

Queen, Street, Tottenham, N17 8HZ

Verity Trustees Ltd

BUILDING SERVICES SPECIFICATION
VOLUME C, PART 1
MECHANICAL AND PUBLIC HEALTH SERVICES
PERFORMANCE SPECIFICATION

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REV: T01 · DATE: 13-10-2025

DOC NO. 6753-CBC-SP-SP-M-000009



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B RECORD OF REVISIONS		
Date.	Revision.	Description of change.
13-10-2025	T01	Tender Issue

C PARTICULAR SPECIFICATION

C.1 INTRODUCTION

- C.1.1.1** This scheme is for the development of 3no. industrial units comprising of a range of vehicle parking types and landscaping. The site is located on Queen Street in Tottenham, N17 8HZ off the A10 / A406 North Circular Road. The contractor shall be responsible for the complete detailed design and build, including liaison with the statutory services.
- C.1.1.2** This Specification shall be read in conjunction with all other documentation produced by the Employer, Architect, Quantity Surveyor and Structural Engineer and the contract conditions.
- C.1.1.3** The Contractor shall be responsible for the disconnection of any redundant services and any necessary diversions on the site and the Contractor shall liaise directly with the statutory services for the disconnection and diversion or modification of any existing service.
- C.1.1.4** All aspects of the mechanical services systems supply, installation, setting to work and testing and commissioning shall also be read in conjunction with and comply fully with the following:
- *Cudd Bentley Consulting Standard Mechanical & Public Health Services Specification*
 - *Cudd Bentley Consulting Mechanical & Public Health Services Tender Documents*
 - *Mechanical & Public Health Services Drawings as indicated on the Cudd Bentley Drawing Issue Sheets*
 - *Cudd Bentley Consulting Electrical Services Drawings and Specifications*
 - *Employers Requirements*
- C.1.1.5** This Specification sets out the principal requirements of the installation but does not relieve the Contractor of his responsibilities for any part of the installation to achieve the necessary performance.
- C.1.1.6** The contractor shall be responsible for complying with the BREEAM and EPC requirements stated within the Mechanical BREEAM Specification and within the Mechanical Performance Specifications.
- C.1.1.7** The building will be certified BREEAM v6.1 Outstanding and shall achieve an EPC A+ Rating. Any works related to achieve such rating shall be completed accordingly.
- C.1.1.8** The drawings are indicative only and are provided as a concept design for full design development by the Mechanical Services Contractor.
- C.1.1.9** The installation shall be complete in every respect, including all ancillaries and works, whether specifically mentioned in this document or not, necessary for the systems to be tested, balanced, commissioned, and perform correctly as intended in the design intent. Where trade names are used, the intention is to indicate a standard. Equipment of equivalent manufacture and performance may be included, provided such equipment is submitted in accordance with the specified procedure.
- C.1.1.10** During the tender period, any anomalies or discrepancies shall be brought to the attention of the Project Manager, who shall direct the Contractor. The Contractor is deemed to have allowed within his price for all items to ensure that the installation is complete in every respect and in accordance with the design intent.

For clarity, the specification sections take precedent over the general specification sections.

C.2 EXISTING SITE & SERVICES

C.2.1 EXISTING SITE

C.2.1.1 The existing site is situated behind Bull Lane Playing Fields off Queen Street, Tottenham approximately 10 miles from central London.

C.2.2 SURVEY WORKS

C.2.2.1 The Contractor shall ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the works. The Contractor shall visit site and survey the premises. No claim arising due to want of knowledge in this respect shall be entertained.

C.2.2.2 During the Tender period the Contractor shall visit site to understand the extent, quality and nature of the existing/surrounding services that will affect the works and make appropriate allowances in his tender. Prior to commencement, the Mechanical Services Contractor shall examine all available drawings of the engineering services and report any discrepancies to the CA.

C.2.3 MODIFICATIONS TO EXISTING SERVICES

C.2.3.1 The contractor shall be responsible for reviewing the statutory services crossing the site entrances and be responsible for any necessary diversions or lowering of services required because of providing new connections to the proposed units or improvements to the site entrance.

C.2.4 REMOVAL OF EXISTING SERVICES

C.2.4.1 The contractor shall be responsible for reviewing the incoming statutory services on site and removing any redundant services that are no longer required for the project.

C.2.5 RISKS TO HEALTH AND SAFETY

C.2.5.1 The nature and condition of the existing services cannot be fully and certainly ascertained before opening.

C.2.5.2 The Employer or the CA do not guarantee the accuracy and sufficiency of this information.

C.2.5.3 The Contractor shall undertake responsibility to obtain any information required to ensure the safety of all persons and the Works.

C.2.5.4 The Contractor shall comply with the requirements of the CDM Regulations by:

- *Compiling risk assessments for the contract works.*
- *Providing information on the contract works which might affect the health or safety of any person.*
- *Providing appropriate input to the health and safety plan and file for the works*

C.3 SCOPE OF WORKS

C.3.1 GENERAL

C.3.1.1 This section outlines the extent of the works and provides a description in a brief manner of the scope of each of the building services installation.

C.3.2 SCOPE OF WORKS

C.3.2.1 The works by the Mechanical Services Contractor includes:

- *Design*
- *Specialist design*
- *Liaison with statutory services*
- *Working drawings*
- *Supply and delivery*
- *Installation*
- *Setting to work and testing and commissioning*
- *Operating and maintenance documentation including record drawings*
- *Final handover of the complete Installation*
- *Spares and tools.*
- *First year maintenance of the installed services installation.*

C.3.2.2 The whole of the work shall be carried out in accordance with this specification, design responsibility matrix and associated drawings and the Mechanical Services Contractor shall ensure the installation complies with the latest editions of all relevant statutory codes and regulations including those that may become current during the contract.

C.3.3 EXTENT OF THE WORKS

C.3.3.1 The extent of the works is as follows:

- *Provision of new gas supplies to each industrial unit, capped externally via an ECV within a floor mounted gas kiosk of GRP type, colour coded to match the building cladding*
- *Provision of new mains cold water supplies to each industrial unit, including new fire hydrants and wash outs*
- *Provision of any necessary diversions of services*
- *Provision of any lowering or modifications of services*
- *Fitout of the units as per the below:*
 - *Heating & Cooling In office areas by external heat pump units and internal fan coil units*
 - *Ancillary spaces heated by electric panel heaters (excluding warehouse)*
 - *Overdoor (Air Curtain) Heaters for the unit entrances*
 - *Domestic hot and cold water services by mains water with electric water heaters to all fittings*
 - *Electric shower units for all showers*

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- *Mechanical ventilation to the office via Mechanical Ventilation Heat Recovery (MVHR) units*
- *Mechanical Extract Ventilation to ancillary welfare facilities via extract fans*
- *Smoke-Fire Dampers as per Building Control's requirements*
- *Above ground drainage services and Fire Collars*
- *Compliance with all targeted BREEAM credits*

C.3.4 WORK BY STATUTORY AUTHORITIES/UNDERTAKERS

INCOMING MAINS WATER (Thames Water)

- C.3.4.1** The Contractor shall be responsible for any diversion works required to the existing mains water service.
- C.3.4.2** The contractor shall be responsible for the connection of the new water main coordinated with Thames Water. The contractor shall extend a new water main along the site road, with fire hydrants installed to meet the fire authority's stipulations and building regulations.
- C.3.4.3** Thames Water will provide water mains supplies extending off the water main, terminating in boundary meter boxes.
- C.3.4.4** The Contractor shall be responsible for the development of a scheme, extending from the mains water meter box to provide mains water to each industrial unit. The Contractor shall make allowance for 1no. supply in Protecta-Line barrier pipe to each industrial unit as indicated on the drawings. The water supply shall enter the building as indicated on the standard detail.
- C.3.4.5** The water supply to each unit shall extend in Protecta-Line barrier pipework, with meters installed on each unit as detailed on the drawings. All on-site pipework shall be in Protecta-Line barrier pipe.

INCOMING GAS SERVICE (Cadent Gas)

- C.3.4.6** The Contractor shall be responsible for any diversion works required to the existing gas service.
- C.3.4.7** The Contractor shall arrange for 1no. new gas supply for each proposed industrial unit. This shall be as indicated on the drawing and shall be by a mains extension of the existing mains to each unit. The gas supply shall enter the kiosks as detailed on the standard detail, with the kiosks located by the external wall of the building. The gas kiosk colour shall be specified to match the building cladding. RAL number as specified by the Architect.
- C.3.4.8** The Contractor will be responsible for the development of the gas installation and will be responsible for liaising with the statutory authorities to provide a new supply into the site.

C.4 DESCRIPTION OF THE WORKS

C.4.1 BREEAM

Refer to all BREEAM Specifications, including the BREEAM Mechanical Contractor Specification.

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C.4.2 GAS INSTALLATION

- C.4.2.1** The Contractor will be responsible for the provision of a low pressure gas installation which will supply each industrial unit. The supply will be designed to provide sufficient gas for heating the building.
- C.4.2.2** The Contractor shall design the gas main based on the heat losses from each unit, using the CIBSE design method for heat losses using U-values and infiltration rates obtained from the Building Regulations part L2A.
- C.4.2.3** The main gas infrastructure to the plots shall be provided by Cadent who own the network to the new development. The Contractor shall allow for liaising with Cadent to determine connection points and infrastructure sizes.
- C.4.2.4** The gas installation shall be coordinated with all incoming services and the Contractor shall ensure that the gas supply is installed in accordance with the Gas Regulations. Where services cross the yard, pipework shall be ducted within reinforced ductwork suitable for HGV traffic.
- C.4.2.5** The Contractor shall ensure that the gas supply is adequately vented, and the supply is installed and terminated and capped. The gas detail shall be as indicated in drawings.
- C.4.2.6** The Contractor shall also make the allowance for crossover and lowering of services to allow their proper installation as required.

C.4.3 MAINS WATER INSTALLATION & HYDRANT PROVISION

- C.4.3.1** The Contractor shall be responsible for the supply of incoming water services to each of the industrial units. The Contractor shall develop a scheme from the design drawings and performance specification and provide an installation which is coordinated with the new and surrounding infrastructure.
- C.4.3.2** The main water infrastructure to the units shall be provided by Thames Water who own the network to the new development. The contractor shall allow for liaising with Thames Water to determine connection points and infrastructure sizes.
- C.4.3.3** The design shall be in accordance with BS EN 806 and BS 8558 and shall be installed and tested in accordance with Thames Water and the Water Regulations guidelines.
- C.4.3.4** The mains services shall be sterilised in accordance with BS EN 806 and BS 8558 immediately prior to being put into service. The Contractor shall be responsible for carrying out this work and for making any temporary connections necessary.
- C.4.3.5** The Contractor shall also make the allowance for crossover and lowering of services to allow their proper installation, as required. Where services cross the yard, pipework shall be ducted within reinforced ductwork suitable for HGV traffic.
- C.4.3.6** The Contractor shall be responsible for the installation of new fire hydrants to serve the site. The position should allow the whole site to be served by the hydrants. The hydrants shall comply with BS750 and shall be identified by an indicator plate in accordance with BS3251. The site shall comply with Building Regulations Approved Document B.
- C.4.3.7** The contractor shall comply with guidance in the document "National Guidance Document on the Provision of Water for Fire Fighting". And undertake all liaison with the local fire authority and water authority on the design flow rate for each hydrant on site and the provision for the site. However, the contractor shall assume that the supply available on site is the maximum that can be obtained and shall work to negotiate with the fire authority to get a working resolution to fight fires. This may include the provision of water storage, additional hydrants and increased pipe sizes. This shall be presented as a provisional sum to the client at tender stage.

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C.4.3.8 The contractor shall allow to pressure test the water main and provide hydrant flow test to be incorporated into the O and M manuals.

C.4.4 ABOVE GROUND FOUL DRAINAGE SERVICES

C.4.4.1 The Contractor shall be responsible for the design, supply, testing and commissioning of an above ground foul drainage system. The system shall connect to all water fittings, water heaters and AC condensate systems. Indicative layouts have been provided on the drawings. The Contractor shall consult with the structural engineering drawing for the exact position of the below ground drainage.

C.4.4.2 The Contractor shall design the above ground drainage system in accordance with the Institute of Plumbing Guide and CIBSE Guide G.

C.4.4.3 The Contractor shall install above ground drainage to all fittings as detailed in this specification and drawings. The above ground drainage shall be installed in accordance with BS 4514.

C.4.4.4 The pipework shall be UPVC and all connections shall be solvent welded. The drainage shall be installed in accordance with BS EN 12056.

C.4.4.5 The installation shall be quick, quiet and completely self-cleansing in normal use. The system shall be free from blockage, crossflow, back fall leakage, odours, noise and nuisance.

C.4.4.6 The drainage pipework should be installed with as few bends as possible and with sufficient access to provide cleaning. The drainage pipework shall be securely fixed and have all necessary expansion joints.

C.4.4.7 The Contractor shall allow for all traps and for making final connections to all fittings. All exposed pipework within the WC's shall be boxed in within decorative panelling or shall be chromium plated.

C.4.4.8 Fan coil units within the office space shall connect to a common condensate pipe which shall fall to drain with a minimum fall of 1:80. Rodding eyes shall be provided at all changes of direction. The discharge pipes shall discharge to drain where it shall be connected to a 'Hepworth' dry trap which shall connect into the above ground drainage. Each water heater shall have its discharge taken to drain via a Hepworth dry trap.

C.4.4.9 External condensers shall have their discharge directed to a drain located beneath the unit which is taken directly to the below ground drainage.

C.4.4.10 The operation and discharge of any appliance shall not cause self or induced siphonage of any water seal within appliance traps and shall be free of "gurgling". Any query concerning the requirements of any regulations governing the installation of the works shall be made known and clarified prior to the commencement of the actual installation.

C.4.4.11 Ends of each waste or soil pipe shall be provided with a rodding eye. All access points are to be closely co-ordinated with the architect's layouts and shall be extended or raised to provide free, easy and unobstructed access.

C.4.4.12 The general philosophy of access provision is as follows:

- *At all changes of direction*
- *At the end of horizontal waste or soil pipes*
- *Within the vertical soil and waste pipes at each floor level*
- *A large square access door at the base of each stack*

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- C.4.4.13** All pipework shall be tested as the works progress with all tests following British Standards and local authority requirements and all witness testing being recorded and signed on certificates prepared by the Contractor. An air test shall be applied to all sanitary plumbing and shall be carried out in strict accordance with BS EN 12056: Part 5. As a minimum the sanitary plumbing system will maintain a pressure of 40mm water gauge for a period of not less than 5 minutes.
- C.4.4.14** Prior to practical completion, a separate witnessed test of the systems shall be undertaken and accepted by the local authority.
- C.4.4.15** The water regulations allow for the overflow of WC cisterns into the bowl and the contractor shall liaise with the architect and client to ensure piped overflows are not required.
- C.4.4.16** The Contractor shall ensure that all sanitary and waste pipework is plugged and sealed as it is installed to prevent the ingress of materials which may cause future blockages.
- C.4.4.17** Fire sleeves / collars shall be installed at each floor level and were passing horizontally through any fire compartment to maintain the fire rated integrity of the floor and compartment.
- C.4.4.18** For the purposes of tendering the Contractor shall assume that fire sleeves are required wherever the pipework passes between floors and wherever it passes out of the toilet areas horizontally to adjacent areas.
- C.4.4.19** The above ground drainage system shall include the venting of stacks. Vent pipes shall discharge externally via weatherproof louvres on the façade (louvre details and position to be agreed with the Architect). Vent discharge points shall be in accordance with Building Regulations. AAV's to vent stacks shall be avoided and only installed once agreed with the Client.
- C.4.4.20** Upon completion of the works, the entire above and below ground drainage systems shall be subject to a CCTV survey to verify its condition. Any defects found shall be rectified and a follow-up CCTV survey conducted to confirm the system is in full working order. Any defects or remedial works shall be rectified by the Contractor.

C.4.5 AIR SOURCE HEAT PUMP HEATING & COOLING AND GENERAL HEATING

- C.4.5.1** The Contractor shall design, supply, test and commission air source heat pump systems as detailed on the drawings. The design shall follow the British Council for Offices Guide. The Mechanical Contractor shall be responsible for the design and shall expand on the design concept shown on the drawings and provide drawings for each unit.
- C.4.5.2** The heat pump system manufacturers shall be either Mitsubishi-Electric or Daikin and shall be designed, installed, commissioned and tested by a manufacturer approved installer. System design shall be based on low GWP, high efficient system using R32 refrigerant charge. The equipment shall be supplied with an extended 7-year warranty. The installing contractor shall pass on the manufacturer warranty to an approved service and maintenance contractor when requested to do so.
- C.4.5.3** The office areas in each unit shall be provided with heating and cooling via independent multi-split and VRF heat pumps. The outdoor air cooled condenser units shall be mounted externally on adjacent to the unit on anti-vibration mounts/feet. The external unit condensate drainage shall discharge into the gravel margin adjacent to the unit. The indoor units shall be cassette type fan coil units with individual wall mounted controllers.
- C.4.5.4** The selected refrigerant used in the heat pump system shall be R32 and A2L refrigerant. The contractor shall ensure that all F-Gas Legislation is met throughout the design and application. The contractor shall consider the toxicity and flammability of the refrigerant. The contractor shall obtain a design quotation from Mitsubishi-Electric for a heat pump system which meets the requirements of the brief and then assess if any additional allowances that may be required based on the refrigeration charge and room volumes. If all the refrigerant in a VRF was to leak into a room the concentration of refrigerant cannot go above set limits in the room.
- C.4.5.5** The contractor shall assess:
- *If the concentration is below 0.061 kg/m³ then no measures are needed;*
 - *between 0.15 – 0.061kg/m³ then one additional measure (leak detection);*
 - *above 0.15kg/m³ two additional measures (leak detection along with additional ventilation or pump down).*

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- C.4.5.6** 1no. local wall mounted controller shall be provided per fan coil unit.
- C.4.5.7** The room temperature shall be measured by the temperature sensor with the controller associated with that fan coil unit.
- C.4.5.8** Where areas do not have the provision of heat pump indoor fan coil units, the Contractor shall allow for electric panel heaters as indicated on the drawings. Low Surface Temperature type panel heaters shall be provided in accessible WCs. The panel heaters shall be complete with their own on-board controller providing time clock, weekly schedule and temperature control.
- C.4.5.9** The contractor shall allow for ceiling mounted panel heaters of sufficient size to heat the shower spaces. The heaters shall be selected to fit within a grid ceiling or fitted to a plasterboard ceiling by a purpose made manufactures bracket with the appropriate fixings to safely secure the heater in place. Where there is insufficient space on the ceiling, wall-mounted low surface temperature panel heaters shall be provided, given the power supply is external to the room. All heaters shall be provided with their own integral controller comprising a wall mounted temperature sensor providing temperature and time clock control.
- C.4.5.10** The entrance / reception area shall be provided with an electric overdoor heater / air curtain. This system shall be temperature controlled and time switch controlled with manual on/off facilities as well.
- C.4.5.11** The heat pump systems shall be installed in accordance with British Standard BSEN378, the BESA RAC 80 and the manufacturer's recommendations. The system shall be installed in accordance with the F gas regulations.
- C.4.5.12** The network of refrigeration quality soft copper pipework shall be to BS 1057 between the outdoor unit and indoor units. The pipework shall be fully annealed degreased and cleaned. All joints and interconnections shall be supplied by the manufacturer. The pipework joints shall be brazed using dry nitrogen in accordance with the BESA RAC80 and manufacturers stipulations.
- C.4.5.13** The refrigeration pipework shall be cleaned, dried, purged and pressure tested in accordance with BSEN 378 and the manufacturer's recommendations prior to being charged with refrigerant. The system shall be charged by a registered manufacturer's trained installer in accordance with the manufacturer's specification.
- C.4.5.14** The refrigeration pipework shall be insulated after it has been inspected and pressure tested. The Contractor shall install close cell elastomeric insulation. This insulation shall be vapour sealed and glued at all butt and longitudinal seam joints at all joints. Where refrigeration pipework is routed externally the insulation shall be protected with ultraviolet resistant paint. All external pipework shall run in a suitably sized tray with lid or below ground and be frost protected.
- C.4.5.15** The design basis manufacturer is Mitsubishi Electric. The air source heat pump systems shall be designed, installed, commissioned and tested by a manufacturer approved installer.
- C.4.5.16** All air source heat pump systems shall utilise R32 refrigerant.
- C.4.5.17** The external condensers shall be installed on a suitable base and bearers with discharge directed beneath the units to discharge directly into the below ground drainage or into the gravel strip adjacent to the building. The base shall prevent any noise or vibration transmission into the structure. The final location of the condensers shall be agreed with the architect before the equipment is ordered as the site is subject to tight planning constraints.
- C.4.5.18** The external condensers shall be installed within an enclosure that does not restrict the unit's airflow. The enclosure type is to be confirmed by the Architect, and shall be installed as per the condenser manufacturer's requirements.

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- C.4.5.19** Where condensers mounted in areas without sufficient drainage the contractor shall make allowance for the installation of a manufacturers standard drain pan and install the condensate to drain in a manner which will not cause potential trip/slip hazards with pipework and condensate.
- C.4.5.20** Contractor to consider pipework lengths when selecting the heat pump systems, where refrigeration pipework is run across the warehouse it shall be close to soffit so as not to impinge on the warehouse height and shall drop internally to serve the external condensers, all refrigeration pipework shall be run on cable tray.
- C.4.5.21** External insulation shall be weather protected with Inaba trunking colour matched to the building cladding.
- C.4.5.22** All plant designed, selected, installed and commissioned shall be in accordance with Part L of the Building Regulations.
- C.4.5.23** Leak detection sensors will be allowed for within the office spaces and provided by either one per heat pump system or one per area served by the heat pump. The final install shall also be as per the manufacturers specification.
- C.4.5.24** The building units have been designed based on the following systems:
- **Unit 1** – VRF Heat Recovery
 - **Unit 2** – VRF Heat Recovery
 - **Unit 3** – VRF Heat Recovery

C.4.6 MECHANICAL VENTILATION

- C.4.6.1** The Contractor shall design, supply, install, test and commission ventilation systems in accordance with the Building Regulations Part F, DW144 & DW143. The Contractor shall view the ventilation systems on the drawings and develop the designs.
- C.4.6.2** Mechanical fresh air supply and extract ventilation to the office areas shall be provided by mechanical heat recovery ventilation units (MVHRs) as indicated on the drawings. Each MVHR shall be internally mounted within the ceiling void. The heat recovery units shall be complete with heat exchanger sections of a minimum efficiency of 73%. 1no. local wall mounted controller shall be provided per ventilation unit.
- C.4.6.3** The Contractor shall allow for the inclusion of system and atmosphere side attenuators on all mechanical ventilation systems to satisfy the design noise criteria. All system side and supply air ductwork shall be insulated in accordance with DW144 & BS 5422:2023.
- C.4.6.4** The on floor fresh air distribution ductwork shall route at high level within the ceiling void. Fresh air shall discharge to the office space via ceiling mounted swirl type supply air diffusers. Return air shall be taken from the space via open ended bell mouths within the ceiling void and exhaust to atmosphere. The extraction rate from each area shall not exceed the supply rate. Return air grilles shall be provided to match the supply air diffuser type.
- C.4.6.5** Wall mounted CO₂ sensors shall be provided in rooms served by an MVHR. The wall mounted CO₂ sensor shall be located adjacent to the MVHR wall mounted controller. 1no. CO₂ sensor shall be provided per MVHR. If the upper CO₂ limit is exceeded, the fan output shall be increased until the lower limit is reached at which point the fan speed will return to the commissioned setting/fan speed.
- C.4.6.6** All smoke fire dampers shall *be installed as per the manufacturers tested and approved installation methods* provided with independent supports. This is to ensure that the smoke fire damper remains in place regardless of whether one or both sides of connecting ductwork have been distorted or removed because of prevailing fire conditions. Smoke fire dampers shall be provided at each penetration of a fire compartment wall or floor (with suitable access). The smoke fire dampers shall be rated to the equivalent fire rating of the fire compartment wall or floor penetrated.
- C.4.6.7** The MVHRs shall exhaust and intake to and from atmosphere via weatherproof louvres, complete with an insect mesh, mounted on the façade. Intake and exhaust positions shall be separated as far as possible to avoid recirculation. Ductwork connections to the rear of each louver shall be via a plenum connection.
- C.4.6.8** The toilet and shower areas shall be provided with mechanical extract ventilation via a twin fan (duty/standby) extract unit as indicated on the drawings.
- C.4.6.9** The make-up air to the toilet areas shall be derived from the adjacent area via undercut doors in addition to a passive duct from the office area complete with an open bell mouth located in the office ceiling void to a passive grille in the core area. Smoke fire dampers shall be provided to suit the fire compartmentation.
- C.4.6.10** Extract air shall be taken from each individual WC cubicle and shower via ceiling mounted circular disc valve type extract grilles. Where individual full height cubicle doors are installed, the doors shall be undercut to permit a return air path. The extract systems shall incorporate a duty and standby twin extract fan unit located internally in the ceiling void of the floor served. The units shall be provided with automatic changeover based upon a differential pressure switch. Extract air shall discharge to atmosphere via wall mounted weatherproof louvres (with plenum connection) complete with insect mesh. .

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- C.4.6.11** All extract fans shall be PIR operated by means of a sensor which will be mounted in a position to be agreed on site and shall be set with a run-on timer set to run on for 15 minutes. The fans will have sufficient duty to comply with Part F of the Building regulations. The systems will comprise extract grilles, ductwork and attenuators where necessary. Contractor shall allow for co-ordinating the ventilation design with all services within the ceiling void and the constraints of the structure.
- C.4.6.12** The contractor shall interlock the mechanical ventilation and heat pumps to the fire alarm. The link shall be hard wired and isolate the system when the fire alarm is activated. The system shall automatically be reset and be programmed to operate in fire alarm tests.
- C.4.6.13** The Contractor shall include for all necessary balancing volume control dampers on branches and in line from any ventilation grille or valve. The ventilation grille dampers shall only be used for final air supply adjustment and not as a means of balancing the whole system.
- C.4.6.14** The Contractor shall include for access panels to all volume control dampers, fire dampers and for cleaning and inspection of the ductwork in accordance with BESA TR19.
- C.4.6.15** The contractor shall be responsible for the installation of ventilation ductwork in accordance with BS 5588 Part 9 1989, the allowance shall include the fitment of fire dampers and smoke fire dampers to prevent the spread of flame and smoke. Where the risk of cold smoke exists, the contractor shall allow for smoke/fire dampers across escapes and in accordance with Building control and the fire engineers report. The installation and fixing of the smoke and fire dampers shall be in accordance with the manufacturers standard details and approved by Building Control.
- C.4.6.16** The HRU manufacturer shall match the air source heat pump manufacturer. The toilet, shower, cleaner's cupboard and tea point extract ventilation manufacturers shall be either VES, Vent Axia or Elta. Louvre and grille colours to be confirmed by the architect prior to ordering.

C.4.7 DOMESTIC COLD WATER SERVICES

- C.4.7.1** The Contractor shall design, install, test and commission a mains water system in accordance with BS EN 806 and BS 8558. The system will be installed in accordance with the HSE ACOPs for water services.
- C.4.7.2** The Contractor shall make an allowance for the connection from the new incoming water supplies and extending new copper mains as indicated within the drawings. The new incoming water supplies enter each unit within the warehouse space.
- C.4.7.3** The Contractor shall make an allowance for the installation of a mains water supply network which will connect to all fittings. The domestic water outlets shall be fitted with water flow regulation cartridges to restrict water flows from appliances to the approved water flow rates as stipulated in BS EN 806 and BS 8558. The Contractor shall ensure that the water flow rates at the outlets meet the BREEAM requirements.
- C.4.7.4** The contractor shall allow for Pulsed Water Meters to comply with BREEAM Wat02. The system shall comprise an External Pulse Meter and an Internal Pulse Meter. Leak detection shall be allowed for on the incoming mains supply in accordance with BREEAM Wat03.
- C.4.7.5** Flow control devices shall be allowed for on each branch to fittings within the WCs and welfare facilities in the form of solenoid valves and PIRs.
- C.4.7.6** The domestic water fittings shall be WAT 01 compliant the contractor shall refer to the BREEAM documents for the level.
- C.4.7.7** The Contractor shall ensure that all water fittings have the correct level of backflow prevention in accordance with the relevant fluid category associated with that fitting in the WRAS Water Regulations.

C.4.7.8 The Contractor should include for extending the domestic water services to each electric hot water heater. Domestic water services pipework shall be pressure tested to 1.5x the maximum working pressure for a period of 1 hour. All pipework shall be flushed through and chemically sterilized prior to practical completion handover and left in a sound condition.

C.4.7.9 Packaged Cat 5 Booster and Break tanks shall be allowed for all units, complete with temporary external bib taps for landscaping purposes.

INSULATION

C.4.7.10 Water services pipework in the following areas shall be thermally insulated in accordance with the standard specification BS 5422:2023:

- *Ceiling voids*
- *Warehouse*
- *Roof spaces*
- *Risers*
- *Boxing's*

CHLORINATION

C.4.7.11 On completion of the works the pipework shall be cleaned, flushed and chlorinated by a specialist contractor. The pipework shall be tested, and a certificate issued. These works shall be in accordance with BSRIA BG 29. The Contractor shall note that chlorination as such could detrimentally affect the copper and shall seek guidance from sentinel for use of non-deteriorating sterilising additive.

C.4.7.12 The domestic cold-water system shall comprise:

- *A suitably sized network of copper pipework to BS EN 1057 / Table X insulated and vapor sealed along its entire length.*
- *Each branch from the distribution shall be provided with a branch stop valve, at the point of the branch connection to facilitate future isolation of the branch. The stop valves shall be easily accessible.*
- *All fittings shall be provided with local, point of use servicing valves complete with flow regulator cartridges.*
- *Drain cocks at low points.*

C.4.8 DOMESTIC HOT WATER SERVICES

- C.4.8.1** The Contractor shall supply, install, test and commission a domestic hot water system as detailed in this specification and drawings and in compliance with the Water Regulations and BS EN 806 and BS 8558.
- C.4.8.2** The provision of hot water shall be by mains fed unvented electric water heaters in the locations detailed on the drawings, instantaneous water heaters shall be installed to serve the WC's and Tea Points. The Contractor shall install all the water heaters in accordance with the manufacturer's recommendations by a competent installer in compliance with part G of the Building Regulations.
- C.4.8.3** The unvented water heaters shall be installed with pressure relief valve, expansion vessel, double check valve, isolation valve and shall be commissioned in accordance with the manufacturer's instructions. The water heaters shall be installed either within the ceiling void or IPS void in a position agreed on site with the architect. The water heaters and ancillaries shall always remain easily accessible.
- C.4.8.4** The water heaters temperature/pressure overflows shall discharge to a tundish to a dry trap to the local above ground drainage.
- C.4.8.5** The Contractor will supply and install a thermostatic mixing valve (TMV) to all wash hand basins. This valve shall be a TMV3 type with integral check valve strainer and means of isolation. All surface mounted pipework shall be insulated and boxed in with a decorative profile.
- C.4.8.6** The TMV3 valves shall be commissioned to provide hot water at temperatures to prevent scalding this shall be 41 degrees Celsius. The Contractor shall not rely on factory settings and shall test each valve.
- C.4.8.7** Showers are to be provided with electric shower units (ESUs).
- C.4.8.8** Where installed in vertical banks, with hot water pipework, the cold-water pipework shall be installed below the hot pipework, to prevent warming of the cold service.

INSULATION

- C.4.8.9** Water services pipework in the following areas shall be thermally insulated in accordance with the standard specification BS 5422:2023:
- *Ceiling voids*
 - *Warehouse*
 - *Roof spaces*
 - *Risers*
 - *Boxing's*

CHLORINATION

- C.4.8.10** On completion of the works the pipework shall be cleaned, flushed and chlorinated by a specialist contractor. The pipework shall be tested, and a certificate issued. These works shall be in accordance with BSRIA BG 29. The Contractor shall note that chlorination as such could detrimentally affect the copper and shall seek guidance from sentinel for use of non-deteriorating sterilising additive.
- C.4.8.11** The domestic hot water system will comprise:
- *A network of supply pipework copper to BS EN 1057 / Table X insulated and vapor sealed along its entire length.*

- *Local point of use electric water heaters and electric shower units.*
- *Each branch from the distribution shall be provided with a branch stop valve, at the point of the branch connection to facilitate future isolation of the branch.*
- *All fittings shall be provided with local, point of use servicing valves complete with flow regulator cartridges.*
- *Drain cocks at low points.*

C.4.9 SANITARYWARE

- C.4.9.1** The Contractor shall supply and install sanitaryware as shown on the drawings. The sanitaryware shall be in white vitreous china. All taps and handles shall be chromium plated. The Contractor shall provide all necessary cisterns, valves, clips and bracketry and install the fittings in accordance with the manufacturer's stipulations.
- C.4.9.2** The Contractor shall provide closed coupled type WC's, vanity units within WC's, wall mounted basins within disabled WC's, wall mounted mirrors. Exposed pipework shall be avoided, and any exposed pipework shall be chrome plated. Where possible all exposed pipework shall be concealed within decorative panelling.
- C.4.9.3** The Contractor shall install fittings and handrails to the disabled toilet in accordance with the building.
- C.4.9.4** Regulations Part M 'Doc M Pack'. A local alarm system with brushed stainless-steel finish will be fitted.
- C.4.9.5** The Contractor shall include for first and second fixing of the fittings and final connection of all domestic hot, cold and above ground drainage. The Contractor shall allow for masticking all fittings in situ.
- C.4.9.6** All fittings shall be fully WRAS approved and agreed with the Architect.

C.4.10 ACOUSTIC REQUIREMENTS

- C.4.10.1** The design noise criteria are set out in the design criteria section of this specification.
- C.4.10.2** The external areas shall be in accordance with the Acoustic Consultant's requirements.
- C.4.10.3** Attenuators, anti-vibration mounts and flexible couplings shall be installed to ensure that noise levels in the building meet the specified levels and prevent vibration being transmitted to the structure.
- C.4.10.4** To ensure the specified levels are achieved, the Contractor shall employ an acoustic consultant to give advice on mechanical equipment, building structure and fabric such that the specified criteria are achieved. The acoustic consultant shall be retained to advise the Contractor throughout the entire period of the contract works to ensure the following criteria are achieved:
- *The specified MEPH services acoustic design criteria are achieved.*
 - *To ensure the specified levels are achieved and the relevant BREEAM credit POL 05 is achieved.*
- C.4.10.5** Prior to practical completion, the Contractor shall produce a report with test results to prove the installation satisfies the internal and external noise criteria.

C.4.11 TESTING & COMMISSIONING

- C.4.11.1** The Contractor shall test and commission all mechanical and public health services in accordance with the CIBSE commissioning codes. The Contractor will provide a fully operational system which will be demonstrated to the Contract Administrator for approval. The system will not be approved until a set of commissioning figures is provided which can be fully validated.
- C.4.11.2** Great importance will be placed on the need for the Contractor to demonstrate that the systems have been set up correctly and that all control routines are working fully in accordance with the Engineer's requirements and Contractor's proposals.
- C.4.11.3** Building Regulation requirements about commissioning necessitate the Contractor's liaison with the company he proposes to commission and certify the works.
- C.4.11.4** It is recommended that such close liaison be extended to include the Engineer and shall be at the commencement of the project such that all parties are aware of requirements for commissioning and valves as specified are installed in accessible locations and in accordance with manufacturer's and the commissioning specialist's requirements.
- C.4.11.5** The Contractor shall note the requirement to comply with the Commissioning Requirements of Building Regulations including provision of a Report a Commissioning Plan and tabulated results. The Contractor shall refer regarding qualifications.
- C.4.11.6** The Contractor shall note the safety requirements for certification of both the soundness of the gas supply and the quality of the water, the latter requiring sampling as detailed under Sterilisation of Water Services.

C.4.12 ELECTRICAL WIRING

- C.4.12.1** The Contractor shall make the allowance for all final wiring of plant from local switch spurs. The wiring of all plant shall be in accordance with the 17th Edition of the IEE Wiring regulations.

C.5 DESIGN, DESIGN CRITERIA & STANDARDS

C.5.1 GENERAL

C.5.1.1 This section outlines the level of the design works required, the design criteria and definitions applicable to the engineering services forming the contract Works.

C.5.2 DESIGN REQUIREMENTS

CONTRACTOR DESIGN PROJECTS

- C.5.2.1** Where the Contractor is required to undertake the design based on the performance standards contained in this document and associated drawings, the Contractor shall employ suitably qualified design engineers to carry out the design works either directly or as a subcontract. It should be noted that the Contractor shall retain full responsibility for the design regardless as to who undertakes the design work. CVs of proposed designers shall form part of the Contractors tender submission.
- C.5.2.2** During the Tender period the Contractor shall review the information provided and any design issues or disagreements with the design intent shall be highlighted as part of the tender.
- C.5.2.3** Design principles shall be adhered to unless a reasoned argument is made and accepted by the CA, and any appropriate adjustment in the contract sum is accepted.
- C.5.2.4** The Contractor shall produce design drawings and schematics for submission to the CA for Comment prior to undertaking working drawings.
- C.5.2.5** The Contractor shall also undertake and show evidence to the CA that all calculations have been undertaken utilising industry recognised methods and software.
- C.5.2.6** A report shall be produced and issued to the CA, along with the design drawings which provides the following information:
- *Design Criteria used.*
 - *Input data for all software calculations.*
 - *Software calculations results*
 - *Heat loss, Heat gain calculations.*
 - *Thermal Model to comply with CIBSE AM11 Requirements*
 - *SAP and or SBEM Calculations indicate a pass result.*
 - *Plant and equipment load calculations.*
 - *Fan pressure calculations.*
 - *System Expansion and Vessel sizing*
 - *Plant and equipment selection schedules, based on the Design Criteria and Selection Criteria indicated within this document and associated specifications, drawings and schedules.*
 - *Flow rates for all system discharges, including surface water, and foul drainage.*
 - *Electrical Loads for all plant equipment and panels. Fuse, breaker and discrimination calculations.*

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C.5.2.7 The Contractor shall prepare all calculations required to obtain Building Regulations approval and for submission to obtain accreditation for requirements such as BREEAM and Code for Sustainable Homes. The Contractor shall produce SAP and SBEM calculations based on the final developed architectural layouts with the finally selected materials and building systems.

C.5.2.8 The Contractor shall ensure that all Planning and related documents relevant to servicing the building are fully understood and that the requirements are fully integrated into the design. Elements that should be noted include the following:

- *Energy and Sustainability reports and requirements.*
- *Emissions reports and requirements.*
- *Foul, waste and surface water discharge reports and requirements.*
- *Noise reports and requirements.*

C.5.2.9 Any services information required to discharge planning conditions shall be produced by the services Contractor.

C.5.3 MECHANICAL SERVICES DESIGN CRITERIA

C.5.3.1 The following specific design criteria shall be used for the design of the mechanical services. However further reference must be made to the sections for individual parts of the works detailed later in this document for other design criteria to be used.

C.5.3.2 The design criteria (based on original Engineering specification of 2009) applied to this project is scheduled below:

EXTERNAL

Humidity Control	None
Summer Ambient:	30°C WB 20°C DB
Winter Ambient:	-4°C 100% SAT
<i>Infiltration</i>	
Warehouse:	0.5 air changes per hour
Core area:	0.5 air changes per hour
Toilets/Shower:	0.5 air changes per hour
Entrance:	1.0 air changes per hour

INTERNAL

Office (Summer):	24°C +/- 2°C
Office (Winter):	20°C +/- 2°C
Toilets & Showers:	18°C minimum
Tea Points:	As per office area
Reception/Circulation Areas:	18°C minimum
Warehouse:	16°C (for gas sizing)
Small power heat gains	23W/m ²
Lighting	6W/m ²

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VENTILATION

Office:	14 l/s/person
Reception/Entrance:	N/A
Toilets & Showers:	10 air changes per hour extract
Tea Points:	15 l/s extract
Circulation Areas:	N/A
Warehouse:	N/A
Office indoor air quality:	CO ₂ <800 ppmv

OCCUPANCY

Office areas:	1 person per 10m ²
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INTERNAL NOISE DESIGN CRITERIA

Office:	NR 38
Reception/Entrance:	NR 40
Toilets & Showers:	NR 45
Tea Points:	As per office area
Circulation Areas:	NR 45
Warehouse:	N/A

C.5.3.3 External Plant – 10dBA below existing ambient noise levels, day and nighttime in accordance with a specialist acoustic report/advice.

C.5.3.4 Gas – 80 W/m² (+10% future tenant allowance) against the buildings net GEA to accommodate any tenant future gas requirements. This allowance is subject to review from the contractor to ensure that the provisional gas quote meets the ER stipulations for heating the warehouse space.

PUBLIC HEALTH

- *Hot water outlet temperature:* 41°C maximum (TMV3 controlled)
- *Incoming mains cold water service:* Sized as per BS EN 806 and BS 8558

C.5.4 MECHANICAL SERVICES PLANT AND EQUIPMENT SELECTION CRITERIA

- C.5.4.1 Where the Contractor is responsible for system design or sizing or for the selection of Plant and Equipment based on either schedule of plant and equipment or calculations provided by the designers or from calculations undertaken by themselves the following selection requirements shall be adhered to;

PIPEWORK SYSTEMS

Maximum pipework velocity inside buildings:	2 m/s
Maximum pipework velocity:	4 m/s
Maximum pressure drops for closed loop systems:	250 pa/m

DUCTWORK SYSTEMS

Branch ductwork velocity:	4 m/s
Discharge ductwork velocity:	2.5m/s
Ductwork pressure loss:	1 pascal/m

MOTOR SELECTION

Fan coil unit Motor efficiency:	90%
Pump and fan Motor efficiency:	95%

- C.5.4.2 The Contractor shall submit to the CA, Technical Submissions which shall include selection tables and graphs indicating that the above selection criteria had been adhered to.

C.5.5 STANDARDS AND REGULATIONS

- C.5.5.1 Unless stated otherwise the Works shall comply with the appropriate British Standard (BS) or Code of Practice (CP) and where no BS or CP is applicable comply with the Agreement Certificate for the item.
- C.5.5.2 Design and Installation works shall also comply with CIBSE, BSRIA, IOP and BESA recommendations and guides to current practice. Any other specialist installations shall also follow the appropriate industry guidance.
- C.5.5.3 Where the building is being designed to accommodate a specific occupier, any appropriate design guide or requirements document shall be followed as a priority, unless it conflicts with any other statutory standards. Any such conflict shall be brought to the attention of the CA.
- C.5.5.4 All product and materials shall have product conformity certification (e.g., BSI Kitemark, BSI Safety Mark or CARES scheme) or product approval (e.g., British Board Agreement Certificate).
- C.5.5.5 All products must have the recognised 'CE' mark attached.

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- C.5.5.6** The Contractor shall provide certificates of compliance with British Standards, BSI Certification Schemes, and/or other Quality Assurance Schemes within the O&M manual or when requested by the CA.
- C.5.5.7** In the absence of specific design, performance or installation standards being stated seek the instructions of the CA prior to commencement of the works and with adequate time so as not to cause delay.
- C.5.5.8** When new editions, versions and amendments are published during the construction, seek the instructions of the CA with respect to any modifications or changes necessary.
- C.5.5.9** References to BSI documents shall be to the versions and amendments listed in the British Standards Catalogue and in subsequent issues of BSI Update Standards up to one month prior to the tender issue date.
- C.5.5.10** The tender shall be based on the standards and regulations current one month prior to the issue date of the tender.
- C.5.5.11** As requested by the CA keep copies on site, readily accessible for reference by all supervisory personnel relevant BS Codes of Practice.

C.5.6 METRIC AND IMPERIAL CONVERSIONS

- C.5.6.1** Some dimensions and units in metric have been converted from imperial units and approximated to the nearest practical dimension, i.e. 12" has been converted to 300 mm.
- C.5.6.2** Metric sizes have been used for both metric and imperial components.
- C.5.6.3** Where only imperial components are available the imperial size has been converted to the metric equivalent size.
- C.5.6.4** Due allowance shall be made for metric and imperial conversions.

C.5.7 ELECTRICAL WIRING

- C.5.7.1** Where systems are specified as being maintained under fire conditions ensure wiring selected is suitable for the temperatures to be encountered.
- C.5.7.2** All cabling shall be LSF unless agreed otherwise.
- C.5.7.3** All electrical design & installation works shall be undertaken to comply with BS 7671:2008.
- C.5.7.4** Cable containment systems shall be medium duty, galvanised steel and supported at centres not less than the manufacturers' recommended spacing's. Support bracket shall be fabricated from uni-strut and suspended from the structural slab using 8mm threaded rod. Cable containment shall be sized for 25% spare capacity.
- C.5.7.5** All power & control wiring shall be sized for the design duty of the equipment it will be serving and take account of external influences, length of run, internal temperatures and mechanical stresses. In addition, cables shall only be selected with Low Smoke & Zero Halogen (LSOH) outer sheaths were installed within buildings. Where systems are specified as being maintained under fire conditions, wiring shall be selected for the temperatures to be encountered.

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- C.5.7.6** Cable calculations along with a wiring schematic drawing shall be submitted to the Engineers for their comment prior to works commencing on site.
- C.5.7.7** Cables shall be neatly clipped on cable containment systems tie-wrapped at regular intervals. At each point of termination, the cable shall be identified by means of a label system, such as Critchley, giving details of size, equipment served and origin of supply.
- C.5.7.8** Control & power cabling installations shall be fully co-ordinated with all other building services systems along with structural building elements.
- C.5.7.9** Non sheathed cables for fixed wiring shall be enclosed in galvanised steel conduit, ducting or trunking.
- C.5.7.10** Upon completion of the electrical wiring works, an electrical test & completion certificate shall be issued and be included as part of the record documentation to be enclosed within the mechanical services Operation & Maintenance manual.

C.5.8 ELECTROMAGNETIC COMPATIBILITY

- C.5.8.1** Ensure all equipment and systems are installed to provide electromagnetic compatibility within the system and with any other systems installed in the same area.
- C.5.8.2** Ensure all equipment meets the requirements of the appropriate electromagnetic compatibility standard.
- C.5.8.3** Ensure all apparatus covered by the Wireless Telegraphy Act meets regulations issued by the Radio communications Agency.
- C.5.8.4** Ensure that all cable installations meet the minimum guidance separation in EMC of Installations and Recommended Cable Separations, published by the ECA.

C.5.9 SOFTWARE

- C.5.9.1** Obtain on behalf of the end user all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating.

C.6 WORKING DRAWINGS AND BUILDERS WORK

C.6.1 WORKING DRAWINGS

- C.6.1.1** For all projects the Contractor is required to produce Working Drawing. The drawings are intended to portray the following:
- *That the services fit into the allocated spaces provided and that there is sufficient space to perform servicing and maintenance*
 - *That the services can be commissioned*
 - *The services co-ordinate with the structure, architecture and other services.*
 - *For the basis of Builders work drawings.*
 - *To provide clear and specific information to fabricators and site installers.*

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C.6.1.2 The working drawings shall be fully detailed and drawn to a scale such that clear information is provided. Any system or service which is on view shall be detailed such that the Architect, Client and CA as appropriate is given a clear indication of what will be seen.

C.6.1.3 For guidance the Working Drawings shall at minimum be the following scales:

Plant Areas	1:20
Risers and service Voids	1:20
Plans	1:50
Drainage	1:50
Details and Co-ordination	1:20

C.6.1.4 All drawings shall be dimensioned for setting out and heights from set points which will be in existence when the services are being installed. The Contractor shall discuss such setting out points with the Main Contractor, prior to starting the working drawings.

C.6.1.5 The services shall be fully co-ordinated with the structure, architecture and other services and systems. The Mechanical services Contractor shall take the lead role in co-ordinating services in areas where other services are being installed, such as ceiling voids, combined risers and plantrooms and areas, regardless of whether the other services are part of their contract or not. The Mechanical Services Contractor shall hold, and lead co-ordination meetings as required with the other services installers and set zones where the other services can be run and installed.

C.6.1.6 The Contractor shall produce a full set of working drawings specifically indicating the fire separation measures taken, and how they are co-ordinated with the Building Structure. Each fire damper and barrier shall be numbered and scheduled indicating the means of access and inspection. This information shall be updated and presented as part of the Record Drawings for the project.

C.6.2 BUILDERS WORK PROVIDED

C.6.2.1 Where structural and/or architectural facilities or provisions, for engineering services are already indicated check that these are correct, satisfactory, and adequate for the purpose and confirm same in writing to the CA within 4 weeks of award of contract.

C.6.2.2 Where alternative equipment or materials has been offered that the CA has accepted and which subsequently varies the works in any way whatsoever, then the Contractor shall undertake the redesign of the associated builder's work.

C.6.3 BUILDER'S WORK RESPONSIBILITIES

C.6.3.1 The requirements for and responsibilities regarding builderswork items are in addition to that normally provided as is normal custom and practice in the building industry.

C.6.3.2 The Contractor shall:

- *Provide builder's work information, appropriate to the stage of design development. Revise, supplement and/or issue final information, drawings/details for the actual requirements of the contract works.*
- *Provide fully dimensioned drawings showing both size and position of builder's work referring to the structural engineering and architectural final dimensioned detailed drawings.*
- *If approved by the CA Mark out on site, all cut holes and chases required, any pockets cast in concrete, any inserts, any built-in sleeves or similar items.*

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- C.6.3.3** All builders work information shall be provided to comply with the programme and include sufficient time for the necessary approvals.
- C.6.3.4** All materials provided for fixing by others are to be included in the contract works cost and supplied in accordance with the programme.
- C.6.3.5** The Mechanical Services Contractor shall co-ordinate and provide all builders' work details required for incoming and connecting gas and water services, regardless of whether they form part of their contract.

C.6.4 SCOPE OF BUILDER'S WORK

- C.6.4.1** Builder's work excludes drilling and/or plugging walls, floors, ceilings etc., for fixings for services and such work is included in the mechanical services contract works.
- C.6.4.2** The Mechanical Services Contractor shall also supply and install the following as necessary for the complete installation:
- *All supporting secondary steelwork.*
 - *Brackets, clamps and fixings.*
 - *Pipe, duct and cable sleeves through walls, floors, slabs etc.*
 - *Supply all sleeves and hand-over to others for fixing.*
 - *Making good around sleeves to provide correct fire barrier protection.*
 - *Supply all puddle flanges and hand-over to the main Contractor for fixing.*
- C.6.4.3** The Mechanical services Contractor shall liaise with other Contractors to try to minimise the amount of builder's work required by sharing openings, bases steelwork and secondary supports.
- C.6.4.4** The following schedule identifies the roles and responsibilities of the Main and the Mechanical Services Contractor:

Ref	Item	Main Contractor	Services Contractor	Comment
1.0	Pipe and duct penetrations through the building envelope		✓	
1.1	Cut holes and make good openings in walls for building services up to 150mm square or diameter		✓	
1.2	Cut holes and make good openings in roof for building services up to 150mm square or diameter		✓	
1.3	Cut holes and make good openings in walls for building services over 150mm square or diameter	✓		
1.4	Cut holes and make good openings in roof for building services over 150mm square or diameter	✓		
1.5	Final weatherproof flashing over pipe, duct passing through external walls	✓		
1.6	Final weatherproof flashing over pipe or duct passing through external roofs.	✓		
1.7	For penetrations through roof, supply proprietary up-stand for directly connected plant and equipment		✓	
1.8	Install proprietary up-stand supplied above	✓		
2.0	External louvres			
2.1	Supply external Louvres		✓	

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Ref	Item	Main Contractor	Services Contractor	Comment
2.2	Install External Louvres		✓	
2.3	Provide Flashing to External Louvres	✓		
3.0	Fire dampers			
3.1	Supply Installation frame for fire dampers		✓	
3.2	Install Installation Frame for Fire Dampers	✓		
3.3	Supply Fire Dampers		✓	
3.4	Install Fire Dampers		✓	
3.5	Make Good around Fire Dampers	✓		
4.0	Concrete bases and plinths			
4.1	Provide all necessary dimensions and details for concrete bases and plinths		✓	
4.2	Construction of concrete bases and plinths	✓		
4.3	Drill and install holding down bolts and make good		✓	
4.4	Supply base insertion material		✓	
5.0	Inertia Bases			
5.1	Design, Supply and install Steel Inertia bases with AV mounts		✓	
5.2	Supply and install concrete infill		✓	
5.3	Drill and fix holding down bolts		✓	
6.0	Steelwork Bases			
6.1	Design, Supply and fix primary steelwork bases for plant	✓		
6.2	Design, Supply and fix secondary steelwork bases for plant and equipment		✓	
6.3	Weatherproofing of roof steelwork connections to structure	✓		
7.0	Anti-vibration mountings and pads			
7.1	Design, Supply and Install anti vibration mountings and pads		✓	
8.0	Anchor Supports and Guides			
8.1	Provide drawings, details and calculated loads for all builder's work required for anchor points and guides.		✓	
8.2	Supply and install primary builders work for anchor points and guides	✓		
8.3	Supply all secondary anchor point and guide steelwork		✓	
8.4	Install all secondary anchor point and guide steelwork		✓	
9.0	Secondary Steelwork for Support of Services			
9.1	Design and prepare drawings for all secondary steelwork including load calculations		✓	
9.2	Supply secondary supporting steelwork		✓	

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Ref	Item	Main Contractor	Services Contractor	Comment
9.3	Install secondary supporting steelwork		✓	
10.0	Internal Grilles and Diffusers			
10.1	Provide dimension drawings for holes required for grilles and diffusers		✓	
10.2	Cut holes in structure for grilles and diffusers	✓		
10.3	Cut holes in suspended ceiling tiles for grilles and diffusers		✓	
10.4	Cut ceiling grid for grilles and diffusers	✓		
10.5	Supply reinforcement backing panels for cut suspended ceiling tiles	✓		
10.6	Install reinforcement backing panels for cut suspended ceiling tiles		✓	
11.0	Ceiling Mounted and recessed AC units and Heaters			
11.1	Provide dimension drawings for holes required for equipment		✓	
11.2	Cut holes and recesses in structure for equipment	✓		
11.3	Cut holes in suspended ceiling tiles for equipment		✓	
11.4	Cut ceiling grid for equipment	✓		
12.0	Sanitary Fittings			
12.1	Supply sanitary Fittings	✓		
12.2	Supply taps and wastes etc.	✓		
12.3	Supply kitchen Sinks	✓		
12.4	Install sanitary Fittings		✓	
12.5	Install kitchen Sinks	✓		
12.6	Install taps and wastes		✓	
12.7	Make final Connections		✓	
12.8	Provide mastic sealing to all fittings	✓		

C.6.5 MARKING OUT OF BUILDER'S WORK HOLES ON SITE

C.6.5.1 If approved by the CA, mark on site actual locations of minor non-structural holes through walls, partitions, floors etc. and chase in non-fair-faced walls, etc. for conduits, pipes and the like in preference to providing drawings of such builder's work requirements. The CA is to be given the opportunity to inspect prior to work being carried out.

C.6.5.2 The CA shall inspect all marking out on site prior to work commencing.

C.6.5.3 Establish a method of working with the CA to ensure the works may proceed without hindrance.

C.6.5.4 The maximum size for a non-structural hole for marking on site shall be 150mm diameter or equivalent.

C.6.6 BUILDER'S WORK INFORMATION TO BE PROVIDED

C.6.6.1 All builders' work drawings shall be fully dimensioned and provided in accordance with the following:

- *Details of all bases for plant formed in concrete, brickwork or blockwork to a scale of not less than 1:20.*
- *Details of all attendant builder's work, holes, chases, etc. for conduits, cables and trunking etc. and any item where access for a function of the installation is required to a scale of not less than 1:50.*
- *Details of all types of purpose made brackets for supporting service or plant/equipment to a scale of not less than 1:20.*
- *Details of all access to ceilings, ducts, etc. to a scale of not less than 1:50.*
- *Details of all special fixings, inserts, brackets, anchors, suspensions, supports etc. to a scale of not less than 1:20.*
- *Details of all sleeves, puddle flanges, access chambers to a scale not less than 1:20*

C.6.7 STRUCTURAL STEELWORK

C.6.7.1 The requirements with respect to structural steelwork are follows:

- *No steelwork shall be cut, drilled or welded on site without written approval from the CA.*
- *All holes required through structural steelwork shall be pre-determined and made at the steelwork fabricators works.*
- *Fixing steelwork shall be an approved clamp type.*
- *All fixings shall be of the correct size and type for the fixing load applied and the type shall be approved prior to commencement of the works.*

C.6.8 PRE-CAST CONCRETE

C.6.8.1 Holes may not be cut in precast concrete without written approval from the CA.

C.6.8.2 Under no circumstances will holes be cut in pre-stressed concrete.

C.7 INFORMATION TO BE PROVIDED BY THE SERVICES CONTRACTOR

C.7.1 RISK ASSESSMENTS

C.7.1.1 Risk assessments (RAMS) shall be undertaken for all works activities undertaken by the services Contractor, including but not limited to the following:

- *Unloading and storage of materials*
- *Fabrication on site*
- *Moving materials and plant*
- *Installation works*
- *Safe use of tools, machinery and access equipment*
- *Cutting and drilling*
- *Crane Lifts*
- *Working in confined spaces*
- *Working in exposed locations or on roofs.*
- *Operating Mechanical handling and access equipment*
- *Testing and Commissioning*
- *Setting to work*

C.7.1.2 All risk assessments shall be specific to the project, the conditions on site, taking account of the contractual arrangements etc. Risk assessments shall be available at any time for review by the Main Contractor, CA, Client representatives and Health and safety officers.

C.7.1.3 Evidence shall be provided that all operatives and managers relevant to the risk assessments have read and understood them and that measures are in place to ensure that they are followed.

C.7.1.4 This statement does not override any measures which have to be followed under legislation, site rules or requirements by the Main Contractor.

C.7.2 METHOD STATEMENTS

C.7.2.1 As required by the main Contractor or the CA the services Contractor shall provide method statements for any aspect of the works, in particular critical operations such as plant placement, works within occupied areas or on equipment which is required to be maintained fully operational.

C.7.2.2 Method statements shall include but not limited to the following:

- *Description of the works to be undertaken*
- *Reason for the works*
- *Programme and sequence of works*
- *Identify Risks*
- *Mitigation of Risks*
- *Organisation Diagram of operatives and managers responsible for the works*
- *Contact telephone numbers. (With out of hours contact as appropriate).*

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C.7.2.3 Method statements shall be submitted at least 10days prior to the works being commenced and shall not proceed unless acceptance of the method statement is given by those requesting it.

C.7.3 PLANT & EQUIPMENT MAINTENANCE AND REPLACEMENT STRATEGY:

C.7.3.1 As part of an ongoing commitment to ensure that works undertaken can be maintained and replaced in the future, at any point during the contract the CA can may request a statement from the Contractor on how any or all the plant and equipment can be accessed for maintenance or replaced in the future. The services Contractor shall within 15 working days of any such request, prepare a report with drawings and sketches as required to show what access arrangements have been made for maintenance, and how plant and equipment can be replaced in the future.

C.7.3.2 If requested maintenance access shall be demonstrated on site by the Services Contractor.

C.7.3.3 If arrangements for maintenance and/or replacement are deemed not to be acceptable by the CA, the Contractor shall at no cost to the Contract ensure that acceptable means of maintenance and replacement is incorporated into the project.

C.7.3.4 The strategy for maintenance and replacement shall be included in the operating and maintenance documents for the project.

C.7.4 PROGRAMME OF WORKS

C.7.4.1 All works undertaken by the services Contractor shall be pre-programmed.

C.7.4.2 The programme shall integrate with the overall programme for the project and those produced by other Contractors working on the project.

C.7.4.3 The Programme shall show critical dates and a critical path. As requested by the CA and /or Main Contractor the programme shall be marked up with progress which shall show areas ahead or behind programme. Should works be behind programme, the Contractor shall indicate how the activities shall be brought back on target to achieve completion.

C.8 COMMISSIONING & TESTING

C.8.1 DEFINITIONS

C.8.1.1 Where used in the documentation the following definitions shall apply and shall be interpreted as such:

- *Commissioning: The advancement of an installation from the stage of static completion to working order to the specified requirements*
- *Testing: The measurement and recording of specified quantifiable characteristics of an installation or parts thereof and includes off-site testing.*
- *Setting to work: The process of setting a static system in motion*
- *Regulation: The process of adjusting the rates of fluid flow in a distribution system to achieve specified values*
- *Environmental testing: The measurement and recording of internal environmental conditions.*
- *System proving: the measuring, recording, evaluating and reporting on the seasonal performance of the systems against their design values.*
- *System demonstration: Demonstrating the capability of the installation to achieve and maintain the specified performance criteria.*

- *Fine-tuning: The adjustment of the system where usage and system proving has shown such a need and includes the reassessment of design values and control set points to achieve the required system performance.*
- *Seasonal Commissioning: The Contractor shall return to site approximately 6 months from the original commissioning date to review the system performance and set points with respect to differing outside conditions. The Contractor shall seek comment from the occupiers and owner of the building on the performance of the systems and to consider if any adjustments are appropriate to the system. The cost of the return visit and for considering and adjusting shall be included in the Contract sum.*

C.8.2 PROGRAMME

- C.8.2.1 The Contractor shall prepare comprehensive programmes for the pre-commissioning checks, setting to work, testing, commissioning, system proving and environmental testing of the contract works. The programmes shall be prepared at the start of the project, to ensure that sufficient time is incorporated into the overall contract.
- C.8.2.2 The programme shall be reviewed and updated to suit the progress of the contract works.
- C.8.2.3 It should be noted that Practical Completion may not be given unless the systems and services are fully tested and commissioned.

C.8.3 COMMISSIONING SPECIALIST

- C.8.3.1 Unless the necessary expertise is retained in house the Contractor shall employ an independent company who specialises in testing and commissioning of building services to undertake the following:
- *All commissioning and testing activities associated with the contract works.*
 - *Overseeing specialist testing and commissioning*
 - *Supervision and overseeing of works testing.*
 - *Preparing final testing and commissioning documentation.*
- C.8.3.2 The Contractor shall submit with the tender, details of the in-house specialist or independent company to be employed.
- C.8.3.3 The commissioning specialist / company shall be a member of The Commissioning Specialists Association (CSA).

C.8.4 STATIC TESTING

C.8.4.1 Progressive static testing shall include the following tests, but other tests may be required and witnessed:

- *Hydraulic / Pneumatic*

C.8.4.2 Sufficient advance notice of the tests shall be given to the CA there is an opportunity to witness all static tests.

C.8.5 PLANT AND EQUIPMENT PERFORMANCE TESTING

C.8.5.1 Critical and or important equipment shall be tested at the works of the manufacturer or in a recognised and approved testing facility to demonstrate the performance complies with the stated and specified duties.

C.8.5.2 These tests shall be in addition to standard works tests that may be performed as part of manufacture.

C.8.5.3 Performance testing shall demonstrate but not limited to the following:

- *Full, partial and minimum load*
- *Response to load change*
- *Efficiency*
- *Noise levels*

C.8.5.4 The tests shall be conducted to simulate design conditions and all ancillary plant and equipment needed to support the tests together with all instrumentation shall be provided and included in the contract cost. The Contractor shall submit to the CA, a full method statement supported by risk assessments detailing the procedures for carrying out the tests 10 days prior to the tests being carried out. Should the method statement be rejected by the CA it shall be re-submitted. Acceptance of the method statement by the CA must be obtained prior to the tests being undertaken.

C.8.5.5 Up to three representatives from the Client's team plus representatives from the Contractors team may inspect and witness the works tests. All costs associated with this visit, including travelling and overnight accommodation as appropriate must be borne by the manufacturer of the equipment. The Commissioning Manager is expected to also witness the test.

C.8.5.6 Upon successful completion of the performance tests the plant and equipment shall be thoroughly cleaned and returned to its new condition and correctly packaged for delivery to site.

C.8.5.7 Test certificate records of the tests shall be issued to the CA within 10 days of the test.

C.8.6 PRE-COMMISSIONING CHECKS

C.8.6.1 Ensure all pre-commissioning examinations and tests have been undertaken and that each system, including components, or item of equipment is complete and in a safe condition prior to start-up.

C.8.6.2 All necessary notices shall be displayed.

C.8.7 COMMISSIONING AND TESTING

C.8.7.1 When the contract works or parts thereof are ready for testing and commissioning the Contractor shall notify the CA in writing.

C.8.7.2 The following shall be in place to allow the commissioning to commence:

- *All necessary facilities shall be provided to enable tests to be witnessed and inspections carried out including all necessary instruments and recorders to monitor systems during commissioning system proving and environmental testing.*
- *Provide information where access is required into ceiling voids, service risers etc. and ensure these points are not closed until the commissioning and testing is complete.*
- *Full set of schematic layouts indicating the required duties and flow rates etc.*
- *Where commissioning, testing, balancing, adjustment, is undertaken in an area of the building taken over and occupied by the Employer, then take all necessary precautions against and be responsible for any damage caused whilst working in such areas for that purpose.*

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- C.8.7.3** Prior to witnessing and inspection by the CA the contract works shall be fully tested, commissioned and be fully operational.
- C.8.7.4** Where portions of the work are required to be commissioned and tested separately, then upon final completion, demonstrate to the CA that all the several portions are capable of proper simultaneous operation in accordance with the requirements of the specification.
- C.8.7.5** If commissioning and testing demonstrates that the plant system or equipment is not properly installed and/or not functioning correctly the Contractor shall carry out such remedial measures and adjustments as may be necessary and repeat the commissioning and testing procedure to the satisfaction of the CA.
- C.8.7.6** The Contractor shall ideally complete all tests before any paint; cladding or similar materials are applied or before services are concealed.
- C.8.7.7** Ensure all requirements such as cleanliness, protection from harmful external and internal elements are provided prior to commencement of commissioning.
- C.8.7.8** The Contractor shall undertake to:
- *Comply with the requirements of the Building Regulations (Approved Document Part L2) for the inspection and commissioning of the building services systems. Prepare all necessary submittals including commissioning plans and reports. Obtain all compliance approvals from the building control bodies.*
 - *Provide all specialist personnel including manufacturer's representatives and coordinate their activities, together with providing any attendance required.*
 - *Provide reports detailing progress of testing and commissioning activities at intervals agreed with CA.*
 - *Maintain a diary/log of significant commissioning and testing activities.*
 - *Measure and reconcile noise levels at agreed locations to verify compliance with design criteria.*
 - *Submit to the CA all certification documents prior to any system being offered for final acceptance.*
 - *Confirm in writing to the CA that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.*
 - *Ensure all certification is attained and witnessed as necessary for inclusion in the record documentation.*
 - *Submit a report for every test, demonstration, balance or commissioning activity witnessed, together with an engineering appraisal on the performance, either on or off-site.*
 - *Co-ordinate and liaise with the Employer's representative.*
 - *Maintain on site full records of all testing, commissioning and performance testing.*

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C.8.7.9 The extent and proportion of results to be witnessed by the CA will be at the discretion of the CA.

C.8.7.10 The CA will only witness test proceedings to establish a level of confidence in the commissioning results being presented, except for the life safety systems which shall be fully witnessed.

C.8.8 FUEL FOR TESTING

C.8.8.1 Fuel for testing and operating the contract works shall be included within the contract price and due allowance made within the tender.

C.8.9 SYSTEM DEMONSTRATION:

C.8.9.1 After the completion of all testing and commissioning to the satisfaction of the CA and when directed operate the plant and demonstrate that the overall systems function correctly in accordance with the requirements of the specification.

C.8.9.2 The systems shall be fully run and operated to demonstrate correct function in accordance with the requirements of the specification for a period of 4 weeks prior to practical completion.

C.8.10 INSPECTIONS AND TESTS

C.8.10.1 The Contractor shall submit schedules indicating those parts of the contract works for which inspections and tests are required to substantiate conformity with the specification.

C.8.10.2 Should any alternative item be proposed that does not carry appropriate certification, ensure independent testing is carried out at no expense to the contract works to confirm compliance.

C.8.10.3 Provide method statements supported by risk assessments detailing the procedures for carrying out on site testing and commissioning.

C.8.10.4 Agree in advance with all parties' procedures for inspections and tests including periods of notice.

C.8.10.5 Where a test indicates non-compliance with the specification submit immediately details of the non-compliance and details for corrective action.

C.8.10.6 Maintain records of all specified inspections and tests performed including third party and works testing. Maintain all records on site for inspection.

C.8.11 TEST CERTIFICATES AND RECORDS

C.8.11.1 Ensure that test certificates include:

- *Project title.*
- *Details and date of test.*
- *Instruments used, serial numbers, calibration dates.*
- *Signature of those witnessing test.*
- *Installers name.*
- *Specific location of the item in the contract works.*

C.8.11.2 2 copies of each test certificate to be issued to the CA within 10 working days of each test.

C.9 RECORD DRAWINGS AND DOCUMENTS

C.9.1 GENERAL

- C.9.1.1 Each building demise shall be provided a separate standalone operating and maintenance manual and set of record drawings. The Contractor shall produce a set of O&M manuals for the works completed and the manuals shall be set out in accordance with BSRIA Application BG 1/2007 "Handover, O&M Manuals and Project Feedback".
- C.9.1.2 Record drawings and operating and Maintenance manuals shall be produced, and final draft issued as part of the practical completion sign off, for the project. Note that the CA reserves the right to refuse Practical Completion should the documents and drawings not be available.
- C.9.1.3 The documents and drawings shall be issued in draft but near completed form for review at least 6 weeks prior to practical completion, with final updated versions being made available at practical completion.

C.9.2 RECORD DRAWINGS

- C.9.2.1 Record drawings shall portray the final installation, generally being the working drawings updated as the works proceed on site to take account of variations and changes. The drawings must be drawn on the latest architectural background, and if this is not available at time of practical completion, it shall be updated when available at no additional cost to the project.
- C.9.2.2 The drawings must reflect accurately the works undertaken, fully cross referenced to the O&M manuals.
- C.9.2.3 For Contractor designed Projects the design drawings must also be updated and issued as part of the Record Drawing set.
- C.9.2.4 Record drawings must include, but not limited to the following:
- *1:50 - Floor Plans and sections for each system and service as appropriate. With reference to all system components. Pipework and ductwork etc. shall be sized, and each drawing shall be cross referenced with the adjacent areas and with drawings covering other systems and services. Drawings to include locations of controls and wiring routes and components associated with the Mechanical services works.*
 - *1:20 - Plant areas and sections, with reference to all plant and equipment. All ducts and pipes to be sized, valves shall be numbered and cross referenced to a valve chart drawing. Drawings to include locations of controls and wiring components associated with the Mechanical services works.*
 - *1:20 - Risers and Voids plans and sections, with reference to all plant and equipment. All ducts and pipes to be sized, valves shall be numbered and cross referenced to a valve chart drawing. Drawings to include locations of controls and wiring components associated with the Mechanical services works.*
 - *Schematic layouts for all systems including design flow rates. Note: the drawings shall also be used as a basis for the commissioning works. Plant references should be indicated and cross referenced to the O&M manuals. Schematics shall include the location in the system for all controls, sensors and actuators etc.*
 - *External services layout. Note external drainage shall be portrayed at 1:50 but incoming services such as gas water and telecoms can be indicated at 1:100. Note The Mechanical services contractor shall obtain information on external mechanical services and provide record information on those systems even though they do not form part of his works. This is to provide a complete picture of the services installation for future reference.*

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- *Controls wiring schematics fully cross referenced to the Plans and sections.*
- *Controls logic Diagrams, points schedules and full description of operation.*
- *Electrical Controls and Power wiring diagrams.*
- *Control panel and MCC wiring diagrams.*
- *Control Panel and MCC fabrication and layout drawings.*
- *Fire damper and barrier layout, showing access arrangements. Note full schedule of all items which require regular inspections to be included.*

C.9.3 OPERATING AND MAINTENANCE MANUALS

- C.9.3.1** The Contractor shall supply a comprehensive set of Operating and Maintenance Manuals to cover all aspects of the services installation.
- C.9.3.2** Before the anticipated completion date, the Contractor shall supply draft copies of the Operating and Maintenance Manuals to the EA and CBSE for comments.
- C.9.3.3** The final Operating and Maintenance Manuals shall be submitted to the EA and CBSE in sufficient time to ensure the complete O&M documentation is complete by practical completion.
- C.9.3.4** If during the defects liability period any discrepancies are found within the documentation, then all copies of the manuals shall be amended at the Contractor's expense.
- C.9.3.5** The Contractor shall note that all the services manuals shall be incorporated into the overall building manual for the project.
- C.9.3.6** The Contractor shall include for instructing the Client's staff in the operation and maintenance of all equipment installed. This instruction shall include attendance by specialist suppliers and shall only be required to be performed once. The Contractor shall also allow for a guided tour of the installation for the Client's benefit.
- C.9.3.7** The operation and maintenance demonstration and guided tour shall be undertaken within 3 months following practical completion. However, the Client can, at his discretion, postpone such instructions to a later date provided the re-arranged date is within the defect's liability period.
- C.9.3.8** The arrangement of the manual shall generally be as follows:
- C.9.3.9** Section One: Contents
- C.9.3.10** Section Two: Description of Services
- *Detailed description of each system, basis of design and principal components.*
 - *Date of installation.*
 - *Names of all relevant parties.*
 - *Design specifications.*
 - *Performance specifications.*
 - *System schedules, tables, etc.*
 - *Key design parameters.*
- C.9.3.11** Section Three: Operating Instructions
- *Functional explanation of all components, switches, controls, etc.*
 - *Start/stopping procedures via step-by-step instructions for each plant/system.*

- *Step-by-step instruction procedure for shutting down each plant/system in an emergency.*
- *Adjustment and regulation.*
- *Description of operational routines including points of isolation for all incoming services.*
- *Fault finding and trouble shooting.*
- *Safety precautions and emergency procedures.*
- *Switching schedules.*

C.9.3.12 Section Four: Inspection and Maintenance

- *Inspection schedule and planned maintenance instructions (to include step-by-step instructions on the maintenance of all items of plant, clearly indicating daily, weekly, monthly, quarterly, 6 monthly and annual procedures).*
- *Maintenance and lubrication schedules and procedures.*
- *Inspection and maintenance records.*
- *Periodic maintenance requirements for all plant.*
- *Data for ordering plant replacements, components and spares.*
- *All information to satisfy all Health and Safety and Statutory Regulations in clearly defined text.*
- *Legend for color coded services.*
- *Risk Assessments for method statements for all maintenance activities.*
- *Schedule of normal consumable items.*
- *List of spares.*

C.9.3.13 Section Five: Test and Commissioning Certificates

- *All air and water pressure test certificates, air and water system balancing test certificates, plant and equipment manufacturers' commissioning test certificates, chemical water treatment analysis test certificates, chlorination certificates, acoustic consultants' reports, controls commissioning test certificates, all control settings, etc.*
- *All test and commissioning sheets to be typed.*
- *Schedule of all fixed and variable equipment settings established during the commissioning process.*

C.9.3.14 Section Six: Service

- *Manufacturers' names, addresses and telephone numbers.*
- *Local Authority names, addresses and telephone numbers.*
- *Sub-Contractors' names, addresses and telephone numbers.*
- *Emergency procedures include telephone numbers for emergency services (including utility supply companies).*

C.9.3.15 Section Seven: Manufacturer's Literature

- *Full list of manufacturer's recommended spares.*
- *Full details of spares provided together with their storage location.*

- *Manufacturer's literature of all plant and equipment, including their maintenance instructions, wiring diagrams and typical fault-finding routines.*
- *The manufacturer's literature shall be actual copies; photocopies will not be acceptable.*
- *Copy of all manufacturers guarantees, warranties and maintenance agreement offered by sub-contractors and manufacturers.*

C.9.3.16 Section Eight: Drawings

- *List of the record drawings.*

C.9.3.17 Section Nine: Equipment Schedule

- *Full detailed schedule of all plant and equipment identifying their locations, duties, commissioning performance figures, reference numbers, serial numbers, unique identification number (cross referenced to the record drawings) plus the manufacturers name, address and telephone number.*
- *Schedule of keys.*

C.9.3.18 Section Ten: Maintenance/Replacement Strategy

- *Details of maintenance and replacement strategy for all items of plant and equipment.*

C.9.4 **END USER TRAINING**

C.9.4.1 Unless otherwise detailed the Contractor shall provide training for the end users staff in the operation of all Systems installed. Training for staff shall be in the form of a course, lasting for two days, held on two occasions (to allow for approximately six people). The course shall cover, as a minimum, the following:

- *A detailed explanation of the operation of each system.*
- *The indication of alarms, status and faults on each system.*
- *The use of all manual controls.*
- *The operational sequence and interfacing to other systems*
- *Procedures for routine testing.*
- *Procedures for repo*

D APPENDICES

D.1 BREEAM MECHANICAL CONTRACTOR REQUIREMENTS

D.1.1 PLEASE REFER TO BREEAM SPECIFICATIONS



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