Design life of building:** Refer to Architectural Specification
 - **Design rate category:** Refer to Architectural Specification
 - **Available capacity of existing below ground drainage (maximum):** Submit proposals.
- **Requirements:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Products

90-90-55/430 Identifying pipework

Shared by: 50-10-00/120 Internal gravity rainwater drainage system; 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS 1710.
- **Identification type:** Adhesive colour bands.
- **Execution:** 90-90-55/660 Installing identification on pipework.

Execution

50-10-00/610 Installation of rainwater drainage generally

- **Collection and distribution of rainwater:** Complete, and without leakage or noise nuisance.
- **Electrolytic corrosion:** Avoid contact between dissimilar metals where corrosion may occur.
- **Plastics and galvanized steel pipes:** Do not bend. Plumb and/ or true to line.
- **Allowance for thermal and building movement:** Provide and maintain clearance as fixing and jointing proceeds.
- **Protection:** Fit purpose-made temporary caps to prevent ingress of debris. Fit access covers, cleaning eyes and blanking plates as the work proceeds.

50-10-00/658 Installing rainwater pipe identification

- **Position:** Junctions, both sides of slabs, bulkheads and wall penetrations.

90-90-55/660 Installing identification on pipework

- **Application of basic identification colour:** Coloured bands as BS 1710.
- **Safety colour identification:** On or next to the colour bands.
- **Information:** Colour bands as BS 1710.
- **Direction of flow:** Indication arrow;
Indication arrow and the word FLOW or the letter F;
and Indication arrow and the word RETURN or the letter R.

System completion

50-10-00/810 Testing rainwater drainage generally

- **Dates for testing:** Give notice.
- **Period of notice (minimum):** Submit proposals.
- **Pipework:** Complete, and fix securely. Make free from defects, obstruction and debris before testing.
- **Testing:**
 - **Clean water:** Provide.
 - **Testing apparatus:** Provide.
 - **Smoke testing:** Do not use.

50-10-00/812 Rainwater drainage internal pipework test – England, Wales, Ireland and Northern Ireland

- **Preparation:** Temporarily seal open ends of pipework with plugs.
- **Test apparatus:** Connect a 'U' tube water gauge and air pump to pipework via a plug.
- **Testing:** Pump air into pipework until gauge registers 38 mm.
- **Required performance:** After a period for temperature stabilization, maintain the pressure of 38 mm without loss for at least 3 minutes.

50-10-00/830 Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Two.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms;
Location, size and route of drainage services;
and Location of outlets.
 - **Format:** A1 paper print and Electronic.
 - **Number of copies:** Two.
- **Submittal date:** At handover.

Ω End of system

50-10-05/120 Above ground wastewater drainage system with internal stacks

System outline

50-10-05/120 Above ground wastewater drainage system with internal stacks

- Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the Above Ground Waste Water Drainage System with Internal Stacks, including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.
 The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.
 The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Design and Installation of above ground soil and waste water drainage systems to serve all sanitary appliances, drainage points and equipment throughout the building.

Waste water from each sanitary appliance, drain point, floor drain/gully and items of plant or equipment with waste water discharge shall be collected via branch drainage pipework to vertical soil/waste and vent pipes designed in accordance with CIPHE Plumbing Engineering Services Design Guide, BS EN 12056-2 & ACCOR Brand Standards.

Soil / Waste stacks shall drop in each room riser collecting soil and waste pipe from each room at each level. At ground floor the stacks shall offset to drop to connect to underground foul drainage as designed and specified by the Civil Engineer.

At first floor all soil and waste fittings shall connect to stub stacks connecting to the horizontal soil / waste drainage at high level ground floor. Similarly all ground floor appliances and equipments shall connect to sub stacks in turn connecting to underground foul drainage as designed and specified by the Civil Engineer. All ground floor floor gullies shall connect direct to underground foul drainage as designed and specified by the Civil Engineer.

All Soil/waste and vent pipes shall terminate to atmosphere through purpose made vent pipe terminals. Access shall be provided at all horizontal changes of direction, pipe size or gradient. Access doors shall be provided on the vertical stacks at each level above the spill over level of the connected appliances on each level. All stub stacks shall terminate above the spillover level of the connected appliances with rodding access caps

All horizontal pipework shall be designed to maintain a self cleansing velocity.

All soil and waste pipes shall be acoustically insulated as required in accordance with the recommendations of the acoustician

All large diameter (80, 100 and 150mm diameter) pipework shall be installed in Cast Iron except where installed over sensitive areas, where the pipework shall be provided with prefabricated drip trays as described on the drawings, and the pipework shall be HDPE jointed with electro-fusion jointing sleeves.

All small diameter soil and waste pipework shall be copper.

Condensate from AC equipment shall be drained to connect to vertical stacks via waterless traps (as HepVO or equal) and tundishes.

Condensate drainage from condensing boilers shall be provided with condensate neutralisation in the condensate pipeline before connection to the soil and waste water above ground drainage systems

- **System performance:** 50-10-05/210 Design of above ground wastewater drainage systems.
- **System manufacturer:** Submit proposals.
- **Floor drainage:**
 - **Preparation to existing floors:** Contractor's design.
 - **Floor channels and gullies:** Submit proposals.
 - **Supports:**
 - Bedding:** Contractor's design.
 - Backfill:** Contractor's design.
 - Fixings:** Contractor's design.
- **Sanitary pipework:**
 - **Small diameter branch discharge pipework:**
 - Traps:** 90-10-60/410 Sanitary appliance traps.
 - Pipelines and fittings:** 90-10-65/315 Copper pipeline fittings and 90-10-65/310 Copper pipelines.
 - Accessories for jointing:** Contractor's design.
 - Supports:** 90-10-20/340 Brackets and clips for above ground drainage pipelines.
 - Fixings:** Contractor's design.
 - **Large diameter branch discharge pipework:**
 - Pipelines and fittings:** 90-10-20/344 Cast iron above ground drainage pipelines to BS EN 877.
 - Accessories for jointing:** Contractor's design.
 - Supports:** 90-10-20/340 Brackets and clips for above ground drainage pipelines.
 - Fixings:** Contractor's design.
 - Insulation:** Submit proposals.
 - **Discharge stack pipework:**
 - Pipelines and fittings:** 90-10-20/344 Cast iron above ground drainage pipelines to BS EN 877 and 90-10-20/348 High density polyethylene (HDPE) above ground drainage pipelines.
 - Accessories for jointing:** Contractor's design.
 - Supports:** 90-10-20/340 Brackets and clips for above ground drainage pipelines.
 - Fixings:** Contractor's design.
 - Insulation:** Submit proposals.
- **Ventilating pipework:**
 - **Ventilating branch pipework:**
 - Pipelines and fittings:** As Branch discharge pipework
 - Accessories for jointing:** Contractor's design.
 - Supports:** 90-10-20/340 Brackets and clips for above ground drainage pipelines.
 - Fixings:** Contractor's design.
 - **Ventilating stack pipework:**

Pipelines and fittings: 90-10-20/344 Cast iron above ground drainage pipelines to BS EN 877.

Accessories for jointing: Contractor's design.

Supports: 90-10-20/340 Brackets and clips for above ground drainage pipelines.

Fixings: Contractor's design.

- **Overflow pipework:**
 - **Pipelines and fittings:** 90-10-65/310 Copper pipelines.
 - **Accessories for jointing:** Contractor's design.
 - **Supports:** 90-10-20/340 Brackets and clips for above ground drainage pipelines.
 - **Fixings:** Contractor's design.
- **Pipework identification:** 90-90-55/430 Identifying pipework and 90-90-55/480 Mechanical plant and equipment identification labels.
- **Fire stopping:**
 - **Floor penetrations:** 90-10-60/405 Pipe sleeves;
45-45-70/433 Flexible intumescent gap sealer;
and 45-55-75/375 Intumescent foam fillers.
 - **Wall penetrations:** 45-45-70/433 Flexible intumescent gap sealer;
45-55-75/375 Intumescent foam fillers;
and 90-10-60/405 Pipe sleeves.
- **System accessories:** 90-10-60/437 Discharge and ventilating stack terminations.
- **Execution:** 50-10-05/622 Access to above ground wastewater drainage systems for testing and maintenance;
50-10-05/612 Applying above ground wastewater drainage internal pipework identification;
50-10-05/620 Electrical continuity of above ground wastewater drainage pipework;
50-10-05/614 Installing above ground wastewater drainage discharge branch pipework;
and 50-10-05/616 Installing above ground wastewater drainage discharge stack pipework generally.
- **System completion:** 50-10-05/820 Above ground wastewater drainage system pipework airtightness test;
50-10-05/830 Above ground wastewater drainage system siphonage and back pressure tests;
50-10-05/860 Documentation;
and 50-10-05/810 Testing above ground wastewater drainage systems generally.

System performance

50-10-05/210 Design of above ground wastewater drainage systems

- **Design:** As detailed on the Tender drawings. Perform all required calculations to review and confirm the proposed design.
- **Standards:** To BS EN 12056-1, BS EN 12056-2 and relevant parts of BS EN 12056-4 and BS EN 12056-5 and to BS EN 12056-2 National Annexes NA-NG.
- **System configuration:**
 - **Form:** System III, single discharge stack system with full bore discharge branch pipes.
 - **Configuration:** Primary ventilated stack system.
- **Design discharges:**
 - **Design discharge types:** Domestic wastewater.

- **Design discharge content:** Blackwater.
- **Recycling requirements:**
- **Requirements:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Products

90-10-65/310 Copper pipelines

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-60-55/120 Natural gas supply system.

- **General requirements:** 90-10-65/320 Copper pipeline jointing materials and 90-10-65/315 Copper pipeline fittings.
- **Manufacturer:** Submit proposals.
- **Standard:** To BS EN 1057.
- **Grade:** R250.
- **Finish:** Plain.
- **Execution:** 90-10-65/630 Installing copper pipelines.

90-10-65/315 Copper pipeline fittings

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; and 90-10-65/310 Copper pipelines.

- **Manufacturer:** Submit proposals.
- **Standards:**
 - **Capillary:** To BS EN 1254-1, solder ring and To BS EN 1254-1, end feed.
 - **Compression:** To BS EN 1254-2, type A and To BS EN 1254-2, type B.
 - **Flanges:** To BS EN 1092-3

90-10-65/320 Copper pipeline jointing materials

- **Manufacturer:** Contractor's choice.
- **Standards:**
 - **Lead free solder for capillary fittings:** To BS EN ISO 9453.
 - **Brazing filling:** To BS EN ISO 17672.
 - **Flange jointing rings:** To BS EN 1514-4.

90-90-55/430 Identifying pipework

Shared by: 50-10-00/120 Internal gravity rainwater drainage system; 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS 1710.

- **Identification type:** Adhesive colour bands.
- **Execution:** 90-90-55/660 Installing identification on pipework.

90-90-55/480 Mechanical plant and equipment identification labels

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 60-45-95/110 Variable refrigerant flow system; 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

Execution

50-10-05/612 Applying above ground wastewater drainage internal pipework identification

- **Standard:** To BS 1710.
- **Method:** Integral lettering on pipe wall, self-adhesive bands or identification clips.
- **Form:**
 - **Wastewater system without recycling:**
 - Definition:** All wastewater from sanitary appliances and sinks.
 - Direction of flow:** White arrow on black background.
 - Wording:** White lettering 'FOUL DRAINAGE' on a black background.
 - **Blackwater in system with recycling:**
 - Definition:** Containing faecal matter or urine.
 - Direction of flow:** White arrow on black background.
 - Wording:** White lettering 'FOUL DRAINAGE' on a black background.
 - **Greywater in system with recycling:**
 - Definition:** As defined in BS EN 12056-1, clause 3.1.
 - Direction of flow:** Black arrow on light grey background.
 - Wording:** Black lettering 'GREYWATER' on a light grey background.

50-10-05/614 Installing above ground wastewater drainage discharge branch pipework

- **Pipework:**
 - **Alignment:** Fix securely plumb and/ or true to line.
 - **Branches and low gradient sections:** Fix with uniform and adequate falls to drain efficiently.
 - **Socketed pipes and fittings:** Fix with sockets facing upstream.
 - **Additional supports:** Provide as necessary to support junctions and changes in direction.
- **Wall and floor penetrations:**
 - **Isolating pipework:** Isolate pipework from structure, e.g. with pipe sleeves.
 - **Masking plates:** Fix at penetrations if visible in the finished work.

50-10-05/616 Installing above ground wastewater drainage discharge stack pipework generally

- **Pipework:**
 - **Alignment:** Fix securely plumb and true to line.
 - **Externally socketed pipes and fittings:** Fix with sockets facing upstream.
 - **Vertical pipes:** Provide a loadbearing support not less than every storey level. Locate at or close below socket collar or coupling. Tighten fixings as work proceeds so that every storey is self-supporting.
 - **Additional supports:** Provide as necessary to support junctions and changes in direction.
- **Wall and floor penetrations:**
 - **Isolating pipework:** Isolate pipework from structure, e.g. with pipe sleeves.
 - **Masking plates:** Fix at penetrations if visible in the finished work.
- **Expansion joint sockets:** Fix rigidly to the building.
- **Fixings:** Allow the pipe to slide.

50-10-05/620 Electrical continuity of above ground wastewater drainage pipework

- **Joints in metal pipes with flexible couplings:** Make with clips (or suitable standard pipe couplings) supplied for earth bonding by pipework manufacturer to ensure electrical continuity.

50-10-05/622 Access to above ground wastewater drainage systems for testing and maintenance

- **General:** Install pipework with adequate clearance to permit testing, cleaning and maintenance, including painting where necessary.
- **Access fittings and rodding eyes:** Position to avoid obstruction.

90-10-65/610 Pipelines installation generally

Shared by: 90-10-65/630 Installing copper pipelines; 90-10-65/645 Installing plastics pipelines; and 90-10-65/680 Installing steel pipelines.

- **Standard:** HVCA TR/20.
- **Dissimilar metals:** Prevent electrolytic corrosion.

90-10-65/615 Installing pipeline fittings

Shared by: 90-10-65/630 Installing copper pipelines; 90-10-65/645 Installing plastics pipelines; and 90-10-65/680 Installing steel pipelines.

- **Fabricated junctions and fittings:**
- **Demountable joints:**

90-10-65/620 Installing anchors generally

Shared by: 90-10-65/630 Installing copper pipelines; 90-10-65/645 Installing plastics pipelines; and 90-10-65/680 Installing steel pipelines.

- **Purpose:** To resist axial stress transmitted by flexure of horizontal and vertical pipe runs, and loading on vertical pipes.
- **Fixings:** Provide associated backing plates, nuts, washers and bolts for attachment to, or building into building structure.
- **Fixing to building structure:** Contractor's choice.

90-10-65/625 Installing slide guides

Shared by: 90-10-65/630 Installing copper pipelines; and 90-10-65/680 Installing steel pipelines.

- **Expansion and contraction:** Direct movement from pipe anchor points towards loops, bellows or flexible inserts.
- **Thrust:** Linear relative to the axis of pipe.

90-10-65/630 Installing copper pipelines

- **General requirements:** 90-10-65/610 Pipelines installation generally;
90-10-65/615 Installing pipeline fittings;
90-10-65/620 Installing anchors generally;
90-10-65/625 Installing slide guides;
90-10-65/690 Spacing of pipelines;
and 90-10-65/710 General inspection and testing.
- **Standard:** In accordance with CDA publications 88 Copper tube in buildings and 149 Large diameter copper tubes.
- **Jointing method:**
 - **Permanently concealed joints:** Brazed.
 - **Accessible joints:** Brazed.
- **Anchor:**
 - **Method:** Two flanges fixed to copper female adaptors.
 - **Pipe restraints:** Saddle clamps.

90-10-65/710 General inspection and testing

Shared by: 90-10-65/630 Installing copper pipelines; 90-10-65/645 Installing plastics pipelines; and 90-10-65/680 Installing steel pipelines.

- **Inspection of joints:**
 - **Joints:** Cut out, cut open and inspect.
 - **Number of joints:** Three.
- **Safety precautions:** In accordance with HSE GS 4.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.

- **Position:** On equipment.

90-90-55/660 Installing identification on pipework

- **Application of basic identification colour:** Coloured bands as BS 1710.
- **Safety colour identification:** On or next to the colour bands.
- **Information:** Colour bands as BS 1710.
- **Direction of flow:** Indication arrow;
Indication arrow and the word FLOW or the letter F;
and Indication arrow and the word RETURN or the letter R.

System completion

50-10-05/810 Testing above ground wastewater drainage systems generally

- **Dates for testing:**
 - **Notice:** Required.
 - **Period of notice (minimum):** 2 working days.
- **Preparation:**
 - **Pipework:** Securely fixed and free from obstruction and debris.
 - **Traps:** Fill with clean water.
- **Testing:**
 - **Water for testing:** Supply clean water, assistance and apparatus.
 - **Smoke for testing:** Do not use.
- **Records of tests:** Submit.

50-10-05/820 Above ground wastewater drainage system pipework airtightness test

- **Preparation:**
 - **Open ends of pipework:** Temporarily seal using plugs.
 - **Test apparatus:** Connect a 'U' tube water gauge and air pump to pipework via a plug or through trap of an appliance.
- **Testing:** Pump air into pipework until gauge registers 38 mm.
- **Required performance:** Maintain pressure of 38 mm without loss for at least 3 minutes.

50-10-05/830 Above ground wastewater drainage system siphonage and back pressure tests

- **Method:**
 - **WC pans:** Test by flushing.
 - **Other appliances:** Test by filling to overflow level, then removing the plug.
- **Number of tests:** Test each appliance three times. Recharge traps before each test.
- **Self siphonage testing:** Test each appliance individually.
- **Induced siphonage and back pressure testing:** Test by discharging the following appliances simultaneously on each stack.
 - **WCs:** [..]

- **Washbasins:** [..]
- **Sinks:** [..]

50-10-05/860 Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Two.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms;
Location, size and route of above ground services;
and Location of outlets.
 - **Format:** A1 paper print and Electronic.
 - **Number of copies:** Two.
- **Submittal date:** At handover.

Ω End of system

55-40-40/110 Incoming water supply

System outline

55-40-40/110 Incoming water supply

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the Incoming Water Supply, including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Liaison with Water Utility provider for provision of and design of metered water supply for domestic usage and fire protection.

The Contractor shall arrange for the provision of an incoming water supply to the building and shall manage its procurement and installation. The Contractor shall confirm the capacity required for the incoming water supply and obtain an updated quotation from the Water Authority for the appropriately sized water main.

All buried water main shall be laid in MDPE or as otherwise directed by the Water Authority. Contractor to determine if the ground is contaminated and provide barrier type pipework as required

- **System performance:** 55-40-40/210 Design and detailing hot and cold water systems.
- **Water company:** North West Water (United Utilities)
- **Volume flow rate:** 4.0l/s to a maximum of 67,200l/day
- **Position of incoming mains water supply:** Contractor's design.
- **Valves:** 90-10-90/314 Stop valves for potable water.
- **Backflow prevention devices:** 90-10-90/318 Backflow prevention devices type A.
- **System completion:** 55-40-40/850 Water quality tests.

System performance

55-40-40/210 Design and detailing hot and cold water systems

Shared by: 55-40-40/110 Incoming water supply; and 55-40-40/130 Pumped cold water supply system.

- **Design:** As detailed on the Tender drawings. Perform all required calculations to review and confirm the proposed design.
- **Standard:** To BS 8558 or BS EN 806-2 and in accordance with HSE publication L8: Legionnaires' disease.

The control of Legionella bacteria in water systems. Approved Code of Practice and guidance on regulations.

- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturer's literature.

System completion

55-40-40/850 Water quality tests

Shared by: 55-40-40/110 Incoming water supply; 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Standard:** To BS EN 806-4.
- **Samples:**
 - **Sample points:** Submit proposals.
 - **Samples for analysis:** Submit samples for bacteriological analysis.
- **Water temperature:** Record at each sampling point at the time of taking the sample.
- **Test results:**
 - **Record:** Details of all analyses.
 - **Submit:** On completion.
 - **Number of copies:** Two.

Ω End of system

55-40-40/130 Pumped cold water supply system

System outline

55-40-40/130 Pumped cold water supply system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the Pumped Cold Water Supply System, including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Design and Installation of cold water supply to all cold water draw off points throughout the building including domestic water booster pumps and storage tanks and Category 5 (wash down) water break tank and booster pumps.

From the incoming metered water supply a pre insulated GRP sectional, two compartment cold water storage tank, (as detailed in the schedules), shall hold sufficient capacity to attenuate the peak demand for the Hotel in keeping with the inflow limitations of the incoming water supply. From the storage tank in the ground floor tank room, a packaged, skid mounted booster pump set, (as detailed in the schedules), complete with control panel and hydraulic accumulator shall be provided to distribute a pressurised potable water supply to each cold water draw off point throughout the building. The pump set shall comprise duty, assist and standby pumps on automatic cyclic changeover.

From the pump set the cold water distribution shall rise to high level on 5th floor and shall distribute via a ring distribution system to each room riser. A falling / rising distribution shall distribute to each level in each room riser. At each level a pressure reducing/regulating valve assembly, with a normally closed valved bypass, shall be provided to limit the pressure at each draw-off point to not exceed 2.0 bar and to enable balancing of pressures in hot and cold water supplies to each room.

At Ground floor level a branch shall be taken from the main cold water service distribution riser a distributed through the ground floor to each Toilet, wet room, kitchen, bar etc. At each toilet, wet room, kitchen, bar etc a pressure reducing valve assembly with a normally closed valved bypass shall be provided to limit the pressure at each drawoff point to not exceed 2.0 bar and to enable balancing of hot and cold water pressures to each room. Kitchen minimum pressures shall be as required by catering specialist.

All cold water (including category 5 water) pipework and fittings shall be installed in copper in accordance with this specification. Distribution pipework shall be run in ceiling void and risers wherever practicable. Exposed pipework in finished areas, (bathrooms, toilets, kitchens, etc), shall be chromium plated. All cold water services, valves and fittings, (except where chromium plated in finished areas), shall be insulated to specification. Additionally all cold water pipework and category 5 wash down pipework exposed to external conditions shall be trace heated.

All cold water draw off points, appliances and equipment connected to the cold water supply shall be

fitted with Ballofix style service isolation valves. No flexible connections to appliances or equipment will be permitted except where specific provision for vibration isolation is described. All cold water draw off points shall be fitted with WRAS approved flow limiting devices to meet a 12.5% water saving required to achieve BREEAM targetted credits

A Leak Detection monitoring "Smart" meter is required on the booster pump discharge line to meet the BREEAM requirement for Leak detection.

Hose Union Bib Taps for wash down purposes shall be provided via a Category 5 break tank and pumps, frame mounted as a package and as detailed in the schedules.

- **System performance:** 55-40-40/210 Design and detailing hot and cold water systems.
- **Arrangement:** Automatic variable speed pumping system.
- **Water meters:** 90-65-55/470 Water meters.
- **Cold water boosting:**
 - **Pressure booster sets:** 90-10-70/390 Pressure booster sets.
 - **Method:** Flooded suction or suction lift to directly pressurize hot and cold water systems.
- **Pumps:** 90-10-70/360 Close coupled in line pumps.
- **Storage tank or cistern:** 90-10-95/310 Glass reinforced tanks and cisterns.
- **Pipelines:**
 - **Below ground:** 90-10-65/365 Medium Density Polyethylene (MDPE) pipelines for water supply.
 - **Above ground:** 90-10-65/310 Copper pipelines.
- **Pipeline accessories:**
 - **Expansion devices:** 90-10-60/325 Axial expansion compensators.
 - **Gauges:** 90-10-60/380 Temperature gauges and 90-10-60/370 Pressure gauges.
 - **Accessories:** 90-10-60/405 Pipe sleeves;
90-10-60/400 Pipeline strainers;
and 90-10-60/420 Tundishes.
 - **Pipeline supports:** 90-90-60/390 Services supports.
- **Valves:**
 - **Backflow prevention devices:** 90-10-90/318 Backflow prevention devices type B.
 - **Float valves:** 90-10-90/320 Float operated valves.
 - **Isolating valves:** 90-10-90/342 Copper alloy gate valves;
90-10-90/330 Ball valves;
and 90-10-90/332 Butterfly valves.
 - **Check valves:** 90-10-90/352 Copper alloy check valves.
 - **Regulating valves:** 90-10-90/358 Flow measuring devices and 90-10-90/410 Pressure regulating valves.
 - **Draining devices:** 90-10-90/374 Draining taps.
 - **Accessories:** 90-10-90/360 Test points.
- **Fire stopping:** Contractor's design.
- **Thermal insulation:**
 - **Pipelines:** 90-90-40/330 Mineral wool pipe section insulation and 90-90-40/350 Nitrile rubber insulation.
 - **Tanks:** Pre-insulated tanks to be used.
- **Vibration isolation:** 90-90-95/390 Rubber bellows.

- **Outlets:** 45-35-70/401 Janitorial units;
45-35-70/315 Water supply fittings for baths;
45-35-70/355 Urinal flushing valves;
45-35-70/371 Water supply fittings for wash basins and troughs;
45-35-70/335 Shower mixers;
45-35-70/387 WC cistern fittings;
and 45-35-70/345 Water supply fittings for sinks.
- **Drinking water outlets:** All sinks and basins
- **Flush control devices:** Contractor's design.
- **Water dispensers:** Contractor's design.
- **Controls:** .
- **Accessories:** 90-90-60/380 Roof equipment support systems and Electrical resistance trace heating.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
90-90-55/480 Mechanical plant and equipment identification labels;
90-90-55/495 Valve identification labels;
and 90-90-55/490 Valve charts and schematics.
- **Execution:** 55-40-40/620 Installing hot and cold water systems generally;
55-40-40/670 Disinfection of hot and cold water systems;
and 55-40-40/650 Hydraulic pressure testing of hot and cold water supply systems.
- **System completion:** 55-40-40/850 Water quality tests;
55-40-40/870 Operating tools;
55-40-40/830 Demonstrations;
55-40-40/880 Maintenance;
55-40-40/840 Documentation;
and 55-40-40/810 Commissioning of hot and cold water supply systems.

System performance

55-40-40/210 Design and detailing hot and cold water systems

Shared by: 55-40-40/110 Incoming water supply; and 55-40-40/130 Pumped cold water supply system.

- **Design:** As detailed on the Tender drawings. Perform all required calculations to review and confirm the proposed design.
- **Standard:** To BS 8558 or BS EN 806-2 and in accordance with HSE publication L8: Legionnaires' disease. The control of Legionella bacteria in water systems. Approved Code of Practice and guidance on regulations.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturer's literature.

Products

90-10-65/310 Copper pipelines

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-60-55/120 Natural gas supply system.

- **General requirements:** 90-10-65/320 Copper pipeline jointing materials and 90-10-65/315 Copper pipeline fittings.
- **Manufacturer:** Submit proposals.
- **Standard:** To BS EN 1057.
- **Grade:** R250.
- **Finish:** Plain.
- **Execution:** 90-10-65/630 Installing copper pipelines.

90-10-65/315 Copper pipeline fittings

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; and 90-10-65/310 Copper pipelines.

- **Manufacturer:** Submit proposals.
- **Standards:**
 - **Capillary:** To BS EN 1254-1, solder ring and To BS EN 1254-1, end feed.
 - **Compression:** To BS EN 1254-2, type A and To BS EN 1254-2, type B.
 - **Flanges:** To BS EN 1092-3

90-10-65/320 Copper pipeline jointing materials

- **Manufacturer:** Contractor's choice.
- **Standards:**
 - **Lead free solder for capillary fittings:** To BS EN ISO 9453.
 - **Brazing filling:** To BS EN ISO 17672.
 - **Flange jointing rings:** To BS EN 1514-4.

90-10-65/365 Medium Density Polyethylene (MDPE) pipelines for water supply

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-85-75/110 Commercial and industrial sprinkler system.

- **General requirements:** 90-10-65/380 Jointing materials for plastics tubes.
- **Standards:**
 - **Pipes:** To BS EN 12201-2 and To BS ISO 4427-2.
 - **Fittings:** To BS EN 12201-3 and To BS ISO 4427-3.
- **Colour:** Blue.
- **Execution:** 90-10-65/645 Installing plastics pipelines.

90-10-65/380 Jointing materials for plastics tubes

- **Manufacturer:** Contractor's choice.
- **Standards:**
 - **Compression:** To BS EN 1254-3.
 - **Electrofusion:** To BS EN 12201-3.
 - **Socket and spigot:** To BS EN 12201-3.
 - **Solvent cement:** To BS EN 14814.
 - **Elastomeric ring seal:** To BS EN 681-1.

90-10-90/330 Ball valves

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Manufacturer:** Herz Valves Ltd, Crane Fluid Systems, Hattersley Valves, TA or Oventrop. Only one valve manufacturer shall be used for all valves and accessories.
- **Material:** Brass copper alloy.
- **Connections:** Threaded joints to BS EN ISO 228-1.
- **Finish:** Natural.
- **Execution:**

90-10-90/332 Butterfly valves

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-60-55/120 Natural gas supply system.

- **Manufacturer:** Herz Valves Ltd, Crane Fluid Systems, Hattersley Valves, TA or Oventrop. Only one valve manufacturer shall be used for all valves and accessories.
- **Standard:** To BS EN 593.
- **Arrangement:** Double flanged.
- **Materials:**
 - **Body:** Cast iron.
 - **Shaft:** Steel with minimum 12% chromium.
 - **Disc:** Stainless steel.
 - **Seat:** Manufacturer's standard.
- **Operation:**
 - **Manual:** Lever operated up to 150mm dia, 200mm dia and greater to be complete with gear unit.
- **Execution:** 90-10-90/610 Installation of valves generally.

90-10-90/342 Copper alloy gate valves

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-85-20/110 Dry riser system.

- **Manufacturer:** Herz Valves Ltd, Crane Fluid Systems, Hattersley Valves, TA or Oventrop. Only one valve manufacturer shall be used for all valves and accessories.
- **Standard:** To BS EN 12288.
- **Series:** A.
- **Size:** To suit pipe.
- **Connections:** Flanged to BS EN 1092-3 or BS EN 1759-3 (65mm dia and greater) and Threaded joints to BS EN ISO 228-1 (15mm dia - 50mm dia).
- **Options:** 15mm dia - 50mm dia - Non-heat handle, screwed in bonnet, high quality packing and gland, solid wedge disc for rising stem type and hollow disc for non-rising stem type;

65mm dia and greater - Malleable iron hand wheels, bolted bonnet and stuffing box, with suitable gasket with one piece glands for 10 bar rating. Wedge discs shall be of cast iron with bronze disc rings rolled into the cast iron. Discs shall be solid for rising stem type valves and hollow for non-rising stem type. Valve

stems shall be manganese bronze and seats shall have shouldered seat rings of bronze screwed into the valve body.

- **Accessories:** Manufacturer's standard.
- **Execution:** 90-10-90/610 Installation of valves generally.

90-10-90/352 Copper alloy check valves

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-85-20/110 Dry riser system.

- **Manufacturer:** Submit proposals.
- **Standard:** To BS 5154.
- **Material:** Copper alloy.
- **Execution:** 90-10-90/670 Installation of check valves.

90-10-90/360 Test points

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 90-10-90/358 Flow measuring devices.

- **Manufacturer:** Ashford Instrumentation Ltd "Binder Style" test plugs, or equal and approved.
One single manufacturer for test plugs to be used.
- **Arrangement:** Self-sealing.
- **Material:** Brass.
- **Connections:** 6 mm (¼ inch) extended length.

90-10-90/374 Draining taps

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-85-20/110 Dry riser system.

- **Manufacturer:** Submit proposals.
- **Standard:** To BS 2879.
- **Material:** Copper alloy.
- **Connections:** Threaded joints to BS EN 10226-1.
- **Execution:** 90-10-90/610 Installation of valves generally.

90-10-95/310 Glass reinforced tanks and cisterns

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-85-75/110 Commercial and industrial sprinkler system.

- **Manufacturer:** Refer to Cold Water Storage Tank schedule.
- **Standard:** To BS EN 13280.
- **Arrangement:** Sectional tank.
- **Duty:**
 - **Capacity:**
 - Maximum:** Refer to Cold Water Storage Tank schedule.
 - Minimum:** Refer to Cold Water Storage Tank schedule.
- **Inspection at factory:** Required.
- **On site erection:** Manufacturer's standard.

- **Accessories:** Submit proposals.
- **Execution:** 90-10-95/650 Installing warning and overflow pipes to feed and expansion cisterns and 90-10-95/630 Installing tanks and cisterns.

90-90-40/350 Nitrile rubber insulation

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 60684-3-151.
- **Form:** Pipe section.
- **Thermal conductivity:** 0.035 W/m·K at 0°C.
0.037 W/m·K at 10°C.
0.040 W/m·K at 50°C.
0.043 W/m·K at 75°C.
- **Finish:** Plain.
- **Insulation thickness (minimum):** To BS 5422.
- **Vapour barrier:**
 - **Material:** Manufacturer's standard.
 - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** 90-90-40/390 Protection.
- **Accessories:** Submit proposals.
- **Items to be insulated:** Manufacturer's standard.
- **Execution:** 90-90-40/630 Installing nitrile rubber insulation on pipelines and 90-90-40/780 Installing vapour barriers.

90-90-40/390 Protection

Shared by: 90-90-40/350 Nitrile rubber insulation; and 90-90-40/360 Phenolic foam insulation.

- **Manufacturer:** Submit proposals.
- **Material:** Manufacturer's standard.
- **Colour:** Manufacturer's standard.
- **Execution:** 90-90-40/715 Installing self adhesive cladding and jacketing.

90-90-55/430 Identifying pipework

Shared by: 50-10-00/120 Internal gravity rainwater drainage system; 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS 1710.
- **Identification type:** Adhesive colour bands.
- **Execution:** 90-90-55/660 Installing identification on pipework.

90-90-55/480 Mechanical plant and equipment identification labels

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 60-45-95/110 Variable refrigerant flow system; 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

90-90-55/490 Valve charts and schematics

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Paper print, glazed frame.
- **Information to be included:** Location and identification of pipework regulating, isolating and control valves.
- **Execution:** 90-90-55/620 Installing valve charts and schematics.

90-90-55/495 Valve identification labels

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** 25mm diameter
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm

- **Information:** Purpose and reference number.
- **Execution:** 90-90-55/630 Installing valve identification labels.

90-90-60/380 Roof equipment support systems

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-85-20/110 Dry riser system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Roof Pro, Bigfoot or equal and approved.
One single manufacturer to be used for roof support systems.
- **Design:** H frame support system with adjustable feet shall be so designed that any two adjacent feet can be raised simultaneously to allow for maintenance of the roof insulation and membrane.
- **Components:**
 - **Support base:**
Type: Nylon GF-30% square pad with compatible fixing for a 41x41mm strut system
Size: Minimum 450x450
Anti-vibration mats: 4mm bonded rubber mat
 - **Support frame:**
Type: Galvanised H frame
Size: Submit proposals.
 - **Threaded rod:**
Type: Galvanised threaded rod.
Size: Submit proposals.

90-90-60/390 Services supports

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Support type:** Submit proposals.

90-90-95/390 Rubber bellows

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **General requirements:** Manufacturer's standard.
- **Manufacturer:** Engineering Appliances (Stourflex) type EA or equal and approved.
One single manufacturer for expansion devices to be used.
- **Rubber bellows type:** Untied.
- **Material:**
 - **Liner:** Butyl for domestic hot and cold potable water
Ethylene-propylene diene monomer (EPDM) rubber for central heating
 - **Reinforcement:** Corrosion resistant steel wire.
 - **Cover:** Ethylene propylene diene monomer (EPDM) rubber.

- **Connections:**
- **Execution:** 90-90-95/620 Installation of flexible hoses and rubber bellows.

Execution

55-40-40/620 Installing hot and cold water systems generally

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Standard:** To BS 8558 and BS EN 806-4.
- **Performance:** Free from leaks and the audible effects of expansion, vibration and water hammer.
- **Fixing of equipment, components and accessories:** Fix securely, parallel or perpendicular to the structure of the building.
- **Preparation:** Immediately before installing tanks and cisterns on a floor or platform, clear the surface completely of debris and projections.
- **Corrosion resistance:** In locations where moisture is present or may occur, avoid contact between dissimilar metals by use of suitable washers, gaskets, and the like.

55-40-40/650 Hydraulic pressure testing of hot and cold water supply systems

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Standard:** To BS 8558 and BS EN 806-4.
- **Notice (minimum):** 1 week.
- **Pressure:** 2 times working pressure.
- **Duration of test:** 2 hours.

55-40-40/670 Disinfection of hot and cold water systems

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Standard:** To BS EN 806-4.
- **Samples for analysis:** Provide after disinfection and flushing.

90-10-60/620 Installing expansion compensators

- **Position:** Submit proposals.
- **Anchors and guides:** Locate to contain movement and resist maximum imposed loads.

90-10-60/630 Installing pressure gauges

- **Position:** As detailed on the Tender drawings.

90-10-60/650 Installing strainers

- **Angle type:** Install with strainer cap at the bottom. Inlet at the top or side.
- **Y-type:** Install in direction of flow with the pocket in the horizontal plane.

90-10-65/610 Pipelines installation generally

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Standard:** HVCA TR/20.
- **Dissimilar metals:** Prevent electrolytic corrosion.

90-10-65/615 Installing pipeline fittings

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Fabricated junctions and fittings:**
- **Demountable joints:**

90-10-65/620 Installing anchors generally

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Purpose:** To resist axial stress transmitted by flexure of horizontal and vertical pipe runs, and loading on vertical pipes.
- **Fixings:** Provide associated backing plates, nuts, washers and bolts for attachment to, or building into building structure.
- **Fixing to building structure:** Contractor's choice.

90-10-65/625 Installing slide guides

Shared by: [90-10-65/630 Installing copper pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Expansion and contraction:** Direct movement from pipe anchor points towards loops, bellows or flexible inserts.
- **Thrust:** Linear relative to the axis of pipe.

90-10-65/630 Installing copper pipelines

- **General requirements:** [90-10-65/610 Pipelines installation generally](#); [90-10-65/615 Installing pipeline fittings](#); [90-10-65/620 Installing anchors generally](#); [90-10-65/625 Installing slide guides](#); [90-10-65/690 Spacing of pipelines](#); and [90-10-65/710 General inspection and testing](#).
- **Standard:** In accordance with CDA publications 88 Copper tube in buildings and 149 Large diameter copper tubes.
- **Joining method:**
 - **Permanently concealed joints:** Brazed.
 - **Accessible joints:** Brazed.
- **Anchor:**
 - **Method:** Two flanges fixed to copper female adaptors.
 - **Pipe restraints:** Saddle clamps.

90-10-65/645 Installing plastics pipelines

- **General requirements:** [90-10-65/690 Spacing of pipelines](#); [90-10-65/615 Installing pipeline fittings](#); [90-10-65/610 Pipelines installation generally](#); [90-10-65/710 General inspection and testing](#); and [90-10-65/620 Installing anchors generally](#).
- **Pipeline material:**
- **Jointing method:** To suit tube.
- **Anchor:** PVC coated overstraps or clamps, with polypropylene strip between pipe and carbon steel section.

90-10-65/710 General inspection and testing

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Inspection of joints:**
 - **Joints:** Cut out, cut open and inspect.
 - **Number of joints:** Three.
- **Safety precautions:** In accordance with HSE GS 4.

90-10-90/610 Installation of valves generally

Shared by: [90-10-90/332 Butterfly valves](#); [90-10-90/342 Copper alloy gate valves](#); [90-10-90/374 Draining taps](#); [90-10-90/380 Ball valves, manually operated](#); and [90-10-90/670 Installation of check valves](#).

- **Installation:** In accordance with BS 6683.
- **Position:**
- **Isolation and regulation valves:** Provide at equipment and on sub-circuits.
- **Access:** Locate valves so they can be readily operated and maintained. Locate next to equipment which is to be isolated.
- **Connection to pipework:** Fit with joints that suit the pipe material.

90-10-90/670 Installation of check valves

- **General requirements:** [90-10-90/610 Installation of valves generally](#).
- **Lift type:** Install in direction of flow as indicated on the body.
- **Disc type:** With spring, fit in any plane. Without spring, fit in vertical plane with flow from bottom to top.
- **Wafer type:** Install between flanges. Fit in horizontal plane or vertical upward flow.
- **Split disc:** Install between flanges. Fit in horizontal plane or vertical upward flow.

90-10-95/630 Installing tanks and cisterns

- **Standards:**
 - **Moulded plastics:** In accordance with BS 4213.
 - **Glass reinforced plastics:** In accordance with BS EN 13280.
- **Position:** As indicated in the Tender drawings.
- **Base:** Install the tank on a firm, level and continuous base to spread the load.

- **Access:** Allow for internal and external inspection and cleaning. Provide space for cleaning and maintenance with clearance above the tank to service valves.
- **Limiting conditions:**

90-10-95/650 Installing warning and overflow pipes to feed and expansion cisterns

- **Material:** PVC-U.
- **Jointing:** Solvent welded.
- **Minimum OD:** Greater than inlet pipe OD, and at least 22 mm.
- **Difference (minimum) between normal water level and overflow level:**
 - **Cold water storage cisterns:** The greater of 32 mm or the bore of warning pipe.
 - **Feed and expansion cisterns:** Sufficient to allow 20% increase in the volume of water in the tank, plus 25 mm.
- **Vertical distance (minimum) of water supply inlet above overflow level:** Bore of warning pipe.
- **Fall of warning pipe (minimum):** 1 in 10.
- **Installation:** Support to prevent sagging. Terminate pipes separately in prominent positions, with turned down ends. Turn down within the cistern. Terminate 50 mm below normal water level.
- **Insulation:** Insulate within the building where the pipe is in an uninsulated space and subject to freezing.

90-90-40/610 Installing insulation and protection products generally

Shared by: 90-90-40/630 Installing nitrile rubber insulation on pipelines; 90-90-40/645 Installing phenolic foam insulation on ductwork; and 90-90-40/660 Installing foil faced mineral wool insulation on ductwork.

- **Standard:** In accordance with BS 5970.
- **Timing:** Insulate after installed system has been fully tested and joints proved sound.
- **Insulation:** Do not enclose adjacent units together.
- **Clearance:** Maintain between pipes.
- **Finish:** Neatly finish joints, corners, edges and overlaps.

90-90-40/630 Installing nitrile rubber insulation on pipelines

- **General requirements:** 90-90-40/610 Installing insulation and protection products generally.
- **Joints:** Close butt, secure with adhesive.
- **At fittings:** Fabricate from mitre cut pieces. Secure with adhesive.

90-90-40/715 Installing self adhesive cladding and jacketing

- **Application:** Cover insulation with self adhesive cladding and jacketing with 50 mm overlaps.

90-90-40/780 Installing vapour barriers

Shared by: 90-90-40/350 Nitrile rubber insulation; and 90-90-40/360 Phenolic foam insulation.

- **Integrity:** Seal to maintain throughout.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

90-90-55/620 Installing valve charts and schematics

- **Fixing:** Plug and screw to wall.
- **Position:** Plant room.

90-90-55/630 Installing valve identification labels

- **Fixing:** Secure with metal chain.

90-90-55/660 Installing identification on pipework

- **Application of basic identification colour:** Coloured bands as BS 1710.
- **Safety colour identification:** On or next to the colour bands.
- **Information:** Colour bands as BS 1710.
- **Direction of flow:** Indication arrow;
Indication arrow and the word FLOW or the letter F;
and Indication arrow and the word RETURN or the letter R.

90-90-95/620 Installation of flexible hoses and rubber bellows

- **Position:** Close to the source of vibration.

System completion**55-40-40/810 Commissioning of hot and cold water supply systems**

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Pre-commissioning:** In accordance with BSRIABG 2/2010 and CIBSE Commissioning Code W.
- **Commissioning:** In accordance with BS EN 806-4, BSRIABG 2/2010 and CIBSE Commissioning Code W.
- **Notice (minimum):** 1 week.
- **Equipment:** Check and adjust operation of equipment, controls and safety devices.
- **Outlets:** Check operation of outlets for satisfactory rate of flow and temperature.

55-40-40/830 Demonstrations

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Running of plant:**
 - **Operation:** Run, maintain and supervise the installations under normal working conditions.
 - **Duration:** 2 weeks.
- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

55-40-40/840 Documentation

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Operating and maintenance instructions:**

- **Scope:** In accordance with BSRIA Guide BG 1/2007 "Handover, O&M Manuals, and Project Feedback".
- **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
- **Format:** Electronic and Paper copy.
- **Number of copies:** Three.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms;
Location, size and route of hot and cold water services;
Location, route and depth of underground services;
Location and identification of regulating, isolation and control valves;
and Location of outlets.
 - **Format:** A1 paper print and Electronic.
 - **Scale:** Max. 1:50 @ A1.
 - **Number of copies:** Three.
- **Submittal date:** At handover.
- **Wholesome water consumption notice:** Submit within 30 days.

55-40-40/850 Water quality tests

Shared by: 55-40-40/110 Incoming water supply; 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Standard:** To BS EN 806-4.
- **Samples:**
 - **Sample points:** Submit proposals.
 - **Samples for analysis:** Submit samples for bacteriological analysis.
- **Water temperature:** Record at each sampling point at the time of taking the sample.
- **Test results:**
 - **Record:** Details of all analyses.
 - **Submit:** On completion.
 - **Number of copies:** Two.

55-40-40/870 Operating tools

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Tools:** Supply tools for operation, maintenance and cleaning purposes.
- **Keys:** Supply keys for valves and vents.

55-40-40/880 Maintenance

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Servicing and maintenance:** Undertake for 12 months after completion.

Ω End of system

55-40-40/160 Indirect hot water storage supply system

System outline

55-40-40/160 Indirect hot water storage supply system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the Indirect Hot Water Storage Supply System, including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Design and Installation of hot water supply to all hot water draw off points throughout the building including indirect hot water generators, buffer vessels, circulation and return circulation pumps.

From the main boosted cold water service distribution rise, a cold feed shall supply the hot water generators in a dedicated prefabricated boiler house at level 8 roof level.

The Hot water generating plant shall comprise dedicated gas fired domestic hot water boilers, buffer vessels and all interconnecting pipework, flues, circulation pumps, valves, gauges, expansion vessels, (as detailed in the schedules) all supplied as a complete package from a single manufacturer

From the Hot water generating plant, the hot water service flow (HWSF) distribution shall drop in the main riser to high level on sixth floor and shall distribute via a ring distribution system to each room riser.

A falling / rising distribution shall distribute to each level in each room riser. At each level a pressure reducing/regulating valve assembly, with a normally closed valved bypass, shall be provided to limit the pressure at each draw-off point to not exceed 2.0 bar and to enable balancing of pressures in hot and cold water supplies to each room. The HWSF shall continue to drop in the main riser to serve the ground floor. At each ground floor toilet, wet room, kitchen, bar etc a pressure reducing valve assembly with a normally closed valved bypass shall be provided to limit the pressure at each drawoff point to not exceed 2.0 bar and to enable balancing of hot and cold water pressures to each room. Kitchen minimum pressures shall be as required by catering specialist.

Immediately upstream of the pressure reducing valve assembly in each room riser and at each level, a branch off the Hot Water Service Flow (HWSF) shall be taken for the Hot Water Service Return, (HWSR).

From the HWSR shall rise / fall in each in each room riser to a HWSR ring at high level on 7th floor from which a HWSR will rise in the main services riser to high level seventh floor and thence to the prefabricated boiler room to connect via a HWS return circulation pump to the hot water generating plant's buffer vessels. The Ground floor HWSF shall rise from ground to high level seventh floor to connect to the rising HWSR from the seventh floor distribution ring.

All hot water pipework and fittings shall be installed in copper in accordance with this specification.

Distribution pipework shall be run in ceiling void and risers wherever practicable. Exposed pipework in finished areas, (bathrooms, toilets, kitchens, etc), shall be chromium plated. All hot water services, valves and fittings, (except where chromium plated in finished areas), shall be insulated to specification. All

pipework exposed to external conditions shall additionally be provided with trace heating.
All hot water draw off points, appliances and equipment connected to the hot water supply shall be fitted with Ballofix style service isolation valves. No flexible connections to appliances or equipment will be permitted except where specific provision for vibration isolation is described. All hot water draw off points shall be fitted with WRAS approved flow limiting devices to meet a 12.5% water saving required to achieve BREEAM targeted credits

- **System performance:** 55-40-40/240 Centralized hot water storage system.
- **Capacity:** Contractor's design in accordance with CIPHE Plumbing Engineering Services Design Guide & ACCOR Brand Standards
- **Primary heat source:** 90-40-05/340 Gas fired condensing boilers.
- **Primary:** Sealed.
- **Storage unit:** 90-15-35/340 Indirectly heated unvented hot water storage (to be supplied as part of a package with Boilers, pumps and accessories)
- **Pumps:**
 - **Primary hot water supply:** 90-10-70/360 Close coupled in line pumps (to be supplied as part of a package with boiler and buffer vessels)
 - **Secondary hot water supply:** 90-10-70/360 Close coupled in line pumps (on hot water service return)
- **Pipelines:** 90-10-65/310 Copper pipelines.
- **Pipeline accessories:**
 - **Expansion devices:** 90-10-60/325 Axial expansion compensators.
 - **Gauges:** 90-10-60/370 Pressure gauges and 90-10-60/380 Temperature gauges.
 - **Accessories:** 90-10-60/400 Pipeline strainers;
90-10-60/405 Pipe sleeves;
and 90-10-60/420 Tundishes.
 - **Pipeline supports:** 90-90-60/390 Services supports.
- **Valves:**
 - **Isolating valves:** 90-10-90/330 Ball valves;
90-10-90/332 Butterfly valves;
and 90-10-90/342 Copper alloy gate valves.
 - **Check valves:** 90-10-90/352 Copper alloy check valves.
 - **Regulating valves:** 90-10-90/358 Flow measuring devices;
90-10-90/410 Pressure regulating valves;
and 90-10-90/356 Double regulating valves.
 - **Mixing valves:** 90-10-90/370 Thermostatic mixing valves.
 - **Draining devices:** 90-10-90/374 Draining taps.
 - **Accessories:** 90-10-90/360 Test points.
- **Fire stopping:** Individual services penetrations fire stopping system.
- **Thermal insulation:**
 - **Pipelines:** 90-90-40/330 Mineral wool pipe section insulation and 90-90-40/350 Nitrile rubber insulation.
 - **Cylinders:** Factory applied insulation preinsulated cylinders to be provided
- **Vibration isolation:** 90-90-95/390 Rubber bellows.
- **Controls:** .

- **Outlets:** 45-35-70/315 Water supply fittings for baths;
45-35-70/335 Shower mixers;
45-35-70/345 Water supply fittings for sinks;
45-35-70/371 Water supply fittings for wash basins and troughs;
and 45-35-70/401 Janitorial units.
- **Accessories:** 90-90-60/380 Roof equipment support systems.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
90-90-55/480 Mechanical plant and equipment identification labels;
90-90-55/490 Valve charts and schematics;
and 90-90-55/495 Valve identification labels.
- **Execution:** 55-40-40/620 Installing hot and cold water systems generally;
55-40-40/650 Hydraulic pressure testing of hot and cold water supply systems;
and 55-40-40/670 Disinfection of hot and cold water systems.
- **System completion:** 55-40-40/810 Commissioning of hot and cold water supply systems;
55-40-40/830 Demonstrations;
55-40-40/840 Documentation;
55-40-40/850 Water quality tests;
55-40-40/870 Operating tools;
and 55-40-40/880 Maintenance.

System performance

55-40-40/240 Centralized hot water storage system

- **System design:** The system has been designed to meet the following requirements.
- **Storage capacity:**
 - **Standard:** In accordance with CIPHEPlumbing engineering services design guide.
 - **Type of building:**
 - **Number of people:**
- **Primary heat source:** Capable of raising temperature of water from 10°C to 60°C within one hour.
- **Temperature range of stored hot water:** 60–65°C.
- **Water supply:**

Products

90-10-65/310 Copper pipelines

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-60-55/120 Natural gas supply system.

- **General requirements:** 90-10-65/320 Copper pipeline jointing materials and 90-10-65/315 Copper pipeline fittings.
- **Manufacturer:** Submit proposals.
- **Standard:** To BS EN 1057.
- **Grade:** R250.

- **Finish:** Plain.
- **Execution:** 90-10-65/630 Installing copper pipelines.

90-10-65/315 Copper pipeline fittings

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; and 90-10-65/310 Copper pipelines.

- **Manufacturer:** Submit proposals.
- **Standards:**
 - **Capillary:** To BS EN 1254-1, solder ring and To BS EN 1254-1, end feed.
 - **Compression:** To BS EN 1254-2, type A and To BS EN 1254-2, type B.
 - **Flanges:** To BS EN 1092-3

90-10-65/320 Copper pipeline jointing materials

- **Manufacturer:** Contractor's choice.
- **Standards:**
 - **Lead free solder for capillary fittings:** To BS EN ISO 9453.
 - **Brazing filling:** To BS EN ISO 17672.
 - **Flange jointing rings:** To BS EN 1514-4.

90-10-90/330 Ball valves

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Manufacturer:** Herz Valves Ltd, Crane Fluid Systems, Hattersley Valves, TA or Oventrop. Only one valve manufacturer shall be used for all valves and accessories.
- **Material:** Brass copper alloy.
- **Connections:** Threaded joints to BS EN ISO 228-1.
- **Finish:** Natural.
- **Execution:**

90-10-90/332 Butterfly valves

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-60-55/120 Natural gas supply system.

- **Manufacturer:** Herz Valves Ltd, Crane Fluid Systems, Hattersley Valves, TA or Oventrop. Only one valve manufacturer shall be used for all valves and accessories.
- **Standard:** To BS EN 593.
- **Arrangement:** Double flanged.
- **Materials:**
 - **Body:** Cast iron.
 - **Shaft:** Steel with minimum 12% chromium.
 - **Disc:** Stainless steel.
 - **Seat:** Manufacturer's standard.
- **Operation:**

- **Manual:** Lever operated up to 150mm dia, 200mm dia and greater to be complete with gear unit.
- **Execution:** 90-10-90/610 Installation of valves generally.

90-10-90/342 Copper alloy gate valves

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-85-20/110 Dry riser system.

- **Manufacturer:** Herz Valves Ltd, Crane Fluid Systems, Hattersley Valves, TA or Oventrop. Only one valve manufacturer shall be used for all valves and accessories.
- **Standard:** To BS EN 12288.
- **Series:** A.
- **Size:** To suit pipe.
- **Connections:** Flanged to BS EN 1092-3 or BS EN 1759-3 (65mm dia and greater) and Threaded joints to BS EN ISO 228-1 (15mm dia - 50mm dia).
- **Options:** 15mm dia - 50mm dia - Non-heat handle, screwed in bonnet, high quality packing and gland, solid wedge disc for rising stem type and hollow disc for non-rising stem type;

65mm dia and greater - Malleable iron hand wheels, bolted bonnet and stuffing box, with suitable gasket with one piece glands for 10 bar rating. Wedge discs shall be of cast iron with bronze disc rings rolled into the cast iron. Discs shall be solid for rising stem type valves and hollow for non-rising stem type. Valve stems shall be manganese bronze and seats shall have shouldered seat rings of bronze screwed into the valve body.

- **Accessories:** Manufacturer's standard.
- **Execution:** 90-10-90/610 Installation of valves generally.

90-10-90/352 Copper alloy check valves

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-85-20/110 Dry riser system.

- **Manufacturer:** Submit proposals.
- **Standard:** To BS 5154.
- **Material:** Copper alloy.
- **Execution:** 90-10-90/670 Installation of check valves.

90-10-90/360 Test points

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 90-10-90/358 Flow measuring devices.

- **Manufacturer:** Ashford Instrumentation Ltd "Binder Style" test plugs, or equal and approved. One single manufacturer for test plugs to be used.
- **Arrangement:** Self-sealing.
- **Material:** Brass.
- **Connections:** 6 mm (¼ inch) extended length.

90-10-90/374 Draining taps

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-85-20/110 Dry riser system.

- **Manufacturer:** Submit proposals.
- **Standard:** To BS 2879.
- **Material:** Copper alloy.
- **Connections:** Threaded joints to BS EN 10226-1.
- **Execution:** 90-10-90/610 Installation of valves generally.

90-90-40/350 Nitrile rubber insulation

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 60684-3-151.
- **Form:** Pipe section.
- **Thermal conductivity:** 0.035 W/m·K at 0°C.
0.037 W/m·K at 10°C.
0.040 W/m·K at 50°C.
0.043 W/m·K at 75°C.
- **Finish:** Plain.
- **Insulation thickness (minimum):** To BS 5422.
- **Vapour barrier:**
 - **Material:** Manufacturer's standard.
 - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** 90-90-40/390 Protection.
- **Accessories:** Submit proposals.
- **Items to be insulated:** Manufacturer's standard.
- **Execution:** 90-90-40/630 Installing nitrile rubber insulation on pipelines and 90-90-40/780 Installing vapour barriers.

90-90-40/390 Protection

Shared by: 90-90-40/350 Nitrile rubber insulation; and 90-90-40/360 Phenolic foam insulation.

- **Manufacturer:** Submit proposals.
- **Material:** Manufacturer's standard.
- **Colour:** Manufacturer's standard.
- **Execution:** 90-90-40/715 Installing self adhesive cladding and jacketing.

90-90-55/430 Identifying pipework

Shared by: 50-10-00/120 Internal gravity rainwater drainage system; 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS 1710.
- **Identification type:** Adhesive colour bands.
- **Execution:** 90-90-55/660 Installing identification on pipework.

90-90-55/480 Mechanical plant and equipment identification labels

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 60-45-95/110 Variable refrigerant flow system; 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

90-90-55/490 Valve charts and schematics

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Paper print, glazed frame.
- **Information to be included:** Location and identification of pipework regulating, isolating and control valves.
- **Execution:** 90-90-55/620 Installing valve charts and schematics.

90-90-55/495 Valve identification labels

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** 25mm diameter
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm

- **Information:** Purpose and reference number.
- **Execution:** 90-90-55/630 Installing valve identification labels.

90-90-60/380 Roof equipment support systems

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-85-20/110 Dry riser system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Roof Pro, Bigfoot or equal and approved.
One single manufacturer to be used for roof support systems.
- **Design:** H frame support system with adjustable feet shall be so designed that any two adjacent feet can be raised simultaneously to allow for maintenance of the roof insulation and membrane.
- **Components:**
 - **Support base:**
Type: Nylon GF-30% square pad with compatible fixing for a 41x41mm strut system
Size: Minimum 450x450
Anti-vibration mats: 4mm bonded rubber mat
 - **Support frame:**
Type: Galvanised H frame
Size: Submit proposals.
 - **Threaded rod:**
Type: Galvanised threaded rod.
Size: Submit proposals.

90-90-60/390 Services supports

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Support type:** Submit proposals.

90-90-95/390 Rubber bellows

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **General requirements:** Manufacturer's standard.
- **Manufacturer:** Engineering Appliances (Stourflex) type EA or equal and approved.
One single manufacturer for expansion devices to be used.
- **Rubber bellows type:** Untied.
- **Material:**
 - **Liner:** Butyl for domestic hot and cold potable water
Ethylene-propylene diene monomer (EPDM) rubber for central heating
 - **Reinforcement:** Corrosion resistant steel wire.
 - **Cover:** Ethylene propylene diene monomer (EPDM) rubber.

- **Connections:**
- **Execution:** 90-90-95/620 Installation of flexible hoses and rubber bellows.

Execution

55-40-40/620 Installing hot and cold water systems generally

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Standard:** To BS 8558 and BS EN 806-4.
- **Performance:** Free from leaks and the audible effects of expansion, vibration and water hammer.
- **Fixing of equipment, components and accessories:** Fix securely, parallel or perpendicular to the structure of the building.
- **Preparation:** Immediately before installing tanks and cisterns on a floor or platform, clear the surface completely of debris and projections.
- **Corrosion resistance:** In locations where moisture is present or may occur, avoid contact between dissimilar metals by use of suitable washers, gaskets, and the like.

55-40-40/650 Hydraulic pressure testing of hot and cold water supply systems

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Standard:** To BS 8558 and BS EN 806-4.
- **Notice (minimum):** 1 week.
- **Pressure:** 2 times working pressure.
- **Duration of test:** 2 hours.

55-40-40/670 Disinfection of hot and cold water systems

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Standard:** To BS EN 806-4.
- **Samples for analysis:** Provide after disinfection and flushing.

90-10-60/620 Installing expansion compensators

- **Position:** Submit proposals.
- **Anchors and guides:** Locate to contain movement and resist maximum imposed loads.

90-10-60/630 Installing pressure gauges

- **Position:** As detailed on the Tender drawings.

90-10-60/650 Installing strainers

- **Angle type:** Install with strainer cap at the bottom. Inlet at the top or side.
- **Y-type:** Install in direction of flow with the pocket in the horizontal plane.

90-10-65/610 Pipelines installation generally

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Standard:** HVCA TR/20.
- **Dissimilar metals:** Prevent electrolytic corrosion.

90-10-65/615 Installing pipeline fittings

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Fabricated junctions and fittings:**
- **Demountable joints:**

90-10-65/620 Installing anchors generally

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Purpose:** To resist axial stress transmitted by flexure of horizontal and vertical pipe runs, and loading on vertical pipes.
- **Fixings:** Provide associated backing plates, nuts, washers and bolts for attachment to, or building into building structure.
- **Fixing to building structure:** Contractor's choice.

90-10-65/625 Installing slide guides

Shared by: [90-10-65/630 Installing copper pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Expansion and contraction:** Direct movement from pipe anchor points towards loops, bellows or flexible inserts.
- **Thrust:** Linear relative to the axis of pipe.

90-10-65/630 Installing copper pipelines

- **General requirements:** [90-10-65/610 Pipelines installation generally](#); [90-10-65/615 Installing pipeline fittings](#); [90-10-65/620 Installing anchors generally](#); [90-10-65/625 Installing slide guides](#); [90-10-65/690 Spacing of pipelines](#); and [90-10-65/710 General inspection and testing](#).
- **Standard:** In accordance with CDA publications 88 Copper tube in buildings and 149 Large diameter copper tubes.
- **Joining method:**
 - **Permanently concealed joints:** Brazed.
 - **Accessible joints:** Brazed.
- **Anchor:**
 - **Method:** Two flanges fixed to copper female adaptors.
 - **Pipe restraints:** Saddle clamps.

90-10-65/710 General inspection and testing

Shared by: 90-10-65/630 Installing copper pipelines; 90-10-65/645 Installing plastics pipelines; and 90-10-65/680 Installing steel pipelines.

- **Inspection of joints:**
 - **Joints:** Cut out, cut open and inspect.
 - **Number of joints:** Three.
- **Safety precautions:** In accordance with HSE GS 4.

90-10-90/610 Installation of valves generally

Shared by: 90-10-90/332 Butterfly valves; 90-10-90/342 Copper alloy gate valves; 90-10-90/374 Draining taps; 90-10-90/380 Ball valves, manually operated; and 90-10-90/670 Installation of check valves.

- **Installation:** In accordance with BS 6683.
- **Position:**
- **Isolation and regulation valves:** Provide at equipment and on sub-circuits.
- **Access:** Locate valves so they can be readily operated and maintained. Locate next to equipment which is to be isolated.
- **Connection to pipework:** Fit with joints that suit the pipe material.

90-10-90/670 Installation of check valves

- **General requirements:** 90-10-90/610 Installation of valves generally.
- **Lift type:** Install in direction of flow as indicated on the body.
- **Disc type:** With spring, fit in any plane. Without spring, fit in vertical plane with flow from bottom to top.
- **Wafer type:** Install between flanges. Fit in horizontal plane or vertical upward flow.
- **Split disc:** Install between flanges. Fit in horizontal plane or vertical upward flow.

90-40-05/610 Installing gas and oil fired boilers

- **Standards:**
 - **Gas fired boilers:** In accordance with BS 6798 or BS 6644.
 - **Oil fired boilers:** In accordance with BS 5410-1 or BS 5410-2.
- **Position:** Minimum clearances as per manufacturer's literature.
- **Space around boiler:** Ensure sufficient air circulation for draught diverter operation; Ensure sufficient air for combustion and cooling; and Facilitate boiler maintenance and servicing.
- **Preparation:** Pressure test joints immediately before installing lagging and casing. Submit test results.
- **Fixing of equipment, components and accessories:** Fix securely to purpose-made bases or supports.
- **Access:** Provide for inspection and servicing of boilers and ancillary equipment.

90-90-40/610 Installing insulation and protection products generally

Shared by: 90-90-40/630 Installing nitrile rubber insulation on pipelines; 90-90-40/645 Installing phenolic foam insulation on ductwork; and 90-90-40/660 Installing foil faced mineral wool insulation on ductwork.

- **Standard:** In accordance with BS 5970.
- **Timing:** Insulate after installed system has been fully tested and joints proved sound.

- **Insulation:** Do not enclose adjacent units together.
- **Clearance:** Maintain between pipes.
- **Finish:** Neatly finish joints, corners, edges and overlaps.

90-90-40/630 Installing nitrile rubber insulation on pipelines

- **General requirements:** 90-90-40/610 Installing insulation and protection products generally.
- **Joints:** Close butt, secure with adhesive.
- **At fittings:** Fabricate from mitre cut pieces. Secure with adhesive.

90-90-40/715 Installing self adhesive cladding and jacketing

- **Application:** Cover insulation with self adhesive cladding and jacketing with 50 mm overlaps.

90-90-40/780 Installing vapour barriers

Shared by: 90-90-40/350 Nitrile rubber insulation; and 90-90-40/360 Phenolic foam insulation.

- **Integrity:** Seal to maintain throughout.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

90-90-55/620 Installing valve charts and schematics

- **Fixing:** Plug and screw to wall.
- **Position:** Plant room.

90-90-55/630 Installing valve identification labels

- **Fixing:** Secure with metal chain.

90-90-55/660 Installing identification on pipework

- **Application of basic identification colour:** Coloured bands as BS 1710.
- **Safety colour identification:** On or next to the colour bands.
- **Information:** Colour bands as BS 1710.
- **Direction of flow:** Indication arrow;
Indication arrow and the word FLOW or the letter F;
and Indication arrow and the word RETURN or the letter R.

90-90-95/620 Installation of flexible hoses and rubber bellows

- **Position:** Close to the source of vibration.

System completion

55-40-40/810 Commissioning of hot and cold water supply systems

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Pre-commissioning:** In accordance with BSRIABG 2/2010 and CIBSE Commissioning Code W.
- **Commissioning:** In accordance with BS EN 806-4, BSRIABG 2/2010 and CIBSE Commissioning Code W.
- **Notice (minimum):** 1 week.
- **Equipment:** Check and adjust operation of equipment, controls and safety devices.
- **Outlets:** Check operation of outlets for satisfactory rate of flow and temperature.

55-40-40/830 Demonstrations

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Running of plant:**
 - **Operation:** Run, maintain and supervise the installations under normal working conditions.
 - **Duration:** 2 weeks.
- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

55-40-40/840 Documentation

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Operating and maintenance instructions:**
 - **Scope:** In accordance with BSRIA Guide BG 1/2007 "Handover, O&M Manuals, and Project Feedback".
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Electronic and Paper copy.
 - **Number of copies:** Three.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms;
Location, size and route of hot and cold water services;
Location, route and depth of underground services;
Location and identification of regulating, isolation and control valves;
and Location of outlets.
 - **Format:** A1 paper print and Electronic.
 - **Scale:** Max. 1:50 @ A1.
 - **Number of copies:** Three.
- **Submittal date:** At handover.
- **Wholesome water consumption notice:** Submit within 30 days.

55-40-40/850 Water quality tests

Shared by: 55-40-40/110 Incoming water supply; 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Standard:** To BS EN 806-4.
- **Samples:**
 - **Sample points:** Submit proposals.
 - **Samples for analysis:** Submit samples for bacteriological analysis.
- **Water temperature:** Record at each sampling point at the time of taking the sample.
- **Test results:**
 - **Record:** Details of all analyses.
 - **Submit:** On completion.
 - **Number of copies:** Two.

55-40-40/870 Operating tools

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Tools:** Supply tools for operation, maintenance and cleaning purposes.
- **Keys:** Supply keys for valves and vents.

55-40-40/880 Maintenance

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-40-40/160 Indirect hot water storage supply system.

- **Servicing and maintenance:** Undertake for 12 months after completion.

Ω End of system

55-60-55/110 Incoming gas supply

System outline

55-60-55/110 Incoming gas supply

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the **incoming gas supply system** including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

A new gas supply will be provided to the site.

It is understood that all external works for running the new supply from the mains, including trenches, builders work and licenses shall be designed by the Utility Consultant (Aecom). The contractor shall work with Aecom to finalise the requirements for the incoming gas connections. The Contractor shall refer to the Technical drawings and Technical Schematics for indicative routes and allowances to the gas network.

The Contractor shall allow for all necessary liaison and negotiations with the gas supplier and shipper. The Contractor shall verify the size of the supplies required and make any necessary alterations to the application(s).

The Contractor shall liaise with the Client and arrange the appointment of a meter operator/gas supplier, ensure all necessary documentation is provided to the Client's nominated meter operator/gas supplier and manage the installation works for the new incoming natural-gas meter operator/gas supplier.

The Contractor shall ensure that it is installed in accordance with the latest Gas Regulations and the suppliers and shipper requirements comprising of:

- * All metering
- * Isolation provisions
- * Enclosures
- * Complete BEMS connectivity including graphics

- * Gas safety alarm
- * Automatic shut off
- * Utility supplier liaison
- * Permanent ventilation
- * Comprehensive safety labelling
- * Identification painting

Gas Metering

The Contractor shall provide gas metering from the appointed meter operator comprising

- * All metering and AMR
 - * Isolation provisions
 - * Enclosures
 - * Complete BEMS connectivity including graphics
 - * Gas safety alarm
 - * Automatic shut off
 - * Utility supplier liaison
 - * Permanent ventilation
 - * Comprehensive safety labelling
 - * Identification painting
- **Gas transporter:** Existing.
 - **Gas supplier:** Existing.
 - **Volume flow rate:** Submit proposals.
 - **Position of meter:** As indicated on the Tender drawings.

Ω End of system

55-60-55/120 Natural gas supply system

System outline

55-60-55/120 Natural gas supply system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the **Natural Gas Supply System** including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Kitchen Gas Supply

A capped off gas service will be provided for the kitchen unit for future use. The future installation of a gas meter must be taken into account and the necessary provisions (ventilation, accessibility) be included in the Contractor's detailed design proposals. A gas meter shall be installed on the branch serving the kitchen unit and this meter shall have the capacity to interface into the BEMS for monitoring and control purposes.

The Contractor shall design, supply and install a gas safety control systems within the kitchen area and this shall be interlinked to the fire alarm system which will cut the supply of gas to the kitchen if the building goes into a life safety mode.

All gas pipework shall be constructed of steel and painted yellow. All gas pipework shall be visible or run within ventilated shafts or pipe in pipe. Any gas pipework running through protected areas shall be provided with the required fire protection based on the fire consultants fire strategy.

All gas pipework is to be installed by a registered Gas Safe Engineer, to current regulations and standards.

Gas Water Heaters

A gas connection shall be provided to serve the gas water heaters located within the Level 08 plantroom. The gas pipework shall run from the gas meter room to the roof within riser R40. A gas meter shall be installed on the branch serving the gas water heaters and this meter shall have the capacity to interface into the BEMS for monitoring and control purposes.

The Contractor shall design, supply and install a gas safety control systems within the gas water heater plant enclosure and this shall be interlinked to the fire alarm system which will cut the supply of gas to

the kitchen if the building goes into a life safety mode.

All gas pipework shall be constructed of steel and painted yellow. All gas pipework shall be visible or run within ventilated shafts or pipe in pipe. Any gas pipework running through protected areas shall be provided with the required fire protection based on the fire consultants fire strategy.

All gas pipework is to be installed by a registered Gas Safe Engineer, to current regulations and standards.

- **System performance:** 55-60-55/210 Design of gas supply installations.
- **Metering:** 90-65-55/400 Secondary gas meters.
- **Pipeline material:** 90-10-65/310 Copper pipelines and 90-10-65/415 Steel pipelines.
- **Support:** 90-90-60/390 Services supports.
- **Gas valves:** 90-10-90/332 Butterfly valves;
90-10-90/380 Ball valves, manually operated;
and 90-30-35/320 Gas solenoid valves.
- **Gas equipment:** Submit proposals.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
90-90-55/480 Mechanical plant and equipment identification labels;
90-90-55/490 Valve charts and schematics;
and 90-90-55/495 Valve identification labels.
- **Execution:** 55-60-55/650 Installing gas pipelines;
55-60-55/630 Gas Safe registration requirements;
and 55-60-55/670 Connection to gas outlets.
- **System completion:** 55-60-55/850 Pressure testing of natural gas supply systems;
55-60-55/870 Inspection and test records;
55-60-55/875 Documentation;
and 55-60-55/880 Maintenance.

System performance

55-60-55/210 Design of gas supply installations

- **Design:** As detailed in the Tender drawings. Perform all calculations to confirm the design of the natural gas supply system.
- **Standards:**
 - **General:** To IGEM Standard UP/2.
 - **Low pressure gas for premises:** To BS 6891.
 - **Gas pipework for buildings:** To BS EN 1775.
 - **Industrial gas supply:** To BS EN 15001-1.
- **Requirement:** Submit proposals, including detailed design drawings, technical information, calculations and manufacturers' literature.

Products

90-10-65/310 Copper pipelines

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-60-55/120 Natural gas supply system.

- **General requirements:** 90-10-65/320 Copper pipeline jointing materials and 90-10-65/315 Copper pipeline fittings.
- **Manufacturer:** Submit proposals.
- **Standard:** To BS EN 1057.
- **Grade:** R250.
- **Finish:** Plain.
- **Execution:** 90-10-65/630 Installing copper pipelines.

90-10-65/315 Copper pipeline fittings

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; and 90-10-65/310 Copper pipelines.

- **Manufacturer:** Submit proposals.
- **Standards:**
 - **Capillary:** To BS EN 1254-1, solder ring and To BS EN 1254-1, end feed.
 - **Compression:** To BS EN 1254-2, type A and To BS EN 1254-2, type B.
 - **Flanges:** To BS EN 1092-3

90-10-65/320 Copper pipeline jointing materials

- **Manufacturer:** Contractor's choice.
- **Standards:**
 - **Lead free solder for capillary fittings:** To BS EN ISO 9453.
 - **Brazing filling:** To BS EN ISO 17672.
 - **Flange jointing rings:** To BS EN 1514-4.

90-10-65/415 Steel pipelines

Shared by: 55-60-55/120 Natural gas supply system; and 55-85-20/110 Dry riser system.

- **General requirements:** 90-10-65/425 Steel pipeline jointing materials and 90-10-65/420 Steel pipeline fittings.
- **Manufacturer:** Submit proposals.
- **Standard:**
 - **Up to 150mm:** To BS EN 10255, heavy weight.
 - **150mm and above:** Manufacturer's standard.
- **Finish:** Manufacturer's standard.
- **Execution:** 90-10-65/680 Installing steel pipelines.

90-10-65/420 Steel pipeline fittings

- **Manufacturer:** Submit proposals.
- **Standards:**
 - **Malleable:** To BS 143 and 1256.
 - **Flanged:** To BS EN 1092-1.
 - **Welded:** To BS EN 10253-1 and BS EN 10253-2.
 - **Wrought:** To BS EN 10241.
 - **Mechanical couplings:** Manufacturer's standard.

90-10-65/425 Steel pipeline jointing materials

- **Manufacturer:** Submit proposals.
- **Standards:**
 - **Jointing compound:** To BS 6956-5.
 - **PTFE tape:** To BS EN 751-3.
 - **Flange jointing rings:** To BS EN 1514-4.
 - **Elastomeric gaskets:** To BS EN 681-1.
 - **Welding rods:**
 - Gas welding:** To BS EN 12536.
 - Arc welding:** To BS EN ISO 636.

90-10-90/332 Butterfly valves

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-60-55/120 Natural gas supply system.

- **Manufacturer:** Herz Valves Ltd, Crane Fluid Systems, Hattersley Valves, TA or Oventrop. Only one valve manufacturer shall be used for all valves and accessories.
- **Standard:** To BS EN 593.
- **Arrangement:** Double flanged.
- **Materials:**
 - **Body:** Cast iron.
 - **Shaft:** Steel with minimum 12% chromium.
 - **Disc:** Stainless steel.
 - **Seat:** Manufacturer's standard.
- **Operation:**
 - **Manual:** Lever operated up to 150mm dia, 200mm dia and greater to be complete with gear unit.
- **Execution:** 90-10-90/610 Installation of valves generally.

90-10-90/380 Ball valves, manually operated

- **Manufacturer:** Submit proposals.
- **Standard:** To BS EN 331.
- **Arrangement:** Lever-operated.
- **Material:** Stainless steel.

- **Execution:** 90-10-90/610 Installation of valves generally.

90-30-35/320 Gas solenoid valves

- **Manufacturer:** Contractor's choice.
- **Arrangement:** Two way safety shut off.
- **Speed of opening:** Fast.
- **Connections:** Manufacturer's standard.
- **Pressure rating:** PN 16 to BS EN 1333.
- **Solenoid supply voltage:** Manufacturer's standard.
- **Actuation method:** Knock off button;
Remote signal;
Sensor above each burner;
and Sensor on ceiling.
- **Reset:** Automatic.
- **Accessories:** Pressure test points.

90-65-55/400 Secondary gas meters

- **Manufacturer:** Contractor's choice.
- **Standards:**
 - **Gas meters:** Contractor's choice.
 - **Unions and adaptors:** To BS 746.
 - **Low pressure meters:** In accordance with IGEM Standard GM/6.
 - **Electrical connections:** In accordance with IGEM Standard GM/7A.
- **Accessories:** Pulsed output for BMS monitoring.
- **Housing type:** Manufacturer's standard.
- **Execution:** 90-65-55/640 Installing secondary gas meters.

90-90-55/430 Identifying pipework

Shared by: 50-10-00/120 Internal gravity rainwater drainage system; 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS 1710.
- **Identification type:** Adhesive colour bands.
- **Execution:** 90-90-55/660 Installing identification on pipework.

90-90-55/480 Mechanical plant and equipment identification labels

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 60-45-95/110 Variable refrigerant flow system; 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

90-90-55/490 Valve charts and schematics

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Paper print, glazed frame.
- **Information to be included:** Location and identification of pipework regulating, isolating and control valves.
- **Execution:** 90-90-55/620 Installing valve charts and schematics.

90-90-55/495 Valve identification labels

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** 25mm diameter
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information:** Purpose and reference number.
- **Execution:** 90-90-55/630 Installing valve identification labels.

90-90-60/390 Services supports

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Support type:** Submit proposals.

Execution

55-60-55/630 Gas Safe registration requirements

- **Type of service:** All services.
- **Type of gas:** Natural gas.
- **Area of work:**

55-60-55/650 Installing gas pipelines

- **Standards:**
 - **General:** To IGEM Standard UP/10.
 - **Gas pipelines:** To BS 6891 and BS EN 1775.
- **Painting:** All pipework shall be readily identified to indicate it carries a fuel gas. This shall be achieved by fully painting with yellow ochre (to BS 4800 08 C 35). Tape identification will not be accepted.

55-60-55/670 Connection to gas outlets

- **Connection:** Connect to installed equipment.

90-10-65/610 Pipelines installation generally

Shared by: 90-10-65/630 Installing copper pipelines; 90-10-65/645 Installing plastics pipelines; and 90-10-65/680 Installing steel pipelines.

- **Standard:** HVCA TR/20.
- **Dissimilar metals:** Prevent electrolytic corrosion.

90-10-65/615 Installing pipeline fittings

Shared by: 90-10-65/630 Installing copper pipelines; 90-10-65/645 Installing plastics pipelines; and 90-10-65/680 Installing steel pipelines.

- **Fabricated junctions and fittings:**
- **Demountable joints:**

90-10-65/620 Installing anchors generally

Shared by: 90-10-65/630 Installing copper pipelines; 90-10-65/645 Installing plastics pipelines; and 90-10-65/680 Installing steel pipelines.

- **Purpose:** To resist axial stress transmitted by flexure of horizontal and vertical pipe runs, and loading on vertical pipes.
- **Fixings:** Provide associated backing plates, nuts, washers and bolts for attachment to, or building into building structure.
- **Fixing to building structure:** Contractor's choice.

90-10-65/625 Installing slide guides

Shared by: 90-10-65/630 Installing copper pipelines; and 90-10-65/680 Installing steel pipelines.

- **Expansion and contraction:** Direct movement from pipe anchor points towards loops, bellows or flexible inserts.
- **Thrust:** Linear relative to the axis of pipe.

90-10-65/630 Installing copper pipelines

- **General requirements:** 90-10-65/610 Pipelines installation generally;
90-10-65/615 Installing pipeline fittings;
90-10-65/620 Installing anchors generally;
90-10-65/625 Installing slide guides;
90-10-65/690 Spacing of pipelines;
and 90-10-65/710 General inspection and testing.
- **Standard:** In accordance with CDA publications 88 Copper tube in buildings and 149 Large diameter copper tubes.
- **Joining method:**
 - **Permanently concealed joints:** Brazed.
 - **Accessible joints:** Brazed.
- **Anchor:**
 - **Method:** Two flanges fixed to copper female adaptors.
 - **Pipe restraints:** Saddle clamps.

90-10-65/680 Installing steel pipelines

- **General requirements:** 90-10-65/610 Pipelines installation generally;
90-10-65/615 Installing pipeline fittings;
90-10-65/620 Installing anchors generally;
90-10-65/625 Installing slide guides;
90-10-65/690 Spacing of pipelines;
and 90-10-65/710 General inspection and testing.
- **Permanently concealed joints:** Welded.
- **Accessible joints:** Screwed, up to and including 50 mm and Welded and flanged, 65 mm and over.
- **Expansion loops:**
- **Anchor:**
 - **Method:** Two slip on flanges welded to pipes, bolted together through a carbon steel channel section.
 - **Pipe restraints:** Carbon steel overstraps or heavy U-bolts welded to pipes.

90-10-65/710 General inspection and testing

Shared by: 90-10-65/630 Installing copper pipelines; 90-10-65/645 Installing plastics pipelines; and 90-10-65/680 Installing steel pipelines.

- **Inspection of joints:**
 - **Joints:** Cut out, cut open and inspect.
 - **Number of joints:** Three.

- **Safety precautions:** In accordance with HSE GS 4.

90-10-90/610 Installation of valves generally

Shared by: 90-10-90/332 Butterfly valves; 90-10-90/342 Copper alloy gate valves; 90-10-90/374 Draining taps; 90-10-90/380 Ball valves, manually operated; and 90-10-90/670 Installation of check valves.

- **Installation:** In accordance with BS 6683.
- **Position:**
- **Isolation and regulation valves:** Provide at equipment and on sub-circuits.
- **Access:** Locate valves so they can be readily operated and maintained. Locate next to equipment which is to be isolated.
- **Connection to pipework:** Fit with joints that suit the pipe material.

90-65-55/640 Installing secondary gas meters

- **Secondary gas meters:**
 - **Low pressure:** In accordance with BS 6400-1.
 - **Medium pressure:** In accordance with BS 6400-2.
 - **Non-domestic:** In accordance with IGEM GM/8-3 and IGEM GM8-5.
- **Electrical connections:** In accordance with IGEM GM/7A.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

90-90-55/620 Installing valve charts and schematics

- **Fixing:** Plug and screw to wall.
- **Position:** Plant room.

90-90-55/630 Installing valve identification labels

- **Fixing:** Secure with metal chain.

90-90-55/660 Installing identification on pipework

- **Application of basic identification colour:** Coloured bands as BS 1710.
- **Safety colour identification:** On or next to the colour bands.
- **Information:** Colour bands as BS 1710.
- **Direction of flow:** Indication arrow;
Indication arrow and the word FLOW or the letter F;
and Indication arrow and the word RETURN or the letter R.

System completion

55-60-55/850 Pressure testing of natural gas supply systems

- **Notice (minimum):** 1 week.

- **Pressure:** 2 times working pressure.
- **Duration of test:** 2 h.

55-60-55/870 Inspection and test records

- **Reports:** Submit proposals.
- **Record sheets:**
 - **Submission:** Submit proposals.
 - **Number of copies:** Three.

55-60-55/875 Documentation

- **Operating and maintenance instructions:**
 - **Scope:** In accordance with BSRIA Guide BG 1/2007 "Handover, O&M Manuals, and Project Feedback".
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Electronic and Paper copy.
 - **Number of copies:** Three.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms;
Location, size and route of mechanical services;
Location, route and depth of underground services;
Location and identification of pipework regulating, isolation and control valves;
and Location of outlets.
 - **Format:** A1 paper print and Electronic.
 - **Scale:** Max. 1:50 @ A1.
 - **Number of copies:** Three.
- **Submittal date:** At handover.

55-60-55/880 Maintenance

- **Servicing and maintenance:** Undertake for 12 months after completion.

Ω End of system

55-85-20/110 Dry riser system

System outline

55-85-20/110 Dry riser system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the Dry Riser System, including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Design and Instal Dry riser systems including inlet breechin units, landing valves, automatic air release valves and pipework.

From 2 no. inlet breeching pieces in locked prefabricated boxes to British Standard, dry risers to extend horizontally at high level ground floor to dedicated dry riser shafts adjacent to each fire fighting lift, with landing valves in prefabricated boxes to British Standard at each floor level and roof.

- **System performance:** 55-85-20/210 Design of dry riser systems.
- **System manufacturer:** Submit proposals.
- **Inlets:** 90-35-95/345 Inlet breechings and boxes.
- **Pipelines:** 90-10-65/415 Steel pipelines.
- **Pipeline supports:** 90-90-60/390 Services supports.
- **Fire stopping:** Individual services penetrations fire stopping system.
- **Outlets:** 90-35-95/350 Landing valves and boxes for dry risers.
- **Pipeline ancillaries:** 90-10-90/342 Copper alloy gate valves;
90-10-90/352 Copper alloy check valves;
and 90-10-90/374 Draining taps.
- **System accessories:** 90-10-90/352 Copper alloy check valves;
90-10-90/374 Draining taps;
90-90-60/380 Roof equipment support systems;
and 90-10-60/310 Automatic air vents.
- **Plant and equipment identification:** 90-90-55/480 Mechanical plant and equipment identification labels;
90-90-55/490 Valve charts and schematics;
and 90-90-55/495 Valve identification labels.
- **Execution:** 55-85-20/620 Installing firefighting systems;
55-85-20/625 Installation for use during construction;
and 55-85-20/630 Installing identification for firefighting systems.

- **System completion:** 55-85-20/810 Flushing;
55-85-20/820 Testing;
55-85-20/830 Setting to work;
55-85-20/840 Inspection and test records;
55-85-20/850 Documentation;
55-85-20/860 Operating tools;
and 55-85-20/870 Servicing and maintenance.

System performance

55-85-20/210 Design of dry riser systems

- **Standards:** In accordance with CIBSE E and BS 9990.
- **Design:** Complete the design of the dry riser system.
- **Bore of main riser:** 100 mm.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Products

90-10-60/310 Automatic air vents

- **Manufacturer:** Spirax-Sarco AE36A or equal and approved.
One single manufacturer for air-vents to be used.
- **Arrangement:** Vertical inlet with integral lockshield isolating valve and check valve.
- **Material:** Austenitic stainless steel type 316L.
- **Connections:** Threaded.

90-10-65/415 Steel pipelines

Shared by: 55-60-55/120 Natural gas supply system; and 55-85-20/110 Dry riser system.

- **General requirements:** 90-10-65/425 Steel pipeline jointing materials and 90-10-65/420 Steel pipeline fittings.
- **Manufacturer:** Submit proposals.
- **Standard:**
 - **Up to 150mm:** To BS EN 10255, heavy weight.
 - **150mm and above:** Manufacturer's standard.
- **Finish:** Manufacturer's standard.
- **Execution:** 90-10-65/680 Installing steel pipelines.

90-10-65/420 Steel pipeline fittings

- **Manufacturer:** Submit proposals.
- **Standards:**
 - **Malleable:** To BS 143 and 1256.

- **Flanged:** To BS EN 1092-1.
- **Welded:** To BS EN 10253-1 and BS EN 10253-2.
- **Wrought:** To BS EN 10241.
- **Mechanical couplings:** Manufacturer's standard.

90-10-65/425 Steel pipeline jointing materials

- **Manufacturer:** Submit proposals.
- **Standards:**
 - **Jointing compound:** To BS 6956-5.
 - **PTFE tape:** To BS EN 751-3.
 - **Flange jointing rings:** To BS EN 1514-4.
 - **Elastomeric gaskets:** To BS EN 681-1.
 - **Welding rods:**
 - Gas welding:** To BS EN 12536.
 - Arc welding:** To BS EN ISO 636.

90-10-90/342 Copper alloy gate valves

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-85-20/110 Dry riser system.

- **Manufacturer:** Herz Valves Ltd, Crane Fluid Systems, Hattersley Valves, TA or Oventrop. Only one valve manufacturer shall be used for all valves and accessories.
- **Standard:** To BS EN 12288.
- **Series:** A.
- **Size:** To suit pipe.
- **Connections:** Flanged to BS EN 1092-3 or BS EN 1759-3 (65mm dia and greater) and Threaded joints to BS EN ISO 228-1 (15mm dia - 50mm dia).
- **Options:** 15mm dia - 50mm dia - Non-heat handle, screwed in bonnet, high quality packing and gland, solid wedge disc for rising stem type and hollow disc for non-rising stem type;

65mm dia and greater - Malleable iron hand wheels, bolted bonnet and stuffing box, with suitable gasket with one piece glands for 10 bar rating. Wedge discs shall be of cast iron with bronze disc rings rolled into the cast iron. Discs shall be solid for rising stem type valves and hollow for non-rising stem type. Valve stems shall be manganese bronze and seats shall have shouldered seat rings of bronze screwed into the valve body.

- **Accessories:** Manufacturer's standard.
- **Execution:** 90-10-90/610 Installation of valves generally.

90-10-90/352 Copper alloy check valves

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-85-20/110 Dry riser system.

- **Manufacturer:** Submit proposals.
- **Standard:** To BS 5154.
- **Material:** Copper alloy.

- **Execution:** 90-10-90/670 Installation of check valves.

90-10-90/374 Draining taps

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 55-85-20/110 Dry riser system.

- **Manufacturer:** Submit proposals.
- **Standard:** To BS 2879.
- **Material:** Copper alloy.
- **Connections:** Threaded joints to BS EN 10226-1.
- **Execution:** 90-10-90/610 Installation of valves generally.

90-90-55/480 Mechanical plant and equipment identification labels

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 60-45-95/110 Variable refrigerant flow system; 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

90-90-55/490 Valve charts and schematics

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Paper print, glazed frame.
- **Information to be included:** Location and identification of pipework regulating, isolating and control valves.
- **Execution:** 90-90-55/620 Installing valve charts and schematics.

90-90-55/495 Valve identification labels

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** 25mm diameter
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information:** Purpose and reference number.
- **Execution:** 90-90-55/630 Installing valve identification labels.

90-90-60/380 Roof equipment support systems

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-85-20/110 Dry riser system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Roof Pro, Bigfoot or equal and approved.
One single manufacturer to be used for roof support systems.
- **Design:** H frame support system with adjustable feet shall be so designed that any two adjacent feet can be raised simultaneously to allow for maintenance of the roof insulation and membrane.
- **Components:**
 - **Support base:**
Type: Nylon GF-30% square pad with compatible fixing for a 41x41mm strut system
Size: Minimum 450x450
Anti-vibration mats: 4mm bonded rubber mat
 - **Support frame:**
Type: Galvanised H frame
Size: Submit proposals.
 - **Threaded rod:**
Type: Galvanised threaded rod.
Size: Submit proposals.

90-90-60/390 Services supports

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Support type:** Submit proposals.

Execution

55-85-20/620 Installing firefighting systems

- **Standard:** In accordance with BS 5306-1 and In accordance with BS 9990.
- **Protection:** Protect from damage, e.g. by frost, traffic loads (underground hydrants) or vibration.

55-85-20/625 Installation for use during construction

- **Standard:** In accordance with BS 9990.

55-85-20/630 Installing identification for firefighting systems

- **Standard:** In accordance with BS 9990.
- **Notice:** Submit proposals.
- **Operating instructions:** Submit proposals.

90-10-65/610 Pipelines installation generally

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Standard:** HVCA TR/20.
- **Dissimilar metals:** Prevent electrolytic corrosion.

90-10-65/615 Installing pipeline fittings

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Fabricated junctions and fittings:**
- **Demountable joints:**

90-10-65/620 Installing anchors generally

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Purpose:** To resist axial stress transmitted by flexure of horizontal and vertical pipe runs, and loading on vertical pipes.
- **Fixings:** Provide associated backing plates, nuts, washers and bolts for attachment to, or building into building structure.
- **Fixing to building structure:** Contractor's choice.

90-10-65/625 Installing slide guides

Shared by: [90-10-65/630 Installing copper pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Expansion and contraction:** Direct movement from pipe anchor points towards loops, bellows or flexible inserts.
- **Thrust:** Linear relative to the axis of pipe.

90-10-65/680 Installing steel pipelines

- **General requirements:** 90-10-65/610 Pipelines installation generally;
90-10-65/615 Installing pipeline fittings;
90-10-65/620 Installing anchors generally;
90-10-65/625 Installing slide guides;
90-10-65/690 Spacing of pipelines;
and 90-10-65/710 General inspection and testing.
- **Permanently concealed joints:** Welded.
- **Accessible joints:** Screwed, up to and including 50 mm and Welded and flanged, 65 mm and over.
- **Expansion loops:**
- **Anchor:**
 - **Method:** Two slip on flanges welded to pipes, bolted together through a carbon steel channel section.
 - **Pipe restraints:** Carbon steel overstraps or heavy U-bolts welded to pipes.

90-10-65/710 General inspection and testing

Shared by: 90-10-65/630 Installing copper pipelines; 90-10-65/645 Installing plastics pipelines; and 90-10-65/680 Installing steel pipelines.

- **Inspection of joints:**
 - **Joints:** Cut out, cut open and inspect.
 - **Number of joints:** Three.
- **Safety precautions:** In accordance with HSE GS 4.

90-10-90/610 Installation of valves generally

Shared by: 90-10-90/332 Butterfly valves; 90-10-90/342 Copper alloy gate valves; 90-10-90/374 Draining taps; 90-10-90/380 Ball valves, manually operated; and 90-10-90/670 Installation of check valves.

- **Installation:** In accordance with BS 6683.
- **Position:**
- **Isolation and regulation valves:** Provide at equipment and on sub-circuits.
- **Access:** Locate valves so they can be readily operated and maintained. Locate next to equipment which is to be isolated.
- **Connection to pipework:** Fit with joints that suit the pipe material.

90-10-90/670 Installation of check valves

- **General requirements:** 90-10-90/610 Installation of valves generally.
- **Lift type:** Install in direction of flow as indicated on the body.
- **Disc type:** With spring, fit in any plane. Without spring, fit in vertical plane with flow from bottom to top.
- **Wafer type:** Install between flanges. Fit in horizontal plane or vertical upward flow.
- **Split disc:** Install between flanges. Fit in horizontal plane or vertical upward flow.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.

- **Position:** On equipment.

90-90-55/620 Installing valve charts and schematics

- **Fixing:** Plug and screw to wall.
- **Position:** Plant room.

90-90-55/630 Installing valve identification labels

- **Fixing:** Secure with metal chain.

System completion

55-85-20/810 Flushing

- **Standard:** In accordance with BS 9990.
- **Operation:** Fill the system with water and discharge it via the topmost outlet. Flush out debris.

55-85-20/820 Testing

- **Standard:** In accordance with BS 9990.
- **Notice before testing (minimum):** Five Working days
- **Static pressure test:** Submit proposals.
- **Flow test:** After static pressure test, pass water through the system under pressure and record flow gauge readings. Submit test results.

55-85-20/830 Setting to work

- **Standard:** In accordance with BS 9990.
- **Operation:** Submit proposals.
- **Make ready:** Drain system and leave ready for use.

55-85-20/840 Inspection and test records

- **Standard:** In accordance with BS 9990.
- **Reports:** Submit proposals.
- **Record sheets:**
 - **Submission:** On completion.
 - **Number of copies:** Three.

55-85-20/850 Documentation

- **Standard:** In accordance with BS 9990.
- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Submit proposals.

- **Number of copies:** Three.
- **Record drawings:**
 - **Content:** Submit proposals.
 - **Format:** Submit proposals.
 - **Number of copies:** Submit proposals.
- **Submittal date:** At handover.

55-85-20/860 Operating tools

- **Tools:**
 - **Type:** Supply tools for operation, maintenance and cleaning purposes.
 - **Quantity:** Submit proposals.
- **Keys:**
 - **Type:** Supply keys for padlocks and air release valves.
 - **Quantity:** Submit proposals.

55-85-20/870 Servicing and maintenance

- **Standard:** In accordance with BS 9990.
- **Requirement:** Undertake for 12 months after completion.

Ω End of system

55-85-75/110 Commercial and industrial sprinkler system

System outline

55-85-75/110 Commercial and industrial sprinkler system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the Water Fire Suppression System, including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

The Design, Manufacture, Installation, Testing, Commissioning and handover of a fully operational and code compliant fire suppression water mist system.

The system shall be compliant with:

NFPA 750
CEN/TS 14972
FM 5560
UL 2167
BE 8489 2016

- **System performance:** 55-85-75/210 Design of sprinkler systems (Water Mist Fire Suppression System).
- **System manufacturer:** Submit proposals (Design Layouts and Equipment based upon Marioff Limited)
- **Supply:** Storage tank and Town mains.
- **Tanks:** 90-10-95/310 Glass reinforced tanks and cisterns.
- **Pumps:** Contractor's design.
- **Pipelines:**
 - **Distribution below ground:** 90-10-65/365 Medium Density Polyethylene (MDPE) pipelines for water supply.
 - **Distribution above ground upstream of alarm valve:** Contractor's design.
 - **Distribution above ground downstream of alarm valve:** Contractor's design.
 - **Pipeline supports:** 90-90-60/390 Services supports.
- **Fire stopping:** Individual services penetrations fire stopping system.
- **Outlets:** Contractor's design.
- **Valves:**
 - **Alarm valves and devices:** Contractor's design.
 - **Back flow prevention:** Contractor's design.
 - **Stop valves:** Contractor's design.

- **Ring main valves:** Contractor's design.
- **Drain valves:** Contractor's design.
- **Test valves:** Contractor's design.
- **Control panels:** Contractor's design.
- **Trace heating:** Contractor's design.
- **System accessories:** Contractor's design.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
90-90-55/480 Mechanical plant and equipment identification labels;
90-90-55/490 Valve charts and schematics;
and 90-90-55/495 Valve identification labels.
- **Execution:** 55-85-75/620 Installing automatic sprinkler systems.
- **System completion:** 55-85-75/820 Testing;
55-85-75/840 Inspection and test records;
55-85-75/860 Servicing and maintenance;
55-85-75/810 Flushing;
and 55-85-75/850 Documentation.

System performance

55-85-75/210 Design of sprinkler systems

- **Standard:** Water Mist System to:
NFPA 750
CEN/TS 14972
FM 5560
UL 2167
BE 8489 2016
- **Design:** The Design, Manufacture, Installation, Testing, Commissioning and handover of a fully operational and code compliant fire suppression water mist system.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Products

90-10-65/365 Medium Density Polyethylene (MDPE) pipelines for water supply

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-85-75/110 Commercial and industrial sprinkler system.

- **General requirements:** 90-10-65/380 Jointing materials for plastics tubes.
- **Standards:**
 - **Pipes:** To BS EN 12201-2 and To BS ISO 4427-2.
 - **Fittings:** To BS EN 12201-3 and To BS ISO 4427-3.
- **Colour:** Blue.
- **Execution:** 90-10-65/645 Installing plastics pipelines.

90-10-65/380 Jointing materials for plastics tubes

- **Manufacturer:** Contractor's choice.
- **Standards:**
 - **Compression:** To BS EN 1254-3.
 - **Electrofusion:** To BS EN 12201-3.
 - **Socket and spigot:** To BS EN 12201-3.
 - **Solvent cement:** To BS EN 14814.
 - **Elastomeric ring seal:** To BS EN 681-1.

90-10-95/310 Glass reinforced tanks and cisterns

Shared by: 55-40-40/130 Pumped cold water supply system; and 55-85-75/110 Commercial and industrial sprinkler system.

- **Manufacturer:** Refer to Cold Water Storage Tank schedule.
- **Standard:** To BS EN 13280.
- **Arrangement:** Sectional tank.
- **Duty:**
 - **Capacity:**

Maximum: Refer to Cold Water Storage Tank schedule.

Minimum: Refer to Cold Water Storage Tank schedule.
- **Inspection at factory:** Required.
- **On site erection:** Manufacturer's standard.
- **Accessories:** Submit proposals.
- **Execution:** 90-10-95/650 Installing warning and overflow pipes to feed and expansion cisterns and 90-10-95/630 Installing tanks and cisterns.

90-90-55/430 Identifying pipework

Shared by: 50-10-00/120 Internal gravity rainwater drainage system; 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS 1710.
- **Identification type:** Adhesive colour bands.
- **Execution:** 90-90-55/660 Installing identification on pipework.

90-90-55/480 Mechanical plant and equipment identification labels

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 60-45-95/110 Variable refrigerant flow system; 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

90-90-55/490 Valve charts and schematics

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Paper print, glazed frame.
- **Information to be included:** Location and identification of pipework regulating, isolating and control valves.
- **Execution:** 90-90-55/620 Installing valve charts and schematics.

90-90-55/495 Valve identification labels

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** 25mm diameter
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information:** Purpose and reference number.
- **Execution:** 90-90-55/630 Installing valve identification labels.

90-90-60/390 Services supports

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Support type:** Submit proposals.

Execution

55-85-75/620 Installing automatic sprinkler systems

- **Standard:** To BS EN 12845.

90-10-65/610 Pipelines installation generally

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Standard:** HVCA TR/20.
- **Dissimilar metals:** Prevent electrolytic corrosion.

90-10-65/615 Installing pipeline fittings

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Fabricated junctions and fittings:**
- **Demountable joints:**

90-10-65/620 Installing anchors generally

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Purpose:** To resist axial stress transmitted by flexure of horizontal and vertical pipe runs, and loading on vertical pipes.
- **Fixings:** Provide associated backing plates, nuts, washers and bolts for attachment to, or building into building structure.
- **Fixing to building structure:** Contractor's choice.

90-10-65/645 Installing plastics pipelines

- **General requirements:** [90-10-65/690 Spacing of pipelines](#); [90-10-65/615 Installing pipeline fittings](#); [90-10-65/610 Pipelines installation generally](#); [90-10-65/710 General inspection and testing](#); and [90-10-65/620 Installing anchors generally](#).
- **Pipeline material:**
- **Jointing method:** To suit tube.
- **Anchor:** PVC coated overstraps or clamps, with polypropylene strip between pipe and carbon steel section.

90-10-65/710 General inspection and testing

Shared by: [90-10-65/630 Installing copper pipelines](#); [90-10-65/645 Installing plastics pipelines](#); and [90-10-65/680 Installing steel pipelines](#).

- **Inspection of joints:**
 - **Joints:** Cut out, cut open and inspect.
 - **Number of joints:** Three.
- **Safety precautions:** In accordance with HSE GS 4.

90-10-95/630 Installing tanks and cisterns

- **Standards:**
 - **Moulded plastics:** In accordance with BS 4213.
 - **Glass reinforced plastics:** In accordance with BS EN 13280.
- **Position:** As indicated in the Tender drawings.
- **Base:** Install the tank on a firm, level and continuous base to spread the load.
- **Access:** Allow for internal and external inspection and cleaning. Provide space for cleaning and maintenance with clearance above the tank to service valves.
- **Limiting conditions:**

90-10-95/650 Installing warning and overflow pipes to feed and expansion cisterns

- **Material:** PVC-U.
- **Jointing:** Solvent welded.
- **Minimum OD:** Greater than inlet pipe OD, and at least 22 mm.
- **Difference (minimum) between normal water level and overflow level:**
 - **Cold water storage cisterns:** The greater of 32 mm or the bore of warning pipe.
 - **Feed and expansion cisterns:** Sufficient to allow 20% increase in the volume of water in the tank, plus 25 mm.
- **Vertical distance (minimum) of water supply inlet above overflow level:** Bore of warning pipe.
- **Fall of warning pipe (minimum):** 1 in 10.
- **Installation:** Support to prevent sagging. Terminate pipes separately in prominent positions, with turned down ends. Turn down within the cistern. Terminate 50 mm below normal water level.
- **Insulation:** Insulate within the building where the pipe is in an uninsulated space and subject to freezing.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

90-90-55/620 Installing valve charts and schematics

- **Fixing:** Plug and screw to wall.
- **Position:** Plant room.

90-90-55/630 Installing valve identification labels

- **Fixing:** Secure with metal chain.

90-90-55/660 Installing identification on pipework

- **Application of basic identification colour:** Coloured bands as BS 1710.

- **Safety colour identification:** On or next to the colour bands.
- **Information:** Colour bands as BS 1710.
- **Direction of flow:** Indication arrow;
Indication arrow and the word FLOW or the letter F;
and Indication arrow and the word RETURN or the letter R.

System completion

55-85-75/810 Flushing

- **Operation:** Fill the system with water and discharge it via the flushing valves. Flush out debris.

55-85-75/820 Testing

55-85-75/840 Inspection and test records

- **Reports:** Submit proposals.
- **Record sheets:**
 - **Submission:** Submit proposals.
 - **Number of copies:** Submit proposals.

55-85-75/850 Documentation

- **Certificate of conformity:** Submit.
- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Submit proposals.
- **Record drawings:**
 - **Content:** Submit proposals.
 - **Format:** A1 paper print drawing.
 - **Number of copies:** Submit proposals.
- **Submittal date:** At handover.

Ω End of system

60-45-95/110 Variable refrigerant flow system

System outline

60-45-95/110 Variable refrigerant flow system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the **Variable Refrigerant Flow System** including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Guestrooms:

The guestrooms on level 01 to level 08 will be heated and cooled using a 3-Pipe Variable Refrigerant Flow (VRF) heat pump system with heat recovery to provide simultaneous heating and cooling. The system shall use non-ozone-depleting HFC refrigerant R410A and be able to run with a minimum indoor cooling of 2.2 kW.

Each floor shall be served off 2 No. VRF systems each serving on average half the guestrooms per floor. The condensing units will be located on the level 08 external plantroom and shall be installed with adequate maintenance and airflow space provisions as stated within the manufacturer's installation/technical requirements.

The background noise from the condensing units shall be under the Acoustic Consultant report and design criteria and the Contractor shall agree the final acoustic equipment/treatment with the Acoustic Consultant and the Architect allowing for the most onerous tender. The Contractor shall ensure the addition of an acoustic enclosure does not affect the cooling duties of the units or affect the installed warranty of the equipment. Details of all acoustic treatment should be agreed with the Architect to ensure compliance with planning conditions. All units are to be installed with suitable Anti-Vibration attenuation to maintain vibrational isolation from the slab and the requirements/performance of said Anti-Vibration attenuation shall be agreed with the Acoustic Consultant and Structural Engineer.

All external condensers shall be mounted on the suitable system (such as a bigfoot system) to raise them off the floor and allow the pipework to run beneath the units. Walkway access shall be provided at the same height between the condenser units to allow and maintain access for plant maintenance purposes.

The refrigeration pipework from the condensing units will be routed down 2 No. service riser at opposite sides of the building and connect to associated Flow Selector (FS) boxes installed within the ceiling void of

the guestroom corridors.

The refrigerant pipework shall be installed to the criteria set out by the manufacturer.

The Condenser units that form the design intent are based on Toshiba Air Conditioning and reference should be made to the technical schedule section for the manufacturer specific design information.

All refrigerant pipework shall be constructed and installed as a minimum to the requirements set out within this specification as well as to the manufacturer installation criteria. Insulation shall be under BREEAM Pol Credit Criteria.

Each indoor unit shall be provided with an individual controller and the contractor shall ensure, where propriety manufacturer controllers are not used, that the controllers are compatible with the indoor units and the VRF system as a whole.

All indoor units shall be selected under the Acoustic Consultants design criteria. The contractor shall agree the noise attenuation treatment/measures with the Acoustic Consultant and the Architect and shall allow for the most onerous tender.

Each indoor unit shall be installed complete with condensate tray which shall run at gravity to foul drainage stacks located within the guestroom toilets. The condensate tray shall be installed to ensure that adequate fall is maintained along its entire length.

A refrigerant leak detection system shall be fitted following BS-EN78 and BREEAM Pol 1 credit criteria. The remote facia plate shall be wall mounted at a height of 500mm from the finished floor level, within 10m of the ducted unit, exact location to be agreed with the Architect. The alarm system shall alert the occupier through both an audible and a visual indicator.

The Contractor shall be fully responsible for the safe installation of all refrigeration gas pipework and shall fully comply with the regulations governing the installation of refrigerant gas.

- **System performance:** 60-45-95/210 Design of variable refrigerant flow systems.
- **System manufacturer:** Submit proposals.
- **Compressor:** 90-40-95/310 Electric driven compressors.
- **System:** Three pipe heat recovery.
- **Pipelines:** 90-10-65/390 Refrigerant pipelines and fittings.
- **Thermal insulation:** 90-90-40/350 Nitrile rubber insulation and 90-90-40/360 Phenolic foam insulation.
- **Outlets:** 90-40-95/330 Indoor units.
- **Controls:** Submit proposals.
- **System accessories:** .
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework;
90-90-55/480 Mechanical plant and equipment identification labels;
90-90-55/490 Valve charts and schematics;
and 90-90-55/495 Valve identification labels.
- **Execution:** 60-45-95/620 Installing variable refrigerant flow systems generally.
- **System completion:** 60-45-95/840 Demonstrations;
60-45-95/850 Documentation;
60-45-95/830 Inspection and test records;

60-45-95/860 Servicing and maintenance;
and 60-45-95/810 Commissioning of refrigerating systems.

System performance

60-45-95/210 Design of variable refrigerant flow systems

- **Design:** As detailed on the Tender drawings. Perform all calculations to review and confirm the design of the variable refrigerant flow system.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Products

90-10-65/390 Refrigerant pipelines and fittings

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 378-2.
- **Pipelines:** To BS EN 12735-1.
- **Execution:** 90-10-65/665 Installing refrigerant pipework.

90-40-95/310 Electric driven compressors

- **Manufacturer:** Refer to Variable Refrigerant Volume/Flow (VRV/F) Air Conditioning Unit schedule.
- **Standards:** To BS EN 378-1, BS EN 378-2, BS EN 14511-2, BS EN 14511-3, BS EN 14511-4 and BS EN 60335-2-40.
- **Output cooling:** Refer to Variable Refrigerant Volume/Flow (VRV/F) Air Conditioning Unit schedule.
- **Output heating:** Refer to Variable Refrigerant Volume/Flow (VRV/F) Air Conditioning Unit schedule.
- **Maximum lift:** Manufacturer's standard.
- **Maximum drop:** Manufacturer's standard.
- **Electrical supply type:** Refer to Variable Refrigerant Volume/Flow (VRV/F) Air Conditioning Unit schedule.
- **Compressor:** Manufacturer's standard.
- **Compressor fan type:** Manufacturer's standard.
- **Drive:** Inverter.
- **Refrigerant:** Refer to Variable Refrigerant Volume/Flow (VRV/F) Air Conditioning Unit schedule.
- **Accessories:** Refer to Variable Refrigerant Volume/Flow (VRV/F) Air Conditioning Unit schedule.

90-40-95/330 Indoor units

- **Manufacturer:** Refer to Variable Refrigerant Volume/Flow (VRV/F) Air Conditioning Unit schedule.
- **Standards:** To BS EN 378-1 and BS EN 378-2.
- **Arrangement:** Refer to Variable Refrigerant Volume/Flow (VRV/F) Air Conditioning Unit schedule.
- **Output cooling:** Refer to Variable Refrigerant Volume/Flow (VRV/F) Air Conditioning Unit schedule.
- **Output heating:** Refer to Variable Refrigerant Volume/Flow (VRV/F) Air Conditioning Unit schedule.

- **Accessories:** Refer to Variable Refrigerant Volume/Flow (VRV/F) Air Conditioning Unit schedule.

90-90-40/350 Nitrile rubber insulation

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 60684-3-151.
- **Form:** Pipe section.
- **Thermal conductivity:** 0.035 W/m·K at 0°C.
0.037 W/m·K at 10°C.
0.040 W/m·K at 50°C.
0.043 W/m·K at 75°C.
- **Finish:** Plain.
- **Insulation thickness (minimum):** To BS 5422.
- **Vapour barrier:**
 - **Material:** Manufacturer's standard.
 - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** 90-90-40/390 Protection.
- **Accessories:** Submit proposals.
- **Items to be insulated:** Manufacturer's standard.
- **Execution:** 90-90-40/630 Installing nitrile rubber insulation on pipelines and 90-90-40/780 Installing vapour barriers.

90-90-40/360 Phenolic foam insulation

Shared by: 60-45-95/110 Variable refrigerant flow system; 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 13166.
- **Form:** Duct slab and Pipe section.
- **Thermal conductivity:** 0.018 W/m·K at 0°C.
0.018 W/m·K at 10°C.
0.023 W/m·K at 50°C.
0.025 W/m·K at 75°C.
- **Finish:** Aluminium.
- **Insulation thickness (minimum):** To BS 5422.
- **Vapour barrier:**
 - **Material:** Manufacturer's standard.
 - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** 90-90-40/390 Protection.
- **Accessories:** Submit proposals.
- **Items to be insulated:** Manufacturer's standard.
- **Execution:** 90-90-40/780 Installing vapour barriers and 90-90-40/645 Installing phenolic foam insulation on ductwork.

90-90-40/390 Protection

Shared by: 90-90-40/350 Nitrile rubber insulation; and 90-90-40/360 Phenolic foam insulation.

- **Manufacturer:** Submit proposals.
- **Material:** Manufacturer's standard.
- **Colour:** Manufacturer's standard.
- **Execution:** 90-90-40/715 Installing self adhesive cladding and jacketing.

90-90-55/430 Identifying pipework

Shared by: 50-10-00/120 Internal gravity rainwater drainage system; 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Contractor's choice.
- **Standards:** To BS 1710.
- **Identification type:** Adhesive colour bands.
- **Execution:** 90-90-55/660 Installing identification on pipework.

90-90-55/480 Mechanical plant and equipment identification labels

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 60-45-95/110 Variable refrigerant flow system; 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

90-90-55/490 Valve charts and schematics

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Paper print, glazed frame.

- **Information to be included:** Location and identification of pipework regulating, isolating and control valves.
- **Execution:** 90-90-55/620 Installing valve charts and schematics.

90-90-55/495 Valve identification labels

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; and 60-45-95/110 Variable refrigerant flow system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** 25mm diameter
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information:** Purpose and reference number.
- **Execution:** 90-90-55/630 Installing valve identification labels.

Execution

60-45-95/620 Installing variable refrigerant flow systems generally

- **Standards:** To BS EN 378-3 and BS EN 378-4.
- **Fixing of equipment, components and accessories:** Fix securely on purpose-made bases or supports.
- **External units:** Protect from high winds. Prevent snow, leaves and debris from blocking air flow.
- **Access:** Provide for inspection and servicing of heat pumps and ancillary equipment.
- **Refrigerant lines:** Short and straight.
All refrigerant pipework is to be installed and fixed on heavy duty cable tray throughout its entire length. No alternative method of fixing will be allowed.
Pipework shall be separated out and shall not be bunched or fixed using plastic cable ties or velcro straps. Control cabling may be run along side the pipework on the same tray but shall not be tied to the pipework or insulation.
- **Location of outdoor units:** Away from windows and adjacent buildings.

90-10-65/665 Installing refrigerant pipework

- **General requirements:** Long radius bends shall be formed using pipe bender. The use of short radius pre formed bends and elbows shall be avoided. Pipe work fittings for branching off to indoor units shall be manufacturer's specific joints where available. The positioning of these joints shall be strictly in accordance to the manufacturer's specification.
- **Standards:** To BS EN 378-3 and BS EN 378-4.
- **Refrigerant lines:** Short and straight.
All refrigerant pipework is to be installed and fixed on heavy duty cable tray throughout its entire length.

No alternative method of fixing will be allowed.
Pipework shall be separated out and shall not be bunched or fixed using plastic cable ties or velcro straps.
Control cabling may be run along side the pipework on the same tray but shall not be tied to the pipework or insulation.

90-90-40/610 Installing insulation and protection products generally

Shared by: 90-90-40/630 Installing nitrile rubber insulation on pipelines; 90-90-40/645 Installing phenolic foam insulation on ductwork; and 90-90-40/660 Installing foil faced mineral wool insulation on ductwork.

- **Standard:** In accordance with BS 5970.
- **Timing:** Insulate after installed system has been fully tested and joints proved sound.
- **Insulation:** Do not enclose adjacent units together.
- **Clearance:** Maintain between pipes.
- **Finish:** Neatly finish joints, corners, edges and overlaps.

90-90-40/630 Installing nitrile rubber insulation on pipelines

- **General requirements:** 90-90-40/610 Installing insulation and protection products generally.
- **Joints:** Close butt, secure with adhesive.
- **At fittings:** Fabricate from mitre cut pieces. Secure with adhesive.

90-90-40/645 Installing phenolic foam insulation on ductwork

- **General requirements:** 90-90-40/610 Installing insulation and protection products generally.
- **Ducts:**
 - **Rectangular:** Apply slabs.
 - **Circular:** Apply circular duct insulation.
 - **Flat oval:** Apply slabs and pipe sections.
- **Joints:** Close butt slabs or section and seal with 100 mm wide tape.
- **Duct supports:** Use rigid phenolic foam inserts at supports on rectangular ducts and Use phenolic foam crocodile strips on circular ducts.

90-90-40/715 Installing self adhesive cladding and jacketing

- **Application:** Cover insulation with self adhesive cladding and jacketing with 50 mm overlaps.

90-90-40/780 Installing vapour barriers

Shared by: 90-90-40/350 Nitrile rubber insulation; and 90-90-40/360 Phenolic foam insulation.

- **Integrity:** Seal to maintain throughout.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

90-90-55/620 Installing valve charts and schematics

- **Fixing:** Plug and screw to wall.
- **Position:** Plant room.

90-90-55/630 Installing valve identification labels

- **Fixing:** Secure with metal chain.

90-90-55/660 Installing identification on pipework

- **Application of basic identification colour:** Coloured bands as BS 1710.
- **Safety colour identification:** On or next to the colour bands.
- **Information:** Colour bands as BS 1710.
- **Direction of flow:** Indication arrow;
Indication arrow and the word FLOW or the letter F;
and Indication arrow and the word RETURN or the letter R.

System completion**60-45-95/810 Commissioning of refrigerating systems**

- **Pre-commissioning:** In accordance with CIBSE Commissioning code R.
- **Commissioning:** In accordance with CIBSE Commissioning code R.
- **Notice (minimum):** 1 week.

60-45-95/830 Inspection and test records

- **Reports:**
 - **Construction phase:** System design is commissionable;
Post-installation;
System cleanliness;
and System commissionable.
- **Records for air systems:** In accordance with BSRIA BG 49/2013.
- **Record sheets:** Submit proposals.
 - **Submission:** On completion.
 - **Number of copies:** Three.

60-45-95/840 Demonstrations

- **Running of plant:**
 - **Operation:** Run, maintain and supervise the installations under normal working conditions.
 - **Duration:** Two weeks.
- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

60-45-95/850 Documentation

- **Operating and maintenance instructions:**
 - **Scope:** In accordance with BSRIA Guide BG 1/2007 "Handover, O&M Manuals, and Project Feedback".
 - **Product information:** Include product description, date of purchase, performance characteristics,

application (suitability for use), method of operation and control, and cleaning and maintenance requirements.

- **Format:** Electronic and Paper copy.
- **Number of copies:** Three.
- **Record drawings:**
 - **Contents:** Location and arrangement of plant in plant rooms;
Location, size and route of mechanical services;
Location, route and depth of underground services;
Location and identification of pipework regulating, isolation and control valves;
and Location of outlets.
 - **Format:** A1 paper print drawing and Electronic drawing.
 - **Scale:** Max. 1:50 @ A1.
 - **Number of copies:** Three.
- **Submittal date:** At handover.

60-45-95/860 Servicing and maintenance

- **Requirement:** Undertake for 12 months after completion.

Ω End of system

65-10-75/110 Smoke and heat exhaust ventilation system

System outline

65-10-75/110 Smoke and heat exhaust ventilation system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the **Smoke and Heat Exhaust Ventilation System** including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

The Contractor shall provide a smoke ventilation system in accordance with the latest Fire Strategy produced by Astute Fire.

The Contractor shall ensure the system complies with the fire strategy and any statutory fire standards or British Standards. The contractor shall include for a CFD analysis for the system to ensure efficient operation of the proposed design and system. The Contractor shall submit a cause and effect matrix to the consultant for approval before to any installation of the proposed system. Note that the system will not be deemed fit for purpose unless it has received sign off from the consultant.

The firefighting lobbies will be mechanically smoke ventilated. The mechanical smoke ventilation system should demonstrate equivalent or better conditions in the firefighting lobby and firefighting stairs than would be provided by a natural shaft as described in BRE Project Report 79204. The specialist shall develop the detailed scheme and shall include the below as a minimum;

* A fire-rated duct or builders work shaft will be located adjacent to each fire fighting lobby and will incorporate a motorised damper to each lobby. Refer the Tender drawings and Risers R01 and R17.

* The smoke shafts shall have a minimum effective area of 0.6 m².

* The mechanical flow rates should be approximately 3-4 m³/s.

* All builderwork extract shafts shall be constructed with a smooth internal face and be of tight construction to BS EN 12101-6 with a maximum air leakage rate of no greater than 3.8 m³/h/m² at 50 Pascals pressure differential.

* The smoke shaft shaft should be constructed of non-combustible materials which do not contribute to flame or rise in temperature as per BS 476-4 and BS 476-11. Note that the most up to date and relevant

versions shall be used.

The stair door and lobby should have a lintel at least 0.3 m deep to act as a smoke reservoir and contain smoke on the other side of the door. No services other than those relating to the smoke extract system shall be contained within the smoke shaft.

The vents from the smoke shaft opening directly into the firefighting lobbies shall be composed of dampers/louvres or fire doors; The dampers shall be installed to maintain the fire integrity of the wall when shut. The vents should achieve at least 0.6m² free area and should be located as close to the ceiling as practicable and should have a minimum fire and smoke resistance of 60min and integrity (leakage) no greater than 360m³/h/m² (BS EN 1366-2:2015 [7]).

Makeup air shall be provided via a louvred vent (AOV) to be fitted at the head of the fire-fighting stair. The AOV shall have a minimum free area of 1m² and be automatically open upon detection in the common corridor. Opening and closing shall be controlled by a 24V electric actuator.

Fire-rated duty/standby smoke extract & environmental fans, installed in series and located at the roof plant space will draw air from the firefighting lobbies via the smoke extract riser/shaft. The smoke fans shall be rated to 300 °C for 1 hour and to CE marked to BS EN 12101-3. The fans shall be variable speed and have automatic changeover between run and standby.

A central control main fire alarm panel shall provide fully automatic operation and reporting. Fire service interface, override and status indication facilities must also be integrated into the system. The main fire alarm panel must have the facility to interface into the BMES for monitoring and control purposes.

The Contractor shall ensure that the design includes repeater panels to suit relevant BS or (and) the requirements for the fire brigade.

Panels are to be located such that they can be accessed from at least one of the fire brigade entrances and this shall be coordinated with the Architect and Interior Architect.

The Contractor shall install all void detection as required within the building to comply with BS 5839, whether noted on the accompanying tender drawings or not.

- **System performance:** 65-10-75/230 Design of smoke control systems.
- **Smoke barriers:** 90-45-80/320 Standard active smoke barriers.
- **External supply terminals:** Contractor's design.
- **External exhaust terminals:** Contractor's design.
- **Controls:**
 - **Control panel:** 90-45-80/370 Smoke and heat exhaust control panels.
 - **Method of actuation:** 90-65-50/450 Manual control switches and 90-75-30/350 Point smoke detectors.
- **Identification of ductwork and equipment:** 90-90-55/480 Mechanical plant and equipment identification labels and 90-90-55/420 Identifying ductwork.
- **Execution:** 65-10-75/640 Installing smoke and heat exhaust control panels and 65-10-75/620 Installing smoke and heat exhaust ventilation systems.
- **System completion:** 65-10-75/810 Acceptance testing for pressure differential smoke control systems; 65-10-75/820 Commissioning of air distribution systems; 65-10-75/830 Inspection and test records;

65-10-75/840 Demonstrations;
65-10-75/850 Documentation;
65-10-75/860 Spares and consumables;
and 65-10-75/870 Maintenance.

System performance

65-10-75/230 Design of smoke control systems

- **Standards:** Complete the design of the smoke control system in accordance with BS 7346-8 and BS 9999.
- **Purpose:** Protects escape routes and Facilitates firefighting operations by creating a smoke-free layer.
- **Smoke zones:** As per Fire Consultant Drawings
- **Requirement:** In accordance with BS 7346-8, clause 4.

Products

90-45-80/320 Standard active smoke barriers

- **Manufacturer:** Submit proposals.
- **Standard:** To BS EN 12101-1.
- **Category:** As required by Building Control
- **Material:** Submit proposals.
- **Classification categories:** As required by Building Control
- **Auxiliary power:** Submit proposals.
- **Control wiring:** Heat resistant.
- **Actuating mechanism operation:** Signal from smoke detection system.
- **Execution:** 90-45-80/610 Installing smoke barriers.

90-65-50/450 Manual control switches

- **Manufacturer:** Submit proposals.
- **Standard:** To BS EN 60947-5-1.
- **Operation:** Key operated switch.
- **Execution:** 90-65-50/605 Installing control components.

90-75-30/310 Fire detection devices generally,

- **Removal of devices:** Must require a special tool. Must not affect the operation of alarm equipment.
- **Device bases:** Maintain circuit continuity when device is removed.
- **Short circuit isolators:** Integral to control equipment.

90-75-30/350 Point smoke detectors

- **General requirements:** 90-75-30/310 Fire detection devices generally.
- **Manufacturer:** Submit proposals.

- **Standard:** To BS EN 54-7.
- **Detector type:** Manufacturer's standard.
- **Execution:** 90-75-30/620 Installing point detectors.

90-90-55/420 Identifying ductwork

Shared by: 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 1710 and To BS EN 13779.
- **Identification type:** Plastics labels.
- **Colour:** Manufacturer's standard.
- **Lettering:** Manufacturer's standard.
- **Shape and size:** Manufacturer's standard.
- **Execution:** 90-90-55/650 Installing ductwork identification.

90-90-55/480 Mechanical plant and equipment identification labels

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 60-45-95/110 Variable refrigerant flow system; 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

Execution

65-10-75/620 Installing smoke and heat exhaust ventilation systems

- **Standard:** In accordance with BS 7346-4.

65-10-75/640 Installing smoke and heat exhaust control panels

- **Position:** Main entrance.
- **Connection to sensors:** Required.

90-45-80/610 Installing smoke barriers

- **Standard:** In accordance with BS EN 12101-1.

90-65-50/605 Installing control components

- **Position:** Submit proposals.
- **Insulation:** Submit details of proposed insulation method where control components are on insulated pipelines.
- **Supports:** Do not strain components.
- **Access:** Adequate for operation and maintenance.

90-75-30/620 Installing point detectors

- **Protective cage:** Contractor shall provide protective cages where detectors are at risk of mechanical impact.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

90-90-55/650 Installing ductwork identification

- **Standard:** In accordance with BESADW/144.
- **Position:** Locate where visible.
- **Direction of flow:** Equilateral triangle, 150 mm length of side, with one apex pointing in the direction of flow.
- **Information:** Space served by the duct and associated plant;
Air being conveyed, direction of flow, destination of the air;
and Location or designation of plant which treats the air.

System completion**65-10-75/810 Acceptance testing for pressure differential smoke control systems**

- **Standard:** Carry out Acceptance testing in accordance with BS EN 12101-6.
- **Test results:** Submit test results in accordance with BS EN 12101-6.

65-10-75/820 Commissioning of air distribution systems

- **Pre-commissioning:** In accordance with BSRIA 3/89.3 and CIBSE Commissioning code A.
- **Commissioning:** In accordance with BSRIA 3/89.3 and CIBSE Commissioning Code A.
- **Notice (minimum):** 48 h.

65-10-75/830 Inspection and test records

- **Record sheets:**
 - **Submission:** On completion.

- **Number of copies:** Three.

65-10-75/840 Demonstrations

- **Running of plant:**
 - **Operation:** Run, maintain and supervise the installations under normal working conditions.
 - **Duration:** One week.
- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

65-10-75/850 Documentation

- **Operating and maintenance instructions:**
 - **Scope:** Submit for the system as a whole giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Two.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms;
Location, size and route of ductwork;
Location and identification of regulating dampers and fire dampers;
and Location of outlets.
 - **Format:** A1 paper print and Electronic.
 - **Number of copies:** Two.
- **Submittal date:** At handover.

65-10-75/860 Spares and consumables

- **Spares:**
 - **Detectors:** Supply two of each type.
 - **Filters:** Supply two of each type.

65-10-75/870 Maintenance

- **Servicing and maintenance:** Undertake for 12 months after completion.

Ω End of system

65-10-95/130 Mechanical Ventilation system

System outline

65-10-95/130 Mechanical Ventilation system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the **Mechanical Ventilation System** including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Ais Distribution System:

The Contractor shall design and install the ventilation air systems within the building as indicated on the Tender drawings.

The systems are to be as far as possible self-balancing, without the need for excessive regulation and balancing dampers. Any adjustment to fan duties to meet the system design air volume is to be achieved by changes to fan speed, not by restricting total system flow with balancing dampers.

The Contractor shall position balancing dampers so that the ductwork system can be adequately balanced following the guidance notes given in the CIBSE and BSRIA Commissioning Codes for Air Distribution Systems (Publ. Ref. CCA and BAG03/89). In large ducts where a multiple damper assembly is required, link the dampers so that operation is from one spindle only. Locate and install fire dampers to meet the requirements of the Building Regulations and BS 5588-9.

The Contractor shall provide all ductwork systems and inline components with suitable access for planned maintenance by the Construction (Design and Management) Regulations 2007 and the Workplace (Health, Safety and Welfare) Regulations 1992.

The use of flexible ductwork is to be limited to final connections to grilles and diffusers. All flexible ducts are to be continuous with no intermediate joint and not exceed 500mm.

The Contractor shall ensure that grilles and diffusers are easily cleanable and removable and any operating mechanisms for balancing dampers may be accessible through the face of the grille.

The Contractor shall ensure all ductwork is free from vibration and drumming and shall install ductwork with electrical continuity throughout to comply with the IEE Regulations (BS 7671).

All ductwork is to be clean before it is put into service and the normal level of cleanliness and protection

to be provided during installation is to be intermediate as defined in BESA DW/TM2 Guide to Good Practice - Internal Cleanliness of New Ductwork Installations.

Where required, folding blade curtain fire dampers are to have blades out of the airstream in the open position. Mark dampers with "bottom of the unit" to assist correct installation and checking. Smoke and combination fire/smoke dampers are to be of the multi-leaf type with aerofoil blades.

Installation of fire dampers is to comply with BESA specification DW144. Any non-standard method of fixing is to be fully tested or assessed by an approved and recognised fire testing house and have the approval of Building Control.

Locate fire dampers at the fire compartment wall or floor they are intended to protect. If compartment walls or floors are subsequently moved at a later date the fire damper is to be moved to the new location together with any monitoring cabling. If compartment walls or floors become redundant and are removed the fire damper is to be also be removed entirely from the ductwork system together with all monitoring cabling.

The contractor shall fit the fire and smoke dampers with an external visual indicator so that the position of the blades can be seen without accessing the inside of the ductwork. Provide a micro-switch having dust and moisture resistant contacts for remote monitoring of damper status on the Fire Alarm Panel, Fire Alarm repeater Panel and BMS system.

All fire and smoke damper actuation mechanisms are to be:

- * Easily accessible for replacement and periodic testing of the damper
- * Safely releasable for testing
- * Capable of being reset by one hand after testing where the mechanism is inside the ductwork
- * Provided with access panels/doors of adequate size to allow regular testing, inspection and reset.

Fire dampers are to be alphanumerically referenced, and photographic evidence shall be provided of all damper installations, with the damper reference visible.

Extract grilles are a proprietary type specifically designed for mechanical ventilation. Extract grilles are to be selected to minimise the build-up of dust on the blades and have removable cores to allow the duct spigot to be cleaned. Design air distribution systems to convey air efficiently and economically. Size ductwork to keep resistance and velocities to the economic minimum and to avoid airflow generated noise from excessive air velocities, fittings and duct mounted components and terminal devices.

All grilles shall be agreed with the Interior Architect with samples provided were requested for sign off purposes.

Carry out air leakage testing on all ductwork systems to establish conformity with Table 2 of DW144 and ensure the procedures comply with BESA Specification DW143 - A Practical Guide to Ductwork Leakage Testing.

Attenuators are to comply with the requirements of BESA Specification DW144. Acoustic linings are to be erosion resistant, fire-resistant, vermin and corrosion-proof faced with a perforated galvanised plate. Splitters are to be round-nosed at inlet and outlet. Attenuators are not to have an air pressure drop exceeding 75Pa. All attenuators shall be selected to meet the requirements set out by the Acoustic

Consultant.

All ventilation system inclusive but not limited to Air Handling Units, Fans and Mechanical Heat Recovery Units shall have the ability to interface with the BMES system for control and monitoring purposes.

Guestrooms and Guestroom Corridor Ventilation

The guestrooms on Level 01 to Level 08 shall be served from 2 No. Centralised AHU's located within the Level 08 plantroom enclosure. The AHU's will draw supply air from the Level 08 plantroom which is open to atmosphere and distribute tempered fresh air to the guestrooms through the numerous guestroom risers located around the building.

Fresh air shall be supplied to each guestroom from grilles located within the guestroom lobbies with stale extract air being drawn back to the AHU via grilles mounted within the guestroom toilets.

The corridors shall also be served from the room risers and supply and extract zones have been allocated around the corridors to facilitate their ventilation.

Fire compartment shall be maintained with the guestroom risers by installing fire dampers in the supply and extract ductwork as they break through the riser(s) to serve the guestrooms.

The guestroom units shall be selected in accordance with the Acoustic Consultants requirements and design criteria. The required internal noise levels shall be achieved at normal mode. The contractor shall agree the noise attenuation treatment/measures with the Acoustic Consultant, Architect and Interior Architect and shall allow for the most onerous one.

Refer to the Mechanical Technical Schedules for indicative selections.

Front of House Ventilation

The Front of House (FOH) which consists of the hotel reception, check-in, restaurant and grab and go area is served from 2 No. locally housed AHU's mounted at high level within the space. The Contractor shall refer to the Tender drawings for indicative AHU plant locations and shall work with the Interior Designer to position the units to suit their aspirations.

The AHU's draw supply air from louvres mounted at high level along the perimeter of the ground floor and also exhaust to the atmosphere from grilles located at a high level around the perimeter of the ground floor. The Contractor shall refer to the Tender drawings for the indicative Louvre locations and ventilation zones. The contractor shall ensure that the supply and extract louvres are coordinated with the Architect to ensure that they are as far away from each other as possible to mitigate/minimise cross circuiting of air streams.

Fresh air shall be supplied to the FOH areas via swirl diffusers mounted at high level within the space with stale extract air being drawn back to the AHU's via bellmouths mounted at high level within the space. The contractor shall refer to the Tender drawings for indicative grille positions which are to be coordinated and agreed with the Interior Architect before any installation.

The FOH units shall be selected in accordance with the Acoustic Consultants requirements and design criteria. The required internal noise levels shall be achieved at normal mode. The contractor shall agree the noise attenuation treatment/measures with the Acoustic Consultant, Architect and Interior Architect

and shall allow for the most onerous one.

Refer to the Mechanical Technical Schedules for indicative selections.

Back of House Ventilation

The Back of House Ventilation (BOH) which consists of the administration room, staff area and associated toilets, linen rooms, BOH Corridors, LV Switchroom, security room and storeroom shall be served off Mechanical Heat Recovery Units (MVHR) which are mounted at high level within the space(s). The Contractor shall refer to the Tender drawings for indicative MVHR plant locations and shall work with the Interior Designer to position the units to suit their aspirations.

The MVHR's draw supply air from louvres mounted at high level along the perimeter of the ground floor and also exhaust to the atmosphere from louvres located at a high level around the perimeter of the ground floor. The Contractor shall refer to the Tender drawings for the indicative Louvre locations and ventilation zones. The contractor shall ensure that the supply and extract louvres are coordinated with the Architect to ensure that they are as far away from each other as possible to mitigate/minimise cross circuiting of air streams.

Fresh air shall be supplied to the BOH areas via grilles mounted at high level within the space with stale extract air being drawn back to the MVHR's via grilles mounted at high level within the space. The contractor shall refer to the Tender drawings for indicative grille positions which are to be coordinated and agreed with the Interior Architect before any installation.

The BOH units shall be selected in accordance with the Acoustic Consultants requirements and design criteria. The required internal noise levels shall be achieved at normal mode. The contractor shall agree the noise attenuation treatment/measures with the Acoustic Consultant, Architect and Interior Architect and shall allow for the most onerous one.

Refer to the Mechanical Technical Schedules for indicative selections.

Gym Ventilation

The Gym area which consists of the main gym, as well as the ancillary toilets and changing rooms, shall be served from 2 No. Locally housed MVHR units. The Contractor shall refer to the Tender drawings for indicative MVHR plant locations and shall work with the Interior Designer to position the units to suit their aspirations.

The MVHR's draw supply air from louvres mounted at high level along the perimeter of the ground floor and also exhaust to the atmosphere from louvres located at a high level around the perimeter of the ground floor. The Contractor shall refer to the Tender drawings for the indicative Louvre locations and ventilation zones. The contractor shall ensure that the supply and extract louvres are coordinated with the Architect to ensure that they are as far away from each other as possible to mitigate/minimise cross circuiting of air streams.

Capped connections have been highlighted within the Gym area however, The Contractor shall work with the Interior Designer to develop up the final ventilation distribution strategy for the Gym area and locate terminal grilles in positions that suit the Interior Architects aspirations.

The Gym area units shall be selected in accordance with the Acoustic Consultants requirements and design criteria. The required internal noise levels shall be achieved at normal mode. The contractor shall agree the noise attenuation treatment/measures with the Acoustic Consultant, Architect and Interior Architect and shall allow for the most onerous one.

Refer to the Mechanical Technical Schedules for indicative selections.

- **System performance:** 65-10-95/240 Ductwork design type General;
65-10-95/260 Attenuator performance;
65-10-95/250 Fan performance;
and 65-10-95/210 Design of ventilation systems.
- **Location of plant:** As per Tender Drawings
- **Route of distribution:** As per Tender Drawings
- **Type of system:** As per Tender Submission
- **External air intake:** 45-25-50/315 Wood louvre panel units;
45-25-50/312 Stainless steel louvre panel units;
and 45-25-50/305 Aluminium louvre panel units.
- **External exhaust air terminals:** Wood louvre panel units;
Stainless steel louvre panel units;
and Aluminium louvre panel units.
- **Air filters:** 90-45-10/360 Panel filters;
90-45-10/340 High efficiency particle arrestor (HEPA) filters;
90-45-15/310 Air handling unit;
and 90-45-10/380 Bag filters.
- **Heat recovery:** 90-45-45/320 Plate recuperators;
and 90-45-45/350 Thermal wheels.
- **Air handling units:** 90-45-15/310 Air handling unit and 90-45-15/325 Supply and exhaust air handling units.
- **Supply fans:** Contractor's design.
- **Extract Fans:** Contractor's design
- **Acoustic treatment:** 90-45-75/330 Rectangular silencers and 90-45-75/310 Air transfer and cross talk attenuators.
- **Air ductwork and accessories:**
 - **Ductwork:** 90-45-25/365 Rectangular sheet metal ductwork and fittings and 90-45-25/315 Circular sheet metal ductwork and fittings.
 - **Accessories:** 90-45-25/430 Flexible ductwork;
90-45-25/460 Non-return dampers;
90-45-25/420 Fire and smoke dampers;
and 90-45-25/400 Access doors.
- **Thermal insulation on supply air ductwork:** 90-90-40/360 Phenolic foam insulation.
- **Vibration isolation mountings:** Submit proposals to meet Acoustic Consultant requirements.
- **Reheat batteries:** 90-45-50/320 Electric heater batteries.
- **Room supply air terminal devices:** Contractor's design to meet Interior Architects requirements.
- **Accessories:** 90-90-60/380 Roof equipment support systems and 90-90-60/390 Services supports.

- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels.
- **Testing:** 90-45-25/790 Air leakage testing of plant items.
- **Execution:** 65-10-95/630 Installing ductwork on air handling units and 65-10-95/640 Ductwork systems cleaning.
- **System completion:** 65-10-95/860 Spares and consumables;
65-10-95/850 Documentation for ventilation systems;
65-10-95/840 Demonstrations;
and 65-10-95/870 Maintenance.

System performance

65-10-95/210 Design of ventilation systems

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Design:** As detailed in the Tender drawings. Perform all required calculations to review and confirm the design of the ventilation systems.
- **Method:** In accordance with CIBSE Applications Manual AM 11.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Computer calculations:**
 - **Submittals:** U-values and heat gain calculations for each room;
Fan sizing calculations;
and Duct sizing calculations.
 - **Format:** IES and Hevacomp.

65-10-95/240 Ductwork design type General

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Air velocity:**
 - **Standard:** As CIBSE Guide B2.
 - **Main ducts:** 7.5 m/s.
 - **Branch ducts:** 3.5 m/s.
 - **Runouts:** <2m/s.
- **Ductwork cleaning:**
 - **Standard:** In accordance with BESATechnical Report TR/19.
 - **Level of protection:** Intermediate PDI.
 - **Cleanliness quality class:** Medium.

65-10-95/250 Fan performance

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Standard:** In accordance with BS EN 13779.

- **Flow rate:** Submit proposals.
- **System pressure:** Submit proposals.
- **Operation:** Continuous and Intermittent.
- **Specific fan power:** Approved Document L2A, Limited Services Efficiencies for Non Domestic Buildings.
- **Classification:** Submit proposals.

65-10-95/260 Attenuator performance

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Performance requirements:**
 - **Standards:** To BS EN ISO 7235 and BS EN ISO 11691.
 - **Insertion loss:** Refer to Attenuator schedule.

Products

45-25-50/305 Aluminium louvre panel units

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Refer to Louvre schedule.
- **Size (l x w x d):** Refer to Louvre schedule.
- **Material:** Extruded aluminium alloy frame and louvre blades, to BS EN 755-1.
- **Finish:** To Architects specification
- **Colour:** To Architects specification
- **Construction:** To Architects specification
- **Air intake and exhaust performance:**
 - **Application:** Refer to Louvre schedule.
 - **Air volume:** Refer to Louvre schedule.
 - **Face velocity:** Refer to Louvre schedule.
 - **Core velocity (maximum):** Refer to Louvre schedule.
- **Calculated weighted sound reduction index (Rw):**
- **Weather performance:**
 - **Water penetration class (minimum):** To BS EN 13030, class A.

45-25-50/312 Stainless steel louvre panel units

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Refer to Louvre schedule.
- **Size (l x w x d):** Refer to Louvre schedule.
- **Material:** Stainless steel to BS EN 10088-1, grade 1.4401.
- **Finish:** To Architects specification
- **Construction:** To Architects specification

- **Air intake and exhaust performance:**
 - **Application:** Refer to Louvre schedule.
 - **Air volume:** Refer to Louvre schedule.
 - **Face velocity:** Refer to Louvre schedule.
 - **Core velocity (maximum):** Refer to Louvre schedule.
- **Weather performance:**
 - **Water penetration class (minimum):** To BS EN 13030, class A.

45-25-50/315 Wood louvre panel units

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Refer to Louvre schedule.
- **Size (l x w x d):** Refer to Louvre schedule.
- **Species:** To Architects specification
- **Finish:** To Architects specification
- **Colour:** To Architects specification
- **Air intake and exhaust performance:**
 - **Application:** Refer to Louvre schedule.
 - **Air volume:** Refer to Louvre schedule.
 - **Face velocity:** Refer to Louvre schedule.
 - **Core velocity (maximum):** Refer to Louvre schedule.
- **Weather performance:**
 - **Water penetration class (minimum):** To BS EN 13030, class A.

90-45-10/340 High efficiency particle arrestor (HEPA) filters

- **Manufacturer:** Submit proposals.
- **Standard:** To BS EN 1822-1.
- **Use of conditioned space:**
- **Duty:**
 - **Maximum air flow rate:** Submit proposals.
 - **Air velocity:** Submit proposals.
 - **Filter dimensions:** Submit proposals.
- **Filter media:** HEPA filter media - Group H.
- **Filter class:** Manufacturer's standard.
- **Filter casing:** Provide with gasket fitted to casing.
- **Filter material:** Stainless steel.
- **Flammability:** Non-flammable for duration of recommended working life.
- **Access:** Manufacturer's standard.
- **Filter frame material:** Manufacturer's standard.
- **Execution:** 90-45-10/640 Installing filters.

90-45-10/360 Panel filters

- **Manufacturer:** Submit proposals.
- **Standards:**
 - **Performance:** To BS EN ISO 16890-1.
 - **Testing:** To Eurovent 4/9 Method of testing air filters.
- **Filter type:** Manufacturer's standard.
- **Duty:**
 - **Air flow rate:** Submit proposals.
 - **Air velocity:** Submit proposals.
 - **Initial filter pressure drop:** Submit proposals
- **Final filter pressure drop:** 250 Pa.
- **Filter class:** Manufacturer's standard.
- **Conditions:** Ambient.
- **Flammability:** Non-flammable for duration of recommended working life.
- **Access:** Manufacturer's standard.
- **Execution:** 90-45-10/640 Installing filters.

90-45-10/380 Bag filters

- **Manufacturer:** Submit proposals.
- **Standards:**
 - **Performance:** To BS EN ISO 16890-1.
 - **Testing:** To Eurovent 4/9 Method of testing air filters.
- **Duty:**
 - **Air flow rate:** Submit proposals.
 - **Air velocity:** Submit proposals.
 - **Initial filter pressure drop:** Submit proposals.
- **Final filter pressure drop:** 450 Pa.
- **Filter class:** Submit proposals.
- **Flammability:** Non-flammable for duration of recommended working life.
- **Casing:**
- **Access:** Manufacturer's standard.
- **Execution:** 90-45-10/640 Installing filters.

90-45-15/310 Air handling unit

- **Manufacturer:** Refer to Air Handling Unit (AHU) schedule.
- **Standard:** To BS EN 13053. and In compliance with ErP2018 Lot 6.
- **Duty:**
 - **Air volume:** Refer to Air Handling Unit (AHU) schedule.
 - **External resistance:** Refer to Air Handling Unit (AHU) schedule.
 - **Discharge velocity:** Refer to Air Handling Unit (AHU) schedule.

- **Sound power level:** Refer to Air Handling Unit (AHU) schedule.
- **Casing construction:**
 - **Standard:** To BS EN 1886.
 - **Details:** Submit shop drawings and details of dimensions and weight.
 - **Acoustic insulation of casing:** To BS EN 1886, section 9.
 - **Fire protection:** Submit proposals.
 - **Air handling unit feet:** Submit proposals.
- **Anti-vibration mountings:** Submit proposals to meet Acoustic Consultant requirements.
- **Components:**
 - **Dampers:**
 - Purpose:** Refer to Air Handling Unit (AHU) schedule.
 - Damper control:** Refer to Air Handling Unit (AHU) schedule.
 - Damper type:** Refer to Air Handling Unit (AHU) schedule.
 - Material:** Refer to Air Handling Unit (AHU) schedule.
 - Ancillaries:** Refer to Air Handling Unit (AHU) schedule.
 - **Filters:** Refer to Air Handling Unit (AHU) schedule. Filter sections require a visual filter change warning signal.
 - **Humidifiers:** Refer to Air Handling Unit (AHU) schedule.
 - **Pre-heaters:** Refer to Air Handling Unit (AHU) schedule.
 - **Re-heaters:** Refer to Air Handling Unit (AHU) schedule.
 - **Cooling coils:** Refer to Air Handling Unit (AHU) schedule.
 - **Heat recovery:** Refer to Air Handling Unit (AHU) schedule.
 - **Fans:** Refer to Air Handling Unit (AHU) schedule.
 - **Attenuators:** Refer to Air Handling Unit (AHU) schedule.
- **Flexible connections:** To BESADW/144.
- **Access:**
 - **General:** Provide access openings and covers complete, including opening devices.
 - **Seal:** To prevent excessive air leakage.
 - **Seal durability:** For normal maintenance operations over at least 10 years.
 - **Access type:** Manufacturer's standard.
 - **Access clear width (minimum):** Manufacturer's standard.
 - **Components requiring access:** All Air Handling Components.
- **Execution:** 90-45-15/610 Installing air handling units.

90-45-15/325 Supply and exhaust air handling units

- **Manufacturer:** Refer to Air Handling Unit (AHU) schedule.
- **Standard:** To BS EN 13053. and In compliance with ErP2018 Lot 6.
- **Duty:**
 - **Air volume:**
 - Supply:** Refer to Air Handling Unit (AHU) schedule.
 - Extract:** Refer to Air Handling Unit (AHU) schedule.

- **External resistance:** Refer to Air Handling Unit (AHU) schedule.
- **Discharge velocity:** Refer to Air Handling Unit (AHU) schedule.
- **Sound power level:** Refer to Air Handling Unit (AHU) schedule.
- **Components:**
 - **Dampers:** Refer to Air Handling Unit (AHU) schedule.
 - **Filters:** Refer to Air Handling Unit (AHU) schedule. Filter sections require a visual filter change warning signal.
 - **Humidifiers:** Refer to Air Handling Unit (AHU) schedule.
 - **Heaters:** Refer to Air Handling Unit (AHU) schedule.
 - **Cooling coils:** Refer to Air Handling Unit (AHU) schedule.
 - **Heat recovery:** Refer to Air Handling Unit (AHU) schedule.
 - **Fans:**
 - Supply:** Refer to Air Handling Unit (AHU) schedule.
 - Extract:** Refer to Air Handling Unit (AHU) schedule.
 - **Attenuators:** Refer to Air Handling Unit (AHU) schedule.

90-45-25/315 Circular sheet metal ductwork and fittings

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Standards:** To BESADW/144, BS EN 1506 and BS EN 12237.
- **Classification:** Class A.
- **Material:** Zinc coated steel to BS EN 10346 grade DX51D+Z140.
- **Construction:** Spirally wound.
- **Regulating dampers:**
 - **Standard:** As BESADW/144.
 - **Regulating function:** Balancing.
 - **Material:** To match ductwork.
- **Access openings:**
 - **Purpose:** Inspection;
Cleaning;
and Maintenance.
 - **Sizes:** To BS EN 12097.
- **Execution:** 90-45-25/790 Air leakage testing of plant items and 90-45-25/640 Installing sheet metal ductwork.

90-45-25/365 Rectangular sheet metal ductwork and fittings

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Standards:** To BESADW/144, BS EN 1505 and BS EN 1507.
- **Classification:** Class A.
- **Material:** Zinc coated steel to BS EN 10346 grade DX51D+Z140.
- **Regulating dampers:**
 - **Standard:** To BESADW/144.
 - **Regulating function:** Balancing.

- **Material:** To match ductwork.
- **Access openings:**
 - **Purpose:** Inspection; Cleaning; and Maintenance.
 - **Sizes:** To BS EN 12097.
- **Execution:** 90-45-25/640 Installing sheet metal ductwork and 90-45-25/790 Air leakage testing of plant items.

90-45-25/400 Access doors

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Galvanized sheet steel.

90-45-25/420 Fire and smoke dampers

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Standard:**
 - **Fire dampers:** To BS EN 15650.
 - **Test:** To BS EN 1366-2.
 - **Classification:** To BS EN 13501-3.
 - **Aerodynamic performance:** To BS EN 1751 and BS EN ISO 5135.
- **Execution:** 90-45-25/750 Access to dampers for resetting and maintenance and 90-45-25/725 Installing fire and smoke control dampers.

90-45-25/430 Flexible ductwork

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Standard:** To BESADW/144.
- **Length:** Maximum 500mm with no with no bends of offset greater than 15 degrees.

90-45-25/460 Non-return dampers

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Standard:** To BS EN 1751.
- **Execution:** 90-45-25/750 Access to dampers for resetting and maintenance.

90-45-45/320 Plate recuperators

- **Manufacturer:** Contractor's choice.
- **Access doors for maintenance:** Hinged, airtight and watertight.

90-45-45/350 Thermal wheels

- **Manufacturer:** Contractor's choice.

- **Access doors for maintenance:** Hinged, airtight and watertight.

90-45-50/320 Electric heater batteries

- **Manufacturer:** Contractor's choice.
- **Electrical supply:**
 - **Type:** Submit proposals.
- **Access doors for maintenance:** Hinged, airtight and watertight.
- **Heating elements:**
 - **Mounting:** Submit proposals.
 - **Type:** Submit proposals.
- **Safety cut-out switch:**
 - **Manual reset:** Manufacturer's standard.
- **Execution:** 90-45-50/610 Installing heating and cooling coils generally.

90-45-75/310 Air transfer and cross talk attenuators

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Performance standards:** To BS EN ISO 7235 and BS EN ISO 11691.
- **Duty:**
 - **Insertion loss:** Refer to Attenuator schedule.
 - **Air volume:** Refer to Attenuator schedule.
 - **Permissible pressure loss:** Refer to Attenuator schedule.
- **Lining material:** Inert, fire proof, inorganic and non- hygroscopic.
- **Duct connections:** Manufacturer's standard.

90-45-75/330 Rectangular silencers

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Performance standards:** To BS EN ISO 7235 and BS EN ISO 11691.
- **Duty:**
 - **Insertion loss:** Refer to Attenuator schedule.
 - **Air volume:** Refer to Attenuator schedule.
 - **Permissible pressure loss:** Refer to Attenuator schedule.
- **Lining material:** Inert, fire proof, inorganic and non-hygroscopic.
- **Duct connections:** Manufacturer's standard.
- **Markings:** Show direction of air flow on silencer.

90-90-40/360 Phenolic foam insulation

Shared by: 60-45-95/110 Variable refrigerant flow system; 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 13166.

- **Form:** Duct slab and Pipe section.
- **Thermal conductivity:** 0.018 W/m·K at 0°C.
0.018 W/m·K at 10°C.
0.023 W/m·K at 50°C.
0.025 W/m·K at 75°C.
- **Finish:** Aluminium.
- **Insulation thickness (minimum):** To BS 5422.
- **Vapour barrier:**
 - **Material:** Manufacturer's standard.
 - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** 90-90-40/390 Protection.
- **Accessories:** Submit proposals.
- **Items to be insulated:** Manufacturer's standard.
- **Execution:** 90-90-40/780 Installing vapour barriers and 90-90-40/645 Installing phenolic foam insulation on ductwork.

90-90-40/390 Protection

Shared by: 90-90-40/350 Nitrile rubber insulation; and 90-90-40/360 Phenolic foam insulation.

- **Manufacturer:** Submit proposals.
- **Material:** Manufacturer's standard.
- **Colour:** Manufacturer's standard.
- **Execution:** 90-90-40/715 Installing self adhesive cladding and jacketing.

90-90-55/420 Identifying ductwork

Shared by: 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 1710 and To BS EN 13779.
- **Identification type:** Plastics labels.
- **Colour:** Manufacturer's standard.
- **Lettering:** Manufacturer's standard.
- **Shape and size:** Manufacturer's standard.
- **Execution:** 90-90-55/650 Installing ductwork identification.

90-90-55/480 Mechanical plant and equipment identification labels

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 60-45-95/110 Variable refrigerant flow system; 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.

- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

90-90-60/380 Roof equipment support systems

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-85-20/110 Dry riser system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Roof Pro, Bigfoot or equal and approved.
One single manufacturer to be used for roof support systems.
- **Design:** H frame support system with adjustable feet shall be so designed that any two adjacent feet can be raised simultaneously to allow for maintenance of the roof insulation and membrane.
- **Components:**
 - **Support base:**
 - Type:** Nylon GF-30% square pad with compatible fixing for a 41x41mm strut system
 - Size:** Minimum 450x450
 - Anti-vibration mats:** 4mm bonded rubber mat
 - **Support frame:**
 - Type:** Galvanised H frame
 - Size:** Submit proposals.
 - **Threaded rod:**
 - Type:** Galvanised threaded rod.
 - Size:** Submit proposals.

90-90-60/390 Services supports

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Support type:** Submit proposals.

Execution

65-10-95/630 Installing ductwork on air handling units

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Air discharge:** Connect ductwork to allow air to straighten as it leaves the air handling unit.

65-10-95/640 Ductwork systems cleaning

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Standards:** In accordance with BESATEchnical Report TR/19 and to BS EN 15780.
- **Verification:**
 - **Method:** Visual inspection.
 - **Completion report:**

Information: System cleaned;
Cleaning method used;
Verification tests;
Pre- and post-clean photographic records;
and Recommendations for future testing and cleaning.

Format: Submit proposals.

Submit: At handover and On completion.

Number of copies: Submit proposals.

90-45-10/640 Installing filters

Shared by: 90-45-10/340 High efficiency particle arrestor (HEPA) filters; 90-45-10/360 Panel filters; and 90-45-10/380 Bag filters.

- **Mounting:** Clamp securely against sealing gasket to prevent leaks.
- **Edge seals:** Prevent air bypassing filters. Seals must remain effective after removal and replacement of cells.
- **Filter frames:**
 - **Fixings:** Securely fasten frames to ductwork walls.
 - **Gaps around frames:** Seal with mastic sealant.

90-45-15/610 Installing air handling units

- **Standard:** In accordance with BS EN 13053.
- **Component assembly:**
 - **Sealing:** Provide gaskets between air handling unit sections to prevent air leakage from casing.

90-45-25/640 Installing sheet metal ductwork

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Standard:** To BESADW/144.

- **Hangers and supports:** Install in accordance with BSRIABG 10/2010 and Strength requirements to BS EN 12236.
- **Installing flexible joint connections:** Install fully stretched to minimize pressure drop.

90-45-25/725 Installing fire and smoke control dampers

- **Standard:** Submit proposals.

90-45-25/750 Access to dampers for resetting and maintenance

Shared by: 90-45-25/420 Fire and smoke dampers; and 90-45-25/460 Non-return dampers.

- **Position:** Provide access to damper mechanisms on fire dampers; smoke dampers; combined smoke and fire dampers, and volume control dampers through access doors, suspended ceilings, etc. Where more than one fire damper is installed in a frame provide access to all fire dampers.
- **Fire links:** Provide access for replacement.

90-45-25/790 Air leakage testing of plant items

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; 65-10-95/160 Kitchen extract ventilation system; 90-45-25/315 Circular sheet metal ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Standard:** To BESADW/144.
- **Report:**
 - **Format:** Submit proposals.
 - **Submit:** At handover and On completion.
 - **Number of copies:** Submit proposals.

90-45-50/610 Installing heating and cooling coils generally

- **Equipment, controls and instruments positioned next to heating coils:** Protect from thermal radiation.

90-90-40/610 Installing insulation and protection products generally

Shared by: 90-90-40/630 Installing nitrile rubber insulation on pipelines; 90-90-40/645 Installing phenolic foam insulation on ductwork; and 90-90-40/660 Installing foil faced mineral wool insulation on ductwork.

- **Standard:** In accordance with BS 5970.
- **Timing:** Insulate after installed system has been fully tested and joints proved sound.
- **Insulation:** Do not enclose adjacent units together.
- **Clearance:** Maintain between pipes.
- **Finish:** Neatly finish joints, corners, edges and overlaps.

90-90-40/645 Installing phenolic foam insulation on ductwork

- **General requirements:** 90-90-40/610 Installing insulation and protection products generally.
- **Ducts:**
 - **Rectangular:** Apply slabs.
 - **Circular:** Apply circular duct insulation.
 - **Flat oval:** Apply slabs and pipe sections.
- **Joints:** Close butt slabs or section and seal with 100 mm wide tape.

- **Duct supports:** Use rigid phenolic foam inserts at supports on rectangular ducts and Use phenolic foam crocodile strips on circular ducts.

90-90-40/715 Installing self adhesive cladding and jacketing

- **Application:** Cover insulation with self adhesive cladding and jacketing with 50 mm overlaps.

90-90-40/780 Installing vapour barriers

Shared by: 90-90-40/350 Nitrile rubber insulation; and 90-90-40/360 Phenolic foam insulation.

- **Integrity:** Seal to maintain throughout.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

90-90-55/650 Installing ductwork identification

- **Standard:** In accordance with BESADW/144.
- **Position:** Locate where visible.
- **Direction of flow:** Equilateral triangle, 150 mm length of side, with one apex pointing in the direction of flow.
- **Information:** Space served by the duct and associated plant;
Air being conveyed, direction of flow, destination of the air;
and Location or designation of plant which treats the air.

System completion

65-10-95/840 Demonstrations

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Running of plant:**
 - **Operation:** Run, maintain and supervise the installations under normal working conditions.
 - **Duration:** Two weeks.
- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

65-10-95/850 Documentation for ventilation systems

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Operating and maintenance instructions:**
 - **Scope:** In accordance with BSRIA Guide BG 1/2007 "Handover, O&M Manuals, and Project Feedback".
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Electronic and Paper copy.

- **Number of copies:** Three.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms;
Location, size and route of ductwork;
Location and identification of regulating dampers and fire dampers;
and Location of outlets.
 - **Format:** A1 paper print and Electronic.
 - **Scale:** Max. 1:50 @ A1.
 - **Number of copies:** Three.
- **Submittal date:** At handover.

65-10-95/860 Spares and consumables

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Filters:**
 - **Filter media:** Supply two sets of filters, the first for use before commissioning and the second for final commissioning.
 - **Retaining clips and rubber gaskets:** Two sets for each type of filter.
 - **Cleaning solution:** Supply coating solution for one complete cleaning of metal plate filters.
- **Detectors:** Supply two of each type.
- **Air terminal device keys:** Supply a set for adjusting each type of grille and diffuser damper.

65-10-95/870 Maintenance

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Servicing and maintenance:** Undertake for 12 months after completion.

Ω End of system

65-10-95/140 Mechanical extract ventilation system

System outline

65-10-95/140 Mechanical extract ventilation system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the **Mechanical Extract Ventilation System** including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Tank Room Extract

The tank room shall be ventilated via a stand-alone extract fan located at high level within the space. Extract air is drawn into the fan via grilles located high level within the space and discharged via louvres mounted around the perimeter of the ground floor. Makeup air shall be drawn in via louvres mounted around the perimeter of the ground floor. The contractor shall refer to the Tender drawings for the indicative positions of the extract fan.

The contractor shall also provide tubular heaters to condition the space to the values set out within the preliminaries section of the specification.

The contractor shall ensure that the Fans have the ability to interface with the BEMS system for monitoring and control purposes.

Bin Room Extract

The bin room shall be ventilated via a stand-alone extract fan located at high level within the space. Extract air is drawn into the fan via grilles located high level within the space and discharged via louvres mounted around the perimeter of the ground floor. Makeup air shall be drawn in via louvres mounted around the perimeter of the ground floor. The contractor shall refer to the Tender drawings for the indicative positions of the extract fan.

The contractor shall also provide tubular heaters to condition the space to the values set out within the preliminaries section of the specification.

The contractor shall ensure that the Fans have the ability to interface with the BEMS system for monitoring and control purposes.

Comms Room Extract

The bin room shall be ventilated via a stand-alone extract fan located at high level within the space. Extract air is drawn into the fan via grilles located high level within the space and discharged via louvres mounted around the perimeter of the ground floor. Makeup air shall be drawn in via louvres mounted around the perimeter of the ground floor. The contractor shall refer to the Tender drawings for the indicative positions of the extract fan.

The contractor shall also provide tubular heaters to condition the space to the values set out within the preliminaries section of the specification.

The contractor shall ensure that the Fans have the ability to interface with the BEMS system for monitoring and control purposes.

- **System performance:** 65-10-95/210 Design of ventilation systems;
65-10-95/240 Ductwork design type General;
65-10-95/250 Fan performance;
and 65-10-95/260 Attenuator performance.
- **Room extract air terminal devices:** 90-45-20/380 Grilles.
- **Air ductwork and accessories:**
 - **Ductwork:** 90-45-25/315 Circular sheet metal ductwork and fittings and 90-45-25/365 Rectangular sheet metal ductwork and fittings.
 - **Accessories:** 90-45-25/400 Access doors;
90-45-25/420 Fire and smoke dampers;
90-45-25/430 Flexible ductwork;
and 90-45-25/460 Non-return dampers.
- **Thermal insulation on extract air ductwork:** 90-90-40/360 Phenolic foam insulation.
- **Vibration isolation mountings:** Submit proposals To meet Acoustic Consultant requirements.
- **Heat recovery:** Submit proposals.
- **Acoustic treatment:** 90-45-75/310 Air transfer and cross talk attenuators and 90-45-75/330 Rectangular silencers.
- **Extract fans:** 90-45-30/310 Axial flow fans;
90-45-30/320 Centrifugal fans;
and 90-45-30/360 Roof mounted fans.
- **External exhaust air terminals:** 45-25-50/305 Aluminium louvre panel units;
45-25-50/312 Stainless steel louvre panel units;
and 45-25-50/315 Wood louvre panel units.
- **Accessories:** 90-90-60/380 Roof equipment support systems and 90-90-60/390 Services supports.
- **Controls:** .
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels.
- **Testing:** 90-45-25/790 Air leakage testing of plant items.
- **Execution:** 65-10-95/630 Installing ductwork on air handling units and 65-10-95/640 Ductwork systems cleaning.
- **System completion:** 65-10-95/840 Demonstrations;
65-10-95/850 Documentation for ventilation systems;

65-10-95/860 Spares and consumables;
and 65-10-95/870 Maintenance.

System performance

65-10-95/210 Design of ventilation systems

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Design:** As detailed in the Tender drawings. Perform all required calculations to review and confirm the design of the ventilation systems.
- **Method:** In accordance with CIBSE Applications Manual AM 11.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Computer calculations:**
 - **Submittals:** U-values and heat gain calculations for each room;
Fan sizing calculations;
and Duct sizing calculations.
 - **Format:** IES and Hevacomp.

65-10-95/240 Ductwork design type General

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Air velocity:**
 - **Standard:** As CIBSE Guide B2.
 - **Main ducts:** 7.5 m/s.
 - **Branch ducts:** 3.5 m/s.
 - **Runouts:** <2m/s.
- **Ductwork cleaning:**
 - **Standard:** In accordance with BESATechnical Report TR/19.
 - **Level of protection:** Intermediate PDI.
 - **Cleanliness quality class:** Medium.

65-10-95/250 Fan performance

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Standard:** In accordance with BS EN 13779.
- **Flow rate:** Submit proposals.
- **System pressure:** Submit proposals.
- **Operation:** Continuous and Intermittent.
- **Specific fan power:** Approved Document L2A, Limited Services Efficiencies for Non Domestic Buildings.
- **Classification:** Submit proposals.

65-10-95/260 Attenuator performance

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Performance requirements:**
 - **Standards:** To BS EN ISO 7235 and BS EN ISO 11691.
 - **Insertion loss:** Refer to Attenuator schedule.

Products**45-25-50/305 Aluminium louvre panel units**

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Refer to Louvre schedule.
- **Size (l x w x d):** Refer to Louvre schedule.
- **Material:** Extruded aluminium alloy frame and louvre blades, to BS EN 755-1.
- **Finish:** To Architects specification
- **Colour:** To Architects specification
- **Construction:** To Architects specification
- **Air intake and exhaust performance:**
 - **Application:** Refer to Louvre schedule.
 - **Air volume:** Refer to Louvre schedule.
 - **Face velocity:** Refer to Louvre schedule.
 - **Core velocity (maximum):** Refer to Louvre schedule.
- **Calculated weighted sound reduction index (Rw):**
- **Weather performance:**
 - **Water penetration class (minimum):** To BS EN 13030, class A.

45-25-50/312 Stainless steel louvre panel units

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Refer to Louvre schedule.
- **Size (l x w x d):** Refer to Louvre schedule.
- **Material:** Stainless steel to BS EN 10088-1, grade 1.4401.
- **Finish:** To Architects specification
- **Construction:** To Architects specification
- **Air intake and exhaust performance:**
 - **Application:** Refer to Louvre schedule.
 - **Air volume:** Refer to Louvre schedule.
 - **Face velocity:** Refer to Louvre schedule.
 - **Core velocity (maximum):** Refer to Louvre schedule.

- **Weather performance:**
 - **Water penetration class (minimum):** To BS EN 13030, class A.

45-25-50/315 Wood louvre panel units

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Refer to Louvre schedule.
- **Size (l x w x d):** Refer to Louvre schedule.
- **Species:** To Architects specification
- **Finish:** To Architects specification
- **Colour:** To Architects specification
- **Air intake and exhaust performance:**
 - **Application:** Refer to Louvre schedule.
 - **Air volume:** Refer to Louvre schedule.
 - **Face velocity:** Refer to Louvre schedule.
 - **Core velocity (maximum):** Refer to Louvre schedule.
- **Weather performance:**
 - **Water penetration class (minimum):** To BS EN 13030, class A.

90-45-20/380 Grilles

- **Manufacturer:** Refer to Grille schedule.
- **Standards:**
 - **Mixed flow applications:** To BS EN 12238.
 - **Displacement flow applications:** To BS EN 12239.
 - **Sound power levels:** To BS EN ISO 5135.
- **Application:** Extract.
- **Duty:**
 - **Air volume:** Refer to Grille schedule.
 - **Size:** Refer to Grille schedule.
 - **Sound power level:** Refer to Grille schedule.
- **Core velocity (maximum):** Refer to Grille schedule.
- **Shape:**
- **Grille type:** Refer to Grille schedule.
- **Execution:** 90-45-20/650 Installing grilles and 90-45-20/690 Support of air terminal units in ceiling grids.

90-45-25/315 Circular sheet metal ductwork and fittings

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Standards:** To BESADW/144, BS EN 1506 and BS EN 12237.
- **Classification:** Class A.
- **Material:** Zinc coated steel to BS EN 10346 grade DX51D+Z140.
- **Construction:** Spirally wound.

- **Regulating dampers:**
 - **Standard:** As BESADW/144.
 - **Regulating function:** Balancing.
 - **Material:** To match ductwork.
- **Access openings:**
 - **Purpose:** Inspection; Cleaning; and Maintenance.
 - **Sizes:** To BS EN 12097.
- **Execution:** 90-45-25/790 Air leakage testing of plant items and 90-45-25/640 Installing sheet metal ductwork.

90-45-25/365 Rectangular sheet metal ductwork and fittings

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Standards:** To BESADW/144, BS EN 1505 and BS EN 1507.
- **Classification:** Class A.
- **Material:** Zinc coated steel to BS EN 10346 grade DX51D+Z140.
- **Regulating dampers:**
 - **Standard:** To BESADW/144.
 - **Regulating function:** Balancing.
 - **Material:** To match ductwork.
- **Access openings:**
 - **Purpose:** Inspection; Cleaning; and Maintenance.
 - **Sizes:** To BS EN 12097.
- **Execution:** 90-45-25/640 Installing sheet metal ductwork and 90-45-25/790 Air leakage testing of plant items.

90-45-25/400 Access doors

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Galvanized sheet steel.

90-45-25/420 Fire and smoke dampers

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Standard:**
 - **Fire dampers:** To BS EN 15650.
 - **Test:** To BS EN 1366-2.
 - **Classification:** To BS EN 13501-3.
 - **Aerodynamic performance:** To BS EN 1751 and BS EN ISO 5135.

- **Execution:** 90-45-25/750 Access to dampers for resetting and maintenance and 90-45-25/725 Installing fire and smoke control dampers.

90-45-25/430 Flexible ductwork

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Standard:** To BESADW/144.
- **Length:** Maximum 500mm with no with no bends of offset greater than 15 degrees.

90-45-25/460 Non-return dampers

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Standard:** To BS EN 1751.
- **Execution:** 90-45-25/750 Access to dampers for resetting and maintenance.

90-45-30/310 Axial flow fans

- **Manufacturer:** Refer to Fan schedule.
- **Performance:**
 - **Standard:** To BS 848-1.
- **Duty:**
 - **Reference:** Refer to Fan schedule.
 - **Air volume:** Refer to Fan schedule.
 - **Resistance:** Refer to Fan schedule.
 - **Fan speed:** Refer to Fan schedule.
 - **External static resistance:** Refer to Fan schedule.
 - **Sound power level:** Refer to Fan schedule.
- **Mechanical safety:** To BS 848-5.
- **Electrical safety:** To BS EN 60335-2-80.
- **Dimensions:** To BS EN ISO 13351.
- **Operating conditions:**
 - **Environment:**
 - **Air density:** 1.20 kg/m³.
- **Inspection doors:** Manufacturer's standard.
- **Motor and drive:**
 - **Type:** Match fan.
- **Execution:** 90-45-30/610 Installing fans generally.

90-45-30/320 Centrifugal fans

- **Manufacturer:** Refer to Fan schedule.
- **Performance:**
 - **Standard:** To BS 848-1.
- **Duty:**

- **Reference:** Refer to Fan schedule.
- **Air volume:** Refer to Fan schedule.
- **Fan speed:** Refer to Fan schedule.
- **External static resistance:** Refer to Fan schedule.
- **Air temperature:** Refer to Fan schedule.
- **Sound power level:** Refer to Fan schedule.
- **Mechanical safety:** To BS 848-5.
- **Electrical safety:** To BS EN 60335-2-80.
- **Dimensions:** To BS EN ISO 13351.
- **Operating conditions:**
 - **Air density:** 1.20 kg/m³.
- **Motor and drive:** Matched to fan.
- **Inspection doors:** Manufacturer's standard.
- **Execution:** 90-45-30/610 Installing fans generally.

90-45-30/360 Roof mounted fans

- **Manufacturer:** Refer to Fan schedule.
- **Performance:**
 - **Standard:** To BS 848-1.
- **Duty:**
 - **Reference:** Refer to Fan schedule.
 - **Air volume:** Refer to Fan schedule.
 - **Resistance:** Refer to Fan schedule.
 - **Fan speed:** Refer to Fan schedule.
 - **External static resistance:** Refer to Fan schedule.
 - **Sound power level:** Refer to Fan schedule.
- **Mechanical safety:** To BS 848-5.
- **Electrical safety:** To BS EN 60335-2-80.
- **Dimensions:** To BS EN ISO 13351.
- **Operating conditions:**
 - **Air density:** 1.20 kg/m³.
- **Motor and drive:** Matched to fan.
- **Execution:** 90-45-30/610 Installing fans generally.

90-45-75/310 Air transfer and cross talk attenuators

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Performance standards:** To BS EN ISO 7235 and BS EN ISO 11691.
- **Duty:**
 - **Insertion loss:** Refer to Attenuator schedule.
 - **Air volume:** Refer to Attenuator schedule.

- **Permissible pressure loss:** Refer to Attenuator schedule.
- **Lining material:** Inert, fire proof, inorganic and non- hygroscopic.
- **Duct connections:** Manufacturer's standard.

90-45-75/330 Rectangular silencers

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Performance standards:** To BS EN ISO 7235 and BS EN ISO 11691.
- **Duty:**
 - **Insertion loss:** Refer to Attenuator schedule.
 - **Air volume:** Refer to Attenuator schedule.
 - **Permissible pressure loss:** Refer to Attenuator schedule.
- **Lining material:** Inert, fire proof, inorganic and non-hygroscopic.
- **Duct connections:** Manufacturer's standard.
- **Markings:** Show direction of air flow on silencer.

90-90-40/360 Phenolic foam insulation

Shared by: 60-45-95/110 Variable refrigerant flow system; 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS EN 13166.
- **Form:** Duct slab and Pipe section.
- **Thermal conductivity:** 0.018 W/m·K at 0°C.
0.018 W/m·K at 10°C.
0.023 W/m·K at 50°C.
0.025 W/m·K at 75°C.
- **Finish:** Aluminium.
- **Insulation thickness (minimum):** To BS 5422.
- **Vapour barrier:**
 - **Material:** Manufacturer's standard.
 - **Vapour permeability:** To BS 5422, clause 5.6.
- **Protection:** 90-90-40/390 Protection.
- **Accessories:** Submit proposals.
- **Items to be insulated:** Manufacturer's standard.
- **Execution:** 90-90-40/780 Installing vapour barriers and 90-90-40/645 Installing phenolic foam insulation on ductwork.

90-90-40/390 Protection

Shared by: 90-90-40/350 Nitrile rubber insulation; and 90-90-40/360 Phenolic foam insulation.

- **Manufacturer:** Submit proposals.
- **Material:** Manufacturer's standard.
- **Colour:** Manufacturer's standard.

- **Execution:** 90-90-40/715 Installing self adhesive cladding and jacketing.

90-90-55/420 Identifying ductwork

Shared by: 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 1710 and To BS EN 13779.
- **Identification type:** Plastics labels.
- **Colour:** Manufacturer's standard.
- **Lettering:** Manufacturer's standard.
- **Shape and size:** Manufacturer's standard.
- **Execution:** 90-90-55/650 Installing ductwork identification.

90-90-55/480 Mechanical plant and equipment identification labels

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 60-45-95/110 Variable refrigerant flow system; 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

90-90-60/380 Roof equipment support systems

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-85-20/110 Dry riser system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Roof Pro, Bigfoot or equal and approved.
One single manufacturer to be used for roof support systems.
- **Design:** H frame support system with adjustable feet shall be so designed that any two adjacent feet can be raised simultaneously to allow for maintenance of the roof insulation and membrane.
- **Components:**
 - **Support base:**
Type: Nylon GF-30% square pad with compatible fixing for a 41x41mm strut system

Size: Minimum 450x450

Anti-vibration mats: 4mm bonded rubber mat

- **Support frame:**

Type: Galvanised H frame

Size: Submit proposals.

- **Threaded rod:**

Type: Galvanised threaded rod.

Size: Submit proposals.

90-90-60/390 Services supports

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Support type:** Submit proposals.

Execution

65-10-95/630 Installing ductwork on air handling units

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Air discharge:** Connect ductwork to allow air to straighten as it leaves the air handling unit.

65-10-95/640 Ductwork systems cleaning

Shared by: 65-10-95/130 Mechanical Ventilation system; and 65-10-95/140 Mechanical extract ventilation system.

- **Standards:** In accordance with BESATEchnical Report TR/19 and to BS EN 15780.
- **Verification:**
 - **Method:** Visual inspection.
 - **Completion report:**

Information: System cleaned;
Cleaning method used;
Verification tests;
Pre- and post-clean photographic records;
and Recommendations for future testing and cleaning.

Format: Submit proposals.

Submit: At handover and On completion.

Number of copies: Submit proposals.

90-45-20/610 Installing air terminal devices

- **General:** Do not distort air terminal devices. Fix securely.
- **Air leakage:** Prevent. Seal joints with self adhesive foam strip or equivalent.

- **Appearance:** Finish visible edge joints neatly. Do not leave sharp edges and protruding screws.
- **Operation:** Fit so that moving parts operate correctly and removable cores can be taken out and replaced.
- **High level and ceiling applications:** On removable cores, provide safety wires with quick release ends.

90-45-20/650 Installing grilles

- **General requirements:** 90-45-20/610 Installing air terminal devices.

90-45-20/690 Support of air terminal units in ceiling grids

- **Standard:** To BESADW/144.
- **Position:** Agree final position of air terminals before installation.

90-45-25/640 Installing sheet metal ductwork

Shared by: 90-45-25/315 Circular sheet metal ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Standard:** To BESADW/144.
- **Hangers and supports:** Install in accordance with BSRIABG 10/2010 and Strength requirements to BS EN 12236.
- **Installing flexible joint connections:** Install fully stretched to minimize pressure drop.

90-45-25/725 Installing fire and smoke control dampers

- **Standard:** Submit proposals.

90-45-25/750 Access to dampers for resetting and maintenance

Shared by: 90-45-25/420 Fire and smoke dampers; and 90-45-25/460 Non-return dampers.

- **Position:** Provide access to damper mechanisms on fire dampers; smoke dampers; combined smoke and fire dampers, and volume control dampers through access doors, suspended ceilings, etc. Where more than one fire damper is installed in a frame provide access to all fire dampers.
- **Fire links:** Provide access for replacement.

90-45-25/790 Air leakage testing of plant items

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; 65-10-95/160 Kitchen extract ventilation system; 90-45-25/315 Circular sheet metal ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Standard:** To BESADW/144.
- **Report:**
 - **Format:** Submit proposals.
 - **Submit:** At handover and On completion.
 - **Number of copies:** Submit proposals.

90-45-30/610 Installing fans generally

Shared by: 90-45-30/310 Axial flow fans; 90-45-30/320 Centrifugal fans; and 90-45-30/360 Roof mounted fans.

- **Fixing:** Use fixing points provided. Do not strain the fan structure when bolts are tightened.

- **Orientation:**
- **Alignment:** Install fan to allow optimum air flow path.

90-90-40/610 Installing insulation and protection products generally

Shared by: 90-90-40/630 Installing nitrile rubber insulation on pipelines; 90-90-40/645 Installing phenolic foam insulation on ductwork; and 90-90-40/660 Installing foil faced mineral wool insulation on ductwork.

- **Standard:** In accordance with BS 5970.
- **Timing:** Insulate after installed system has been fully tested and joints proved sound.
- **Insulation:** Do not enclose adjacent units together.
- **Clearance:** Maintain between pipes.
- **Finish:** Neatly finish joints, corners, edges and overlaps.

90-90-40/645 Installing phenolic foam insulation on ductwork

- **General requirements:** 90-90-40/610 Installing insulation and protection products generally.
- **Ducts:**
 - **Rectangular:** Apply slabs.
 - **Circular:** Apply circular duct insulation.
 - **Flat oval:** Apply slabs and pipe sections.
- **Joints:** Close butt slabs or section and seal with 100 mm wide tape.
- **Duct supports:** Use rigid phenolic foam inserts at supports on rectangular ducts and Use phenolic foam crocodile strips on circular ducts.

90-90-40/715 Installing self adhesive cladding and jacketing

- **Application:** Cover insulation with self adhesive cladding and jacketing with 50 mm overlaps.

90-90-40/780 Installing vapour barriers

Shared by: 90-90-40/350 Nitrile rubber insulation; and 90-90-40/360 Phenolic foam insulation.

- **Integrity:** Seal to maintain throughout.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

90-90-55/650 Installing ductwork identification

- **Standard:** In accordance with BESADW/144.
- **Position:** Locate where visible.
- **Direction of flow:** Equilateral triangle, 150 mm length of side, with one apex pointing in the direction of flow.
- **Information:** Space served by the duct and associated plant;
Air being conveyed, direction of flow, destination of the air;
and Location or designation of plant which treats the air.

System completion

65-10-95/840 Demonstrations

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Running of plant:**
 - **Operation:** Run, maintain and supervise the installations under normal working conditions.
 - **Duration:** Two weeks.
- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

65-10-95/850 Documentation for ventilation systems

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Operating and maintenance instructions:**
 - **Scope:** In accordance with BSRIA Guide BG 1/2007 "Handover, O&M Manuals, and Project Feedback".
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Electronic and Paper copy.
 - **Number of copies:** Three.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms;
Location, size and route of ductwork;
Location and identification of regulating dampers and fire dampers;
and Location of outlets.
 - **Format:** A1 paper print and Electronic.
 - **Scale:** Max. 1:50 @ A1.
 - **Number of copies:** Three.
- **Submittal date:** At handover.

65-10-95/860 Spares and consumables

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Filters:**
 - **Filter media:** Supply two sets of filters, the first for use before commissioning and the second for final commissioning.
 - **Retaining clips and rubber gaskets:** Two sets for each type of filter.
 - **Cleaning solution:** Supply coating solution for one complete cleaning of metal plate filters.
- **Detectors:** Supply two of each type.
- **Air terminal device keys:** Supply a set for adjusting each type of grille and diffuser damper.

65-10-95/870 Maintenance

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Servicing and maintenance:** Undertake for 12 months after completion.

Ω End of system

65-10-95/160 Kitchen extract ventilation system

System outline

65-10-95/160 Kitchen extract ventilation system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the **Kitchen Extract Ventilation System** including all necessary ancillaries complete with electrical controls and wiring interface with the BEMS.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Ais Distribution System:

The Contractor shall design and install the kitchen ventilation air systems within the building as indicated on the Tender drawings.

The systems are to be as far as possible self-balancing, without the need for excessive regulation and balancing dampers. Any adjustment to fan duties to meet the system design air volume is to be achieved by changes to fan speed, not by restricting total system flow with balancing dampers.

The Contractor shall position balancing dampers so that the ductwork system can be adequately balanced following the guidance notes given in the CIBSE and BSRIA Commissioning Codes for Air Distribution Systems (Publ. Ref. CCA and BAG03/89). In large ducts where a multiple damper assembly is required, link the dampers so that operation is from one spindle only. Locate and install fire dampers to meet the requirements of the Building Regulations and BS 5588-9. Reference shall be made to the guidance within DW 172 when considering the installation of dampers for the kitchen ventilation distribution system;

* For extract systems, the damper blades shall be fabricated from stainless steel.

* The operating mechanism shall be outside the airstream and be capable of withstanding the higher air temperatures associated with kitchen extract systems.

If a fire suppression system is incorporated within the system and a volume control damper is used in an extract spigot, then the duct protection nozzle shall be downstream of the damper.

In accordance with BS 9999, fire dampers shall not be used in the extract system from a kitchen as the fire authorities may use the extract fan to clear smoke from the kitchen.

When fire dampers are required on the supply side, the following points should be considered:

- * The damper shall be of a robust construction suitable for its application and be complete with an installation frame where appropriate.
- * A visual or audible alarm to signal damper closure should be considered if the fire damper is in a remote location.
- * All motorised fire dampers shall have the ability to interface back to the Fire Alarm and BMES systems for monitoring and resetting purposes.
- * All fire dampers shall be provided with access panels/doors of adequate size to allow regular testing, inspection and reset.

Back-draught dampers should not be used as they are difficult to clean and prevent a natural 'stack' effect from the kitchen which would otherwise release overnight lingering smells.

For Ventilated Ceilings volume control dampers shall be installed either in the dedicated ductwork or on the plenum boxes

Extract grilles are a proprietary type specifically designed for mechanical ventilation. Extract grilles are to be selected to minimise the build-up of dust on the blades and have removable cores to allow the duct spigot to be cleaned. Design air distribution systems to convey air efficiently and economically. Size ductwork to keep resistance and velocities to the economic minimum and to avoid airflow generated noise from excessive air velocities, fittings and duct mounted components and terminal devices.

All grilles shall be agreed with the Kitchen Consultant with samples provided where requested for sign off purposes.

Carry out air leakage testing on all ductwork systems to establish conformity with Table 2 of DW144 and ensure the procedures comply with BESA Specification DW143 - A Practical Guide to Ductwork Leakage Testing.

Attenuators are to comply with the requirements of BESA Specification DW144. Acoustic linings are to be erosion resistant, fire-resistant, vermin and corrosion-proof faced with a perforated galvanised plate. Splitters are to be round-nosed at inlet and outlet. Attenuators are not to have an air pressure drop exceeding 75Pa. All attenuators shall be selected to meet the requirements set out by the Acoustic Consultant.

All ventilation system inclusive but not limited to Air Handling Units, Fans and Mechanical Heat Recovery Units shall have the ability to interface with the BMES system for control and monitoring purposes.

Kitchen Supply

A new AHU shall be installed at roof level to supply the fresh air into the Kitchen. The Contractor shall refer to the Tender drawings for indicative AHU plant locations and shall work with the Architect and Structural Engineers to position the units to suit.

The fresh air to the Kitchen will be distributed through ductwork running on the roof before being routed

down Riser R14 to a fire rated intake plenum at high level ground floor. Note that riser R14 is situated above one of the fire escape corridors and this will need to be fully isolated off from the intake plenum. From this intake riser, the kitchen supply ductwork is routed into the kitchen. The Contractor shall refer to the Tender drawings for indicative routes and shall work with the Architects, Interior Architects, Kitchen Consultants and Fire Consultants to finalise the routes.

Capped connections have been highlighted within the kitchen area however, The Contractor shall work with the Kitchen Consultant to develop the final ventilation distribution strategy to suit the kitchen layouts.

Kitchen Extract

A new AHU shall be installed at roof level to extract the stale air from the kitchen and kitchen appliances. The Contractor shall refer to the Tender drawings for indicative AHU plant locations and shall work with the Architect and Structural Engineers to position the units to suit.

The extract air from the kitchen shall be from ductwork routed through riser R21 where it shall distribute on the roof level to the kitchen extract AHU. The Contractor shall refer to the Tender drawings for indicative routes and shall work with the Architects and Kitchen Consultants to finalise any routes.

The ductwork serving the kitchen extract shall be fully fire rated with access to it every 3 meters. The contractor shall ensure that suitable access is coordinated with the architects to suit the final design of the kitchen ventilation system.

Capped connections have been highlighted within the kitchen area however, The Contractor shall work with the Kitchen Consultant to develop the final ventilation distribution strategy to suit the kitchen layouts.

The Contractor shall ensure that the kitchen ventilation system includes a gas interlock system linked to the shut off of any gas appliances and if kitchen ductwork is to be used for smoke clearance, that the system is interlocked to the Fire Alarm system and BMES for monitoring and control purposes.

- **System performance:** 65-10-95/210 Design of ventilation systems;
65-10-95/240 Ductwork design type General;
65-10-95/240 Ductwork design type Kitchen Extract;
65-10-95/250 Fan performance;
and 65-10-95/260 Attenuator performance.
- **Room extract air terminal devices:** 45-25-38/305 Air transfer grilles and 90-45-25/340 Kitchen canopies.
- **Thermal insulation on extract air ductwork:** 90-90-40/340 Mineral wool slabs insulation.
- **Extract fans:** Contractor's design.
- **External exhaust air terminals:** 45-25-50/305 Aluminium louvre panel units;
45-25-50/312 Stainless steel louvre panel units;
and 45-25-50/315 Wood louvre panel units.
- **Accessories:** 90-90-60/380 Roof equipment support systems and 90-90-60/390 Services supports.
- **Controls:** Contractor's design.
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels.
- **Testing:** 90-45-25/790 Air leakage testing of plant items.
- **Execution:** 65-10-95/630 Installing ductwork on air handling units and 90-45-25/775 Cleaning of kitchen extract systems.

- **System completion:** 65-10-95/840 Demonstrations;
65-10-95/850 Documentation for ventilation systems;
65-10-95/860 Spares and consumables;
and 65-10-95/870 Maintenance.

System performance

65-10-95/210 Design of ventilation systems

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Design:** As detailed in the Tender drawings. Perform all required calculations to review and confirm the design of the ventilation systems.
- **Method:** In accordance with CIBSE Applications Manual AM 11.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Computer calculations:**
 - **Submittals:** U-values and heat gain calculations for each room;
Fan sizing calculations;
and Duct sizing calculations.
 - **Format:** IES and Hevacomp.

65-10-95/240 Ductwork design type General

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Air velocity:**
 - **Standard:** As CIBSE Guide B2.
 - **Main ducts:** 7.5 m/s.
 - **Branch ducts:** 3.5 m/s.
 - **Runouts:** <2m/s.
- **Ductwork cleaning:**
 - **Standard:** In accordance with BESATechnical Report TR/19.
 - **Level of protection:** Intermediate PDI.
 - **Cleanliness quality class:** Medium.

65-10-95/240 Ductwork design type Kitchen Extract

- **Air velocity:**
 - **Standard:** As CIBSE Guide B2.
 - **Main ducts:** 9 m/s.
 - **Branch ducts:** Submit proposals.
 - **Runouts:** Contractor's choice.
- **Ductwork cleaning:**
 - **Standard:** In accordance with BESATechnical Report TR/19.

- **Level of protection:** Intermediate PDI.
- **Cleanliness quality class:** Medium.

65-10-95/250 Fan performance

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Standard:** In accordance with BS EN 13779.
- **Flow rate:** Submit proposals.
- **System pressure:** Submit proposals.
- **Operation:** Continuous and Intermittent.
- **Specific fan power:** Approved Document L2A, Limited Services Efficiencies for Non Domestic Buildings.
- **Classification:** Submit proposals.

65-10-95/260 Attenuator performance

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Performance requirements:**
 - **Standards:** To BS EN ISO 7235 and BS EN ISO 11691.
 - **Insertion loss:** Refer to Attenuator schedule.

Products

45-25-38/305 Air transfer grilles

- **Manufacturer:** Refer to Grille schedule.
- **Standard:** To BS EN 13141-1.
- **Third party certification:** Manufacturer's standard.
- **Configuration:** Refer to Grille schedule.
- **Size:** Refer to Grille schedule.
- **Equivalent area (minimum):** Refer to Grille schedule.
- **Material and finish:** Submit proposals.
- **Colour:** Self coloured.
- **Execution:** 45-25-38/610 Fasteners for hardware.

45-25-50/305 Aluminium louvre panel units

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Refer to Louvre schedule.
- **Size (l x w x d):** Refer to Louvre schedule.
- **Material:** Extruded aluminium alloy frame and louvre blades, to BS EN 755-1.
- **Finish:** To Architects specification
- **Colour:** To Architects specification

- **Construction:** To Architects specification
- **Air intake and exhaust performance:**
 - **Application:** Refer to Louvre schedule.
 - **Air volume:** Refer to Louvre schedule.
 - **Face velocity:** Refer to Louvre schedule.
 - **Core velocity (maximum):** Refer to Louvre schedule.
- **Calculated weighted sound reduction index (Rw):**
- **Weather performance:**
 - **Water penetration class (minimum):** To BS EN 13030, class A.

45-25-50/312 Stainless steel louvre panel units

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Refer to Louvre schedule.
- **Size (l x w x d):** Refer to Louvre schedule.
- **Material:** Stainless steel to BS EN 10088-1, grade 1.4401.
- **Finish:** To Architects specification
- **Construction:** To Architects specification
- **Air intake and exhaust performance:**
 - **Application:** Refer to Louvre schedule.
 - **Air volume:** Refer to Louvre schedule.
 - **Face velocity:** Refer to Louvre schedule.
 - **Core velocity (maximum):** Refer to Louvre schedule.
- **Weather performance:**
 - **Water penetration class (minimum):** To BS EN 13030, class A.

45-25-50/315 Wood louvre panel units

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Refer to Louvre schedule.
- **Size (l x w x d):** Refer to Louvre schedule.
- **Species:** To Architects specification
- **Finish:** To Architects specification
- **Colour:** To Architects specification
- **Air intake and exhaust performance:**
 - **Application:** Refer to Louvre schedule.
 - **Air volume:** Refer to Louvre schedule.
 - **Face velocity:** Refer to Louvre schedule.
 - **Core velocity (maximum):** Refer to Louvre schedule.
- **Weather performance:**
 - **Water penetration class (minimum):** To BS EN 13030, class A.

90-90-55/420 Identifying ductwork

Shared by: 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Standard:** To BS 1710 and To BS EN 13779.
- **Identification type:** Plastics labels.
- **Colour:** Manufacturer's standard.
- **Lettering:** Manufacturer's standard.
- **Shape and size:** Manufacturer's standard.
- **Execution:** 90-90-55/650 Installing ductwork identification.

90-90-55/480 Mechanical plant and equipment identification labels

Shared by: 50-10-05/120 Above ground wastewater drainage system with internal stacks; 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 60-45-95/110 Variable refrigerant flow system; 65-10-75/110 Smoke and heat exhaust ventilation system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Submit proposals.
- **Material:** Face engraved rigid plastic laminate.
- **Label size:** Manufacturer's standard.
- **Colour:**
 - **Background:** White.
 - **Lettering:** Black.
- **Typography:**
 - **Font:** Helvetica medium.
 - **Size:** 10mm
- **Information to be included:** Equipment name and Equipment reference number.
- **Execution:** 90-90-55/610 Installing mechanical plant and equipment identification.

90-90-60/380 Roof equipment support systems

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-85-20/110 Dry riser system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Roof Pro, Bigfoot or equal and approved.
One single manufacturer to be used for roof support systems.
- **Design:** H frame support system with adjustable feet shall be so designed that any two adjacent feet can be raised simultaneously to allow for maintenance of the roof insulation and membrane.
- **Components:**
 - **Support base:**

Type: Nylon GF-30% square pad with compatible fixing for a 41x41mm strut system

Size: Minimum 450x450

Anti-vibration mats: 4mm bonded rubber mat

- **Support frame:**

Type: Galvanised H frame

Size: Submit proposals.

- **Threaded rod:**

Type: Galvanised threaded rod.

Size: Submit proposals.

90-90-60/390 Services supports

Shared by: 55-40-40/130 Pumped cold water supply system; 55-40-40/160 Indirect hot water storage supply system; 55-60-55/120 Natural gas supply system; 55-85-20/110 Dry riser system; 55-85-75/110 Commercial and industrial sprinkler system; 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Manufacturer:** Contractor's choice.
- **Support type:** Submit proposals.

Execution

45-25-38/610 Fasteners for hardware

- **Fasteners:**
- **Colour and finish:** To match hardware.

65-10-95/630 Installing ductwork on air handling units

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Air discharge:** Connect ductwork to allow air to straighten as it leaves the air handling unit.

90-45-25/650 Installing kitchen ductwork and canopy

- **Standard:** To BESADuctwork Specification DW/172.

90-45-25/775 Cleaning of kitchen extract systems

- **Cleaning:** In accordance with HVCA TR/19.

90-45-25/790 Air leakage testing of plant items

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; 65-10-95/160 Kitchen extract ventilation system; 90-45-25/315 Circular sheet metal ductwork and fittings; and 90-45-25/365 Rectangular sheet metal ductwork and fittings.

- **Standard:** To BESADW/144.
- **Report:**
 - **Format:** Submit proposals.
 - **Submit:** At handover and On completion.
 - **Number of copies:** Submit proposals.

90-90-40/610 Installing insulation and protection products generally

Shared by: [90-90-40/630 Installing nitrile rubber insulation on pipelines](#); [90-90-40/645 Installing phenolic foam insulation on ductwork](#); and [90-90-40/660 Installing foil faced mineral wool insulation on ductwork](#).

- **Standard:** In accordance with BS 5970.
- **Timing:** Insulate after installed system has been fully tested and joints proved sound.
- **Insulation:** Do not enclose adjacent units together.
- **Clearance:** Maintain between pipes.
- **Finish:** Neatly finish joints, corners, edges and overlaps.

90-90-40/660 Installing foil faced mineral wool insulation on ductwork

- **General requirements:** [90-90-40/610 Installing insulation and protection products generally](#).
- **Fixing to underside of ducting:** Self adhesive stick pins. Further support with 0.7–1.0 x 50 mm mesh galvanized wire netting.
- **Joints, pin penetrations, cut outs for test holes and supports:** Seal with 100 mm wide class 0 foil tape.

90-90-40/770 Insulation carried through ductwork supports

- **High density phenolic foam:** Close butt to insulation.
- **Sleeve:** Provide sheet metal protective sleeve.

90-90-55/610 Installing mechanical plant and equipment identification

- **Fixing:** Fix with adhesive to equipment.
- **Position:** On equipment.

90-90-55/650 Installing ductwork identification

- **Standard:** In accordance with BESADW/144.
- **Position:** Locate where visible.
- **Direction of flow:** Equilateral triangle, 150 mm length of side, with one apex pointing in the direction of flow.
- **Information:** Space served by the duct and associated plant;
Air being conveyed, direction of flow, destination of the air;
and Location or designation of plant which treats the air.

System completion**65-10-95/840 Demonstrations**

Shared by: [65-10-95/130 Mechanical Ventilation system](#); [65-10-95/140 Mechanical extract ventilation system](#); and [65-10-95/160 Kitchen extract ventilation system](#).

- **Running of plant:**
 - **Operation:** Run, maintain and supervise the installations under normal working conditions.
 - **Duration:** Two weeks.
- **Instruction:** Instruct and demonstrate the purpose, function and operation of the installations.

65-10-95/850 Documentation for ventilation systems

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Operating and maintenance instructions:**
 - **Scope:** In accordance with BSRIA Guide BG 1/2007 "Handover, O&M Manuals, and Project Feedback".
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Electronic and Paper copy.
 - **Number of copies:** Three.
- **Record drawings:**
 - **Content:** Location and arrangement of plant in plant rooms;
Location, size and route of ductwork;
Location and identification of regulating dampers and fire dampers;
and Location of outlets.
 - **Format:** A1 paper print and Electronic.
 - **Scale:** Max. 1:50 @ A1.
 - **Number of copies:** Three.
- **Submittal date:** At handover.

65-10-95/860 Spares and consumables

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Filters:**
 - **Filter media:** Supply two sets of filters, the first for use before commissioning and the second for final commissioning.
 - **Retaining clips and rubber gaskets:** Two sets for each type of filter.
 - **Cleaning solution:** Supply coating solution for one complete cleaning of metal plate filters.
- **Detectors:** Supply two of each type.
- **Air terminal device keys:** Supply a set for adjusting each type of grille and diffuser damper.

65-10-95/870 Maintenance

Shared by: 65-10-95/130 Mechanical Ventilation system; 65-10-95/140 Mechanical extract ventilation system; and 65-10-95/160 Kitchen extract ventilation system.

- **Servicing and maintenance:** Undertake for 12 months after completion.

Ω End of system

75-75-05/150 Building monitoring and management system

System outline

75-75-05/150 Building monitoring and management system

- **Description:** This is a performance specification and it shall be clearly understood that the Contractor is fully responsible for the detailed design, supply, installation, testing, commissioning, demonstrating and documentation (i.e. design coordination, fabrication, production of working drawings, O&M manuals and record drawings) of the **Building Monitoring and Management System (BEMS)** including all necessary ancillaries and electrical controls and wiring.

The contractor shall provide a complete system, fully installed and in working order as described within the Preliminary Specification, this Specification and as indicated on the project drawings and within the technical schedules.

The contractor shall accept the Engineering RIBA Stage 4 design and Performance Specification details and complete the RIBA Stage 5 & 6 design and coordination including installation drawings and design verification/validation checks as detailed within this Specification and accept without qualification full design responsibility.

Objectives

To provide an Open Protocol Fully integrated intelligent microprocessor-based direct digital control and metering system, complete with BMES head end and system graphics, fully integrated with proprietary controllers, installed as a complete package by the Contractors appointed Controls Specialists.

The Controls system shall provide fully automatic control and monitoring of all MEPH systems and ancillaries, whether or not these sundry components are mentioned in detail, including the facility for web-based access via a password protected "dial in" to enable full monitoring and overriding control of the MEPH services systems from an off-site, central facilities management location.

The Controls specialist shall provide the complete BEMS/controls and metering system interface, including the MCCs, local control panels, equipment starters, meters (free issued by the energy metering specialist) etc. located within the MCCs, local plant isolators located at the equipment, all necessary power and controls cabling, all necessary power and controls cable containment, all necessary indicator lamps, fuses, timers, interfaces, interlocks, sensors, actuators, motorised valves, inverters (that are not integral to packaged equipment items), remote meters (by others) etc as detailed within this specification scope of works and/or drawings and as necessary to achieve the specified operations.

The contractor shall provide full details of their proposals within a technical submittal

The Controls system shall be in accordance with BS EN ISO, CIBSE Guide H and TM39, BSRIA Standard Specification for BMS - Application Guide AG 9/2001 & AG 10/2001 to serve the Waterloo Retail scheme.

The controls system shall be completely independent of other HVAC control systems within the Waterloo Station terminal. However, the provision shall be included for the future integration of the Retail controls system with others to create a single site-wide controls system in the future.

Select all control components and equipment, suitable to meet system objective requirements and BG 4/2007 & BG 3/2006. Ensure that system safety complies with BS EN ISO 13849. Where necessary comply with BS EN 61508, BS EN 15500 & BS EN ISO 16484.

The automatic control and BEMS for the above MEPH systems shall be provided by a Trend 963 direct digital control (DDC) client/server-based system, providing control and monitoring via IQ4 controllers to provide the required control regimes and field devices, each outstation networked using a LAN connection to the BEMS with a head end and system graphics.

The controls system shall comprise 4No. Motor Control Panels (MCCP's) complete with IQ viewers in the following locations:

The Controls installation details shall be read in conjunction with and shall comply with, the associated Electrical Specifications.

General Design

All works associated with the design, supply, installation, configuring, testing, commissioning & demonstrating of the Automatic Control System shall include the supply of new Control Panels, electrical and controls wiring & containment between the control panels and new items of mechanical plant. The Contractor shall appoint a controls system specialist from one of the following or similar equal & approved:

* E.ON Control Solutions Ltd.

* BMSI

* Lloret Control System

The Contractor shall be responsible for all aspects of the final design of the automatic controls system.

The Contractor shall allow for advising the Controls Specialist of all necessary system details and selection information based on general information provided in other sections of this specification, and for confirming all power loads, phase requirements, and equipment interface details, before finalising the Controls system installation drawings & Technical submittal details.

Where indicative control valve/damper pressure drops have been provided, these are for tender purposes only. The Contractor shall allow for advising the Controls Specialist(s) of all necessary system details, including equipment coil pressure drops for specific selections, to allow control valve selections to be made to achieve the correct control authority.

The Contractor shall be responsible for the selection, supply and installation of all motorised valves, dampers and actuators, except where these are provided as an integral part of a plant item. Where they are provided as part of a plant item, the Contractor/Controls specialist shall verify compatibility with the BMS.

The Contractor shall be responsible for the selection, supply and installation of all pump and fan inverters where these are not supplied as an integral item of the pertaining item of equipment.
The Contractor shall also provide final data and commissioning certificates as required under subsequent

clauses, provide a minimum of 3 days training to the client's representatives and provide complete O&M Manual documentation.

The DDC Controls shall be as manufactured by Trend Control Systems Ltd.

A complete automatic controls system shall be provided to control all items of Mechanical services plant and equipment, monitor plant items and plant interfaces as identified within this specification.

The controls system shall be interfaced (Hard wired) with the i.e. fire alarm system etc. bringing to the engineer's attention any works required where not covered under the automatic controls system works.

The automatic controls system shall be installed in line with the specification including all user interfaces, field control wiring, the provision of cable tray, galvanised steel conduits for all circuits emanating from the MCC's between the control panels and items of plant/equipment.

The system shall be designed to operate seven days per week, 24 hours a day. The BMES shall calculate optimised start and stop times based on external temperatures.

Outstations shall be provided within dedicated MCC panels and separate additional panels where necessary. All outstations shall be incorporate integral battery backup capable of retaining the controller DDC logic on power failure for a minimum period of 72 hours.

The system shall be fully user-programmable so that setpoints, time schedules and DDC control functions can be altered without specialist attendance.

A Web-based Ethernet data connection shall be provided for remote access as required.

The control system shall monitor the building services providing feedback of all plant performance for analysis.

The control system shall also monitor the energy metering (provided by others & interfaced with BEMS) usage of all MEPH equipment.

The Contractor shall carry out all necessary testing and commissioning of the BEMS/controls systems, in liaison with other contractors and the CA/Engineer.

A draft list of proposed values for all setpoints, high and low limits, alarms and control dead bands shall be prepared and issued by the Contractor before the commissioning of the system to the CA/Engineer for comment. The completed list shall be included as part of the system operation and maintenance manuals.

The completed system comprising building, plant, controls and BEMS shall be capable of being fine-tuned.

All Air Handling Units (AHU's), kitchen and smoke extract ventilation, Boilers, Condensers and Pumps etc. shall be commissioned as part of the control system.

Automatic controls installations shall be provided to control all items of Mechanical services plant and equipment, as identified within this specification and schedule and shall include:

* Installation of an Ethernet communications network between the Plantroom(s) MCCP's and BMES head-end PC.

* Supply of the latest graphics software package for remote access from IOS, Android and Windows-based devices complete with a five-year maintenance agreement.

* Supply and installation of graphics including dashboards for heating and ventilation systems etc.

* Load commissioning tests for all VSD pump circuits at 33%, 66% and 100% with separate witnessing by the CA

* User training at handover and a re-visit 1 month after PC plus 4 No. seasonal commissioning inspections (i.e. 1No. at Winter, spring, summer and autumn) during the 12month defects liability period).

Emergency Recovery Process

The Contractor shall ensure that the BEMS fully restores all control and monitoring functions following an emergency shutdown period.

Ensure that the start delay times can be adjusted according to the magnitude of the load.

Provide, as a minimum, password-protected operator access for the following levels.

* Level 1 - Ability to display all point data.

* Level 2 - Ability to display all point data and to initiate data logging functions.

* Level 3 - Ability to display all point data; to initiate data logging functions; and to change set points and time schedules.

* Level 4 - Ability to display all point data; to initiate data logging functions; to change set points and time schedules; and to change control strategies and schematic/graphics functions and password assignment.

Ensure that password-protected operator access is set up for both operator workstations and field controllers which have an operator interface.

Ensure that passwords permit at least 6 alpha/numeric characteristics. Ensure that the BMS software is protected from unauthorised entry.

Ensure that the BMS, and its operation performed under any maintenance contract, complies with BS ISO/IEC 27001 and BS ISO/IEC 17799 Code of practice for information security management.

System Software:

Ensure that the IT industry-standard operating systems are used.

Ensure that copies of all BEMS vendor-specific software are held by an independent third party and that this software can be released to the client.

Ensure that the ESCROW Agreement is completed and signed.

Ensure that licences to use software applications are owned by the Client. Use communications protocol

Provide application software written in accordance with BS 7649. Software.

Design for Commissionability:

Ensure that the BEMS specification details required for commissioning are made available to the BEMS commissioning engineer.

Ensure that all field controllers, sensors and controlled devices are easily accessible and can be removed for testing and future maintenance.

Liaise with the Contractor to ensure that air handling units are provided with appropriate access doors. Ensure that access is available to all control devices.

Ensure that the requirements of the following documents are met:

Ensure that sensors are installed correctly in order to give representative readings. Ensure that reference labels are attached to each control device.

Future System Expansion:

Ensure that the BEMS is capable of dealing with a future 20% increase in the number of points without compromising the system's functionality or speed of operation.

Design, Operation & Maintenance:

Ensure that a full O&M manual is prepared which reflects any system changes made during the installation and commissioning stages.

Ensure that adequate access to BEMS equipment and components is provided.

Ensure that all components and wiring are identified by a consistent numbering system.

System Support:

Ensure that a viable strategy is in place to fully support the BEMS for a minimum of 10 years from the date of practical completion.

System Maintenance:

Provide maintenance support for 2 years in accordance with BSRIA BG 4/03 - BMS Maintenance Guide.

Control Panels (MCC's):

The Controls Specialist shall purchase, assemble and wire up the equipment within the Control Panel as specified under each system description. In addition to the schedules of equipment specified under the individual systems, the Control Specialist shall provide all necessary relays, timers, contactors, fuses, interlocks and other items as required to perform the control functions as described elsewhere in this Specification.

All new Control Panels shall be provided within the main plant rooms to supply all mechanical services within the plant room areas. The panels must be constructed using materials and equipment that is readily available from several sources. Please adhere carefully and incorporate the following absolute minimum requirements:

BEMS outstations sized to provide all control and monitoring functions as described herein, with a minimum of 10% spare capacity for future expansion

Rotary Hand/Off/Auto 3 position switches for each motor, or drive, fed from the panel. These devices must be of a type that is readily available from the electrical wholesaler network in the UK. The use of non-standard H/O/A switches is not permitted.

- Duty Selector switch for each duty/standby set of drives
- Run/Trip/Fault Indication for each motor, or drive, fed from the panel (LED's).
- Panel Live Indication (LED).
- Control Circuit Live Indication (LED). " Door Interlocked Isolator.
- A network link to the Central system, to repeat all control signals, alarms etc. remotely and allow remote alteration of all time clocks, setpoints etc.
- Panel lamp test facility.
- The use of control panel Programmable logic Controllers (PLC's) is not permitted.

Energy Metering System:

The BEMS system shall be capable of automatically capturing, retrieving & storing energy metering data electronically. The metering system shall interface with the Trend BEMS and shall provide but not limited to the following facilities:

Data protection for tenant information

- To retain all memory during power failure
- To include Energy Use Analysis Software that enables the analysis of energy metering data and the key factors that influence energy use, and the production of reports on energy consumption.
- Facility to set out of range values for any of the above services and raise appropriate alarms
- Facility to raise formal bills for tenant use of gas, water & electricity
- Facility to transfer recorded data in other formats (i.e. excel)
- Facility to export information to remote users in a secure format
- Metering & recording of electricity consumption

- Metering & recording of water consumption
- Spare 20% capacity to allow for future connections

Alarm Panels:

Alarms shall be grouped by general location and type. A display page(s) shall be set up showing the condition of all critical alarms. Critical alarms and any other alarm specified shall automatically load the schematic or text page to ensure accurate identification of the event.

Where appropriate the two-stage schematics shall be used to ensure easy identification of the alarm event. Alarm information need also be grouped by workgroups, such that an alarm panel can be sent to the appropriate person/s should they be logged into the system at the time of the alarm occurring.

BMS Graphics:

The Controls Specialist shall install and commission the following IQvision graphics, as a minimum, for the Trend IQvision BEMS software package

The BEMS shall be configured and have the facility for graphic pages to be interrogated from a remote head end.

Dynamic colour graphics pages shall be provided as detailed but not limited to. Note that the format of graphics pages shall be agreed before commencing development.

Every item/point monitored by the BEMS shall appear on a graphic (i.e. there shall be no item monitored or controlled by the BEMS whose status cannot be assessed from the BEMS graphics pages).

For each new item/point, graphics shall display dynamically: "Status (on/off, duty/standby, run/fail etc).

* Alarm conditions; to be shown flashing "Set points

* Monitored condition/status/value

A facility shall be provided (operator selectable on/off, by alarm) such that in an alarm condition, the relevant graphic page shall automatically be brought up.

The operator shall be able to use the graphics icons to adjust set-points, alarm limits, time-schedules, manually over-ride plant on/off etc from within the graphics page.

The Contractor/BEMS Specialist shall nominate the proposed number of graphics pages for review during the tender.

Graphics shall typically be provided for the following items:

* Building Dashboard/overview site plan graphic with key information with links to each building or plantroom and floor etc.

* A graphic plan for each building or plantroom and include a summary of the systems status. The plan

buttons to the major plant systems and locations etc..

* One graphic for each building level showing the floor plan with single line ducting and pipework, variable air volume boxes, constant volume boxes, unit coolers, fans, DX units, and zones, temperature setpoints and actual valves, minimum maximum and actual airflows and heat on/off for each box etc.

* One graphic for each air handling unit ventilation system showing set point and actual temperatures, water flow and return temperatures, valve position, outside, supply and return air temperatures and enthalpies, supply and return air volume flow rates, damper positions, filter status. Motor speeds etc.

* One graphic for each Direct Expansion cooling system/fan coil unit and condenser unit showing set point and actual temperatures

* One graphic of each boiler showing percentage load, motor amps, all water flow and return temperatures, alarms. Water flow and return pressures, alarms, external air temperature etc.

* One or more graphics showing the status of the Gas Distribution system, metering and valve status etc.

* One or more graphics showing the status of ventilation systems i.e. toilets, kitchen, refuse, smoke extract systems etc. showing set point and actual temperatures, water flow and return temperatures, valve position, outside, supply and return air temperatures and enthalpies, supply and return air volume flow rates, damper positions, filter status. Motor speeds etc.

* One or more graphic showing status of all fans in fire mode.

* One or more graphics showing the status of Domestic water services i.e. potable water storage and booster system and hot water services. Graphic to include tank high and low level and temperature, booster system operational status

* One or more graphics showing the status of Sprinkler services i.e. sprinkler storage and booster system. Graphic to include tank high and low level and temperature, booster system operational status.

* One or more graphic showing the status of all energy metering i.e. utility, heat flow, gas, water & electrical providing but not limited to water flow metering and temperature details, Consumption data including Instantaneous reading (kW), Daily heating range (kWh) & Continually totalised range (kWh). "

One or more graphics showing the status of Generator set operational status.

* One or more graphics showing the status of Motorised Fire/smoke dampers, showing operational status and position etc.

* Provide controls for the instigation of system operations. " Provide separate graphics page for every item of plant.

Provide a software library of plant schematics and symbols, the format/contents of which should be confirmed with the specifier based upon samples.

* Provide a facility to allow the operator to modify and/or generate additional schematics and symbols. "

Ensure that the system can accommodate the addition of 20% extra graphics 'pages'.

* Ensure that the graphics can be displayed in a layered approach (building layout down to plant subsystems and components). A single page shall be provided for each item of mechanical plant,

switchboard, meter, etc.

* Ensure that the operator can modify the structure of the layered approach.

* Each graphic shall incorporate an 'About' button which will provide direct access to a text file that describes the plant, safety interlocks, normal and emergency operation, reset procedure, the outline of control strategy, plant data - capacity, manufacturers references, etc.

* Set-up logging of all monitored conditions.

* Graphic slides shall be in a two-dimensional, consistent structure format.

The Controls Specialist shall confirm the quantity of graphics proposed in the tender return

Training and Seasonal Commissioning

The Controls Specialist shall provide 3 days of Client training at project handover, together with an additional 1-day visit 1 month thereafter.

Within the 12 months defects liability period the Controls Specialist shall provide 4No.separate visits for system functionality checks and re-commissioning to cover winter, spring, summer and autumn seasons.

:

- **Execution:** 75-75-05/620 Installation of building monitoring and management systems.
- **System completion:** 75-75-05/810 Inspection and testing;
75-75-05/820 Commissioning;
and 75-75-05/830 Documentation.

Execution

75-75-05/620 Installation of building monitoring and management systems

- **General:** Install in accordance with BSRIAAG 9/2001.

System completion

75-75-05/810 Inspection and testing

- **Standard:** In accordance with BS 7671.
- **Notice before commencing tests (minimum):** 5 days
- **Certificates:**
 - **Submission:** Submit proposals.
 - **Number of copies:** Submit proposals.
- **Test equipment identity:** Record on test certificates.
- **Certificates of calibration:** Submit for each test instrument.
- **Control panel test certificates:**
 - **Submission:** Submit proposals.
 - **Number of copies:** Submit proposals.

75-75-05/820 Commissioning

- **General:** Commission in accordance with BSRIAAG 9/2001 and BCIA Start up and commissioning guide.

75-75-05/830 Documentation

- **Operation and maintenance instructions:**
 - **Scope:** Submit giving optimum settings for controls.
 - **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - **Format:** Paper copy.
 - **Number of copies:** Submit proposals.
- **Record drawings:**
 - **Content:** Location of control panels, equipment and repeater panels.
 - **Format:** A1 paper print.
 - **Number of copies:** Submit proposals.
- **Submittal date:** At handover.

Ω End of system

QODA Consulting

Oxfordshire

t: 01367 245960

London

t: 0207 394 2125

Birmingham

t: 0121 2278570

Bristol

t: 0117 450 9511

w: www.qodaconsulting.com

e: enquiries@qodaconsulting.com