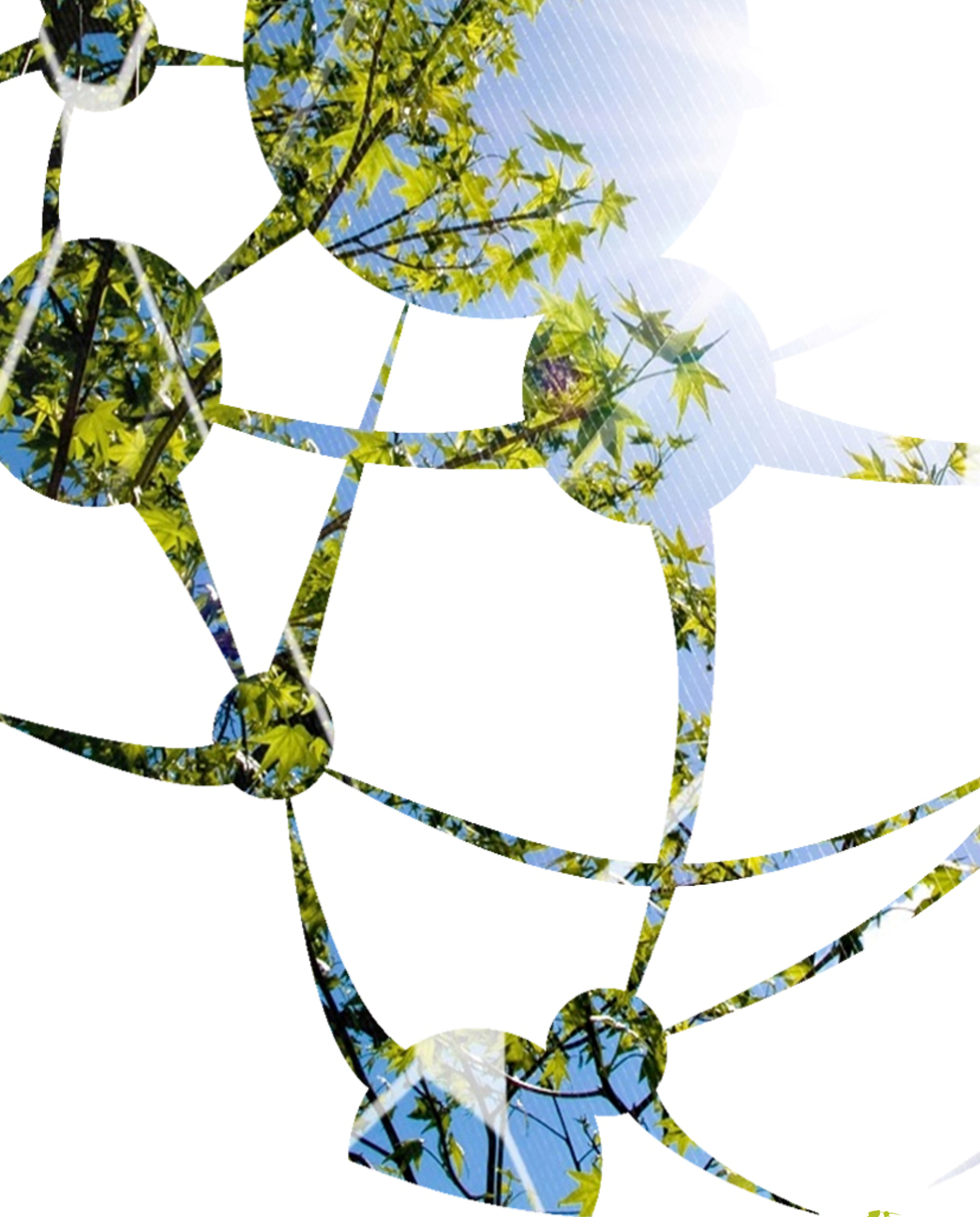
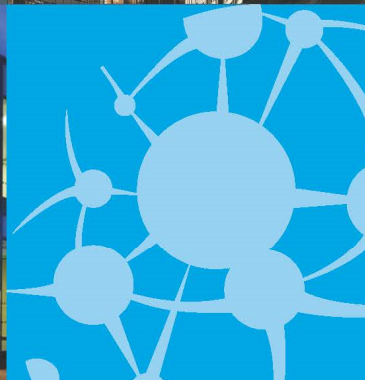
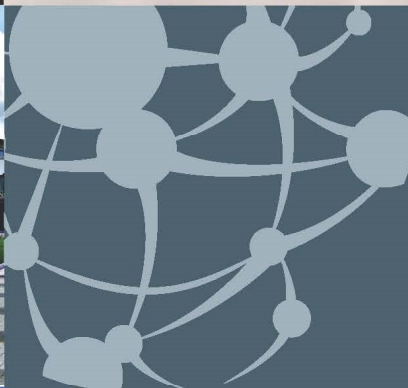
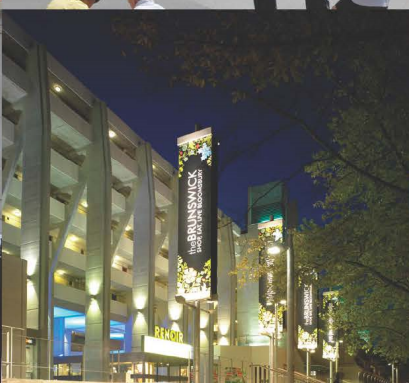




THE HEIGHTS PRIMARY SCHOOL
MEP STAGE 4 SPECIFICATION
APRIL 2019



DOCUMENT CONTROL

Issue	Description	Date	Prepared By	Signed Off
T01	Tender Issue	01/05/2019	SS/CF/GL	ES
T02	Tender Issue	16/05/2019	SS/CF/GL	ES

Stage 4a MEP Outline Specification

Custom report

16/05/2019 - 11:04

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Outline Specification

End of RIBA Stage 4 - Technical Design

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System/Section	Modified
Above ground wastewater drainage system with internal stacks (50-10-05/120)	No
Incoming water supply (55-40-40/110)	No
Cold water supply system (55-40-40/120)	No
Direct hot water storage supply system (55-40-40/150)	No
Incoming gas supply (55-60-55/110)	No
Low temperature hot water heating system (60-45-40/110)	No
Natural ventilation system (65-10-95/110)	No
Mechanical ventilation systems (65-10-95/130)	No
Kitchen ventilation system (65-10-95/160)	No
Room air conditioning system (65-70-45/110)	No
Incoming low voltage electricity supply (70-50-45/110)	No
Grid connected photovoltaic system (70-65-60/110)	No
Earthing and bonding system (70-70-25/110)	No
Inspection and testing of existing electrical installations (70-70-40/130)	No
Low voltage distribution system (70-70-45/110)	No
Hard wired low voltage small power system (70-70-75/110)	No
Amenity lighting system (70-80-25/120)	No
Hard wired general lighting system (70-80-35/110)	No
Data distribution system (75-45-20/110)	No
Telecommunications system (75-45-85/110)	No
Access control system (75-60-05/110)	No
Audio intercom system (75-60-05/120)	Yes - 1 clauses modified
CCTV system (75-60-10/110)	No
Intruder detection and alarm system (75-60-40/110)	No
Fire detection and alarm system (75-65-30/110)	No
Fixed gas detection and alarm system (75-65-35/110)	No

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Flow sample gas detection and alarm system (75-65-35/120)	No
Water leak detection and alarm system (75-65-95/120)	Yes - 1 clauses modified
Assistance call system (75-70-05/110)	No
Disabled Refuge Emergency voice communication system (75-70-05/120)	No
Electricity metering (75-75-05/110)	No
Water metering (75-75-05/130)	No
Building monitoring and management system (75-75-05/150)	No
Electrical connections (75-75-05/160)	No
Water supply systems control (75-75-50/110)	No
Heating systems control (75-75-50/120)	No
Natural ventilation control (75-75-50/145)	No
Mechanical ventilation systems control (75-75-50/155)	No
Gas fired heating system control strategy (75-75-50/190)	No
Lightning protection system (75-85-45/110)	No
Vertical lifting platform system (80-45-90/140)	No

Outline Specification

50-10-05 Above ground waste water drainage systems

120 Above ground wastewater drainage system with internal stacks

The contractor shall supply, install, test, commission, demonstrate and set to work the disposal systems as set out within this specification and as described on the layout drawings, equipment schedules including the detailed requirements set out below:

The new drainage points will be provided to receive the foul and waste discharges from the sanitary appliances and equipments through the school and are to be connected to the new below drainage system.

The new foul drainage system will discharge by gravity and will be designed to receive all soil and waste pipes.

The new soil & waste pipes shall be provided on the Primary Ventilated System and all dry vent pipes shall be installed in uPVC to BS EN 1451-1:2000. These shall be taken from above the highest wet branch connection(s) of the above ground drainage system and either terminate to atmosphere singularly or connect to adjacent vent pipes to form a common vent pipe. (Maximum of 4No. drain points per vent termination.)

The sanitary plumbing system will be accessible to allow for maintenance to be carried out with the minimum of disruption to the running of the building. Access points will also be provided at the bottom length of all stacks. Access panels will be provided to allow first stage rodding of blockages to be achieved from a higher point than the flood level of the fitting served.

55-40-40 Hot & cold water supply systems

110 Incoming water supply

Complete the design, supply, install, test, commission, demonstrate and set to work the entire complete system as set out within this specification and as described on the drawings/equipment schedules including the detailed requirements set out below.

A new below ground incoming mains water supply from the site boundary to the new school building as per drawing No.FS0280-ELE-XX-XX-DR-ME-96001 - Incoming Services Layout. The installation of the mains water supply below ground is to be installed complete with mains water leak detection to suit BREEAM Wat 03 requirements. This is to include a BMS link between the local water authority meter and the school plantroom sub-meter & solenoid shut-off valve.

Include for soil analysis to establish requirement for barrier pipe.

120 Cold water supply system

The contractor shall supply, install, test, commission, demonstrate and set to work the entire complete system as set out within this specification and as described on the drawings/equipment schedules for cold water supply system including the detailed requirements set out below.

The cold water supply system is to be generally mains fed with the addition of a hydraulic pressurisation system which incorporates a mainsboost Charger and 2No. 450L vessels, which can deliver increased water pressure up to 3.5 bar and provide flow rates of at least 80 litres per minute (per vessel) guaranteeing both pressure and flow to multiple outlets.

All domestic cold water pipework will generally be distributed at high level in ceiling void, dropping down locally to serve new sanitaryware.

In addition to the above, there is a requirement for a CAT 5 non-potable water supply for irrigation and washdown purposes. This is fed from a dedicated CAT 5 break tank and pump set within the plantroom where it is to be distributed to serve the building heating pressurisation unit, roof mounted non-freeze hose union bibtap and refuse store wash-down point.

150 Direct hot water storage supply system

The contractor shall supply, install, test, commission, demonstrate and set to work the entire complete system as set out within this specification and as described on the drawings/equipment schedules for direct hot water storage supply system.

The hot water supply system is to be fed via an unvented direct gas fired water heater located within the plantroom, this is to be fed direct from the pressurised mains water service fitted with an unvented kit to suit the manufacturers safety requirements.

All domestic hot water pipework will generally be distributed at high level in ceiling voids, dropping down locally to serve new sanitaryware.

55-60-55 Natural gas supply systems

110 Incoming gas supply

Supply, install, test, commission, demonstrate and set to work the entire complete system as set out within this specification and as described on the drawings/equipment schedules for the incoming gas supply

An approved 'utility infrastructure provider' (UIP) or gas transporter shall be employed by the Contractor to provide a new suitably-sized incoming utility service from the existing gas infrastructure external to the site, which shall terminate within the site boundary, at a position to be agreed with the UIP/gas transporter and Employer.

The Contractor shall include for the provision of a suitable ventilated free-standing gas-meter enclosure, and all associated builderswork, which shall be located in a position as shown on the drawings

The Contractor shall arrange for the provision of the suitably-sized gas meter from the Client's chosen gas shipper. The utility gas meter provided by the gas shipper shall have pulsed output to the BMS for monitoring consumption.

The Contractor shall be responsible for liaising and co-ordinating with the Client's gas shipper, to ensure that the gas meter is formally registered with the shipper, and that gas supply is live prior to commissioning.

The Contractor shall also extend the gas infrastructure from the gas meter to the gas-fired boiler plant and to the kitchen to serve the gas fire kitchen equipment.

The gas service shall be installed below ground within a services trench, and then rise externally to pass through the external wall of the plantroom (via a continuous sleeve).

Gas cocks shall be provided on the gas service pipework prior to the connection to each item of equipment.

An auto reset gas solenoid valve and check meter shall be provided at the branch to the boilers, branch to the gas fired water heaters and to the kitchen.

Electro thermal links shall be located above gas-fired equipment. Emergency knock off buttons shall be provided at points of ingress/egress to/from the plant room. The solenoid valve shall be linked to the fire alarm system.

The gas infrastructure shall include an auto reset solenoid valve on the incoming gas supply at the point of entry into the kitchen. Emergency knock off buttons shall be provided at points of ingress/egress to/from the kitchen. The solenoid valve shall be linked to the fire alarm system. The kitchen gas/ventilation control panel shall interlock the ventilation and gas and shall only allow the kitchen appliances to operate once the ventilation airflow has been proven.

External gas pipework shall be carried out in a continuous length of suitable polyethylene pipe. Internal gas pipework shall be heavy weight steel to plant rooms and risers, and medium weight black mild steel to BS EN 10255:2004 elsewhere. The gas pipework installation shall be in accordance with the requirements of BS EN 1775 and IGE/UP/2. All pipework shall be colour coded in accordance with BS 1710.

The Contractor shall include for all builderswork associated with the provision of the new gas infrastructure, including all necessary trenching, bedding and backfilling.

All gas works shall be in full accordance with Gas Regulations, Gas Safe requirements, and the UIP/gas transporters requirements, as well as other relevant guidelines.

60-45-40 Heating systems

110 Low temperature hot water heating system

Supply, install, test, commission, demonstrate and set to work the an entire complete heating systems as set out within this specification and as described on the drawings/equipment schedules.

3 No. high efficiency low NO_x gas-fired condensing boilers (N+1) located within the ground floor plant room shall be provided to generate Low Temperature Hot Water (LTHW), which shall be supplied to a primary heating circuit incorporating a low loss header. A constant temperature (CT) and variable temperature (VT) secondary heating circuits shall be provided from the low loss header. The CT circuit shall serve LTHW heating coils within ventilation system (NVHRs and AHU). The VT system shall serve radiators.

The boilers shall be atmospheric and complete with flue connection to a flue header which risers to the roof in a dedicated shaft.

The boiler flues shall be designed and installed in accordance with the boiler manufacturers recommendations, and shall be provided complete with all fittings, terminals, appliance connectors, bends, drop-rods, brackets, supports and fixings necessary. The flues shall also be complete with flashings if required, and all additional fittings necessary to provide a weatherproof installation. Access panels shall be provided wherever flue joints are concealed, to facilitate inspection/maintenance.

Air for combustion and plant room ventilation shall be provided by fully louvred access doors in the external wall, to meet the requirements of BS 6644 and HTM 03-01.

Secondary heating circuits shall incorporate twin head, variable speed circulating pump sets sized to suit the load requirements; with the secondary pumps provided complete with inverter speed controls. The primary heating circuit shall have a single head pump for each boiler and operate via a time channel on the controls system, with the primary pump sets operating on a constant speed basis.

The secondary circulating pumps shall operate via independent time channels on the controls system, and shall each operate on their constant pressure characteristics to match the prevailing load conditions. Pump sets are to be provided with isolating valves on both the suction and delivery connections. Pump

sets are to be provided with suitably calibrated pressure gauges on the suction and delivery side. Secondary pump sets are to be located on the flow infrastructure.

A new pressurisation set and dirt and air separator shall be provided to serve the heating system.

LTHW pipework within classrooms shall be ventureclad (or equal and approved) in a colour to be specified by the architect.

All necessary valves, strainers, actuators, sensors, and gauges for control and maintenance shall be provided as required. Fixed orifice venturi type commissioning sets and/or pressure independent control valves shall be installed in suitable positions to provide adequate flow control. Isolating valves shall be provided to permit each zone to be isolated separately and easily accessible. Drain valves shall be provided to allow each zone to be fully drained.

Pipework shall be heavy grade black mild steel to plant rooms and risers, and medium weight black mild steel elsewhere. The pipework shall be installed in accordance with the manufacturers' recommendations. Installation shall be undertaken by manufacturer trained and certified operatives. Carbon Steel pipework shall not be utilised.

The Contractor shall allow for system expansion using loops, anchors and/or bellows as necessary. All necessary flushing loops, bypass pipes and valves shall be provided to facilitate flushing of the system in accordance with BSRIA Application Guide 1:2004.

After successful completion of the pressure test and prior to any commissioning taking place for each phase, flushing of the LTHW distribution system shall be undertaken in accordance with BSRIA Application Guide 1:2004, and re-filled. During filling corrosion inhibitor and biocide is to be injected into the system, to prevent corrosion and pseudomonas bacteria proliferation and tested on completion for compliance of concentration.

All heating distribution pipework shall be insulated and labelled, as specified within this specification. All services pipes must be concealed.

Access panels shall be kept to a minimum but where necessary for access to systems fittings the contractor shall confirm to the Architect the location access panels required.

All heating system components shall be provided with all necessary sound and vibration control equipment.

There shall be no exposed pipework serving radiators, all pipework boxed in to architects detail. Where boxing in is required, the boxing in system shall be tamperproof, of durable quality to allow regular removal for maintenance and cleaning and approved by the architect. The Contractor shall allow for taking down and refixing each radiator twice for the convenience of other trades making good wall surfaces.

All services must be identifiable and be provided with direction of flow indication in accordance with the requirements of the relevant British Standard.

TRACE HEATING

Trace heating shall be provided on all external water carrying pipework. The trace heating system shall comprise all necessary heating cables, thermostatic controllers, line sensors, adapters etc. The system shall be installed in full accordance with the manufacturer's requirements.

The Product shall be supplied and delivered by Tyco Thermal Controls (UK) Ltd of Tyne & Wear (Tel. 0800 969 013), or equal and approved.

Frost protection trace heating circuits shall be controlled and monitored via an on-line sensing thermostat. A line sensing control unit should be part of an integrated frost protection system for pipes in order to switch power on in freezing conditions.

The thermostat shall be of an electronic programmable type known as RAYSTAT-CONTROL-10 as manufactured by Tyco Thermal Controls, or equal and approved.

The controller must have the following functions:

- Adjustable Hysteresis
- High and low temperature alarm function
- Digital display
- Capacity for Off-site programming without external power supply.
- 25 amp switching capacity rating.
- Sensor failure alarm
- Voltage failure alarm
- Selectable fail safe mode, either ON or OFF
- Alarm relay for remote controls monitoring
- System error codes for quick diagnostic of system failure.

All pipework with trace heating applied shall be suitably labelled to indicate risk of electric shock.

All valves shall be insulated by proprietary valve jackets.

65-10-95 Ventilation systems

110 Natural ventilation system

In general, classrooms, library and the staff room shall be ventilated by Breathing Buildings (or equal and approved) NVHR units.

The contractor shall supply, install, test, commission and set to work the entire NVHR systems. All units shall be the NVHR+ units which incorporate a heater battery

The weatherproof external louvres and insulation boarding adjacent to windows shall form part of the window construction and will be supplied and installed by others to provide a weather tight building. The Contractor shall install an insulated ductwork sleeve to connect the NHVR unit to the top louvre and insulation board assembly between the supply and extract sections of the ductwork to the NVHR unit and in the louvre. The Contractor shall liaise with the Main Contractor and the Architect to discuss the detailing of the fixing arrangement

The NVHR units shall be hung by steel drop rod hangers securely bolted to the fixing brackets on the unit.

Each space is designed to meet the ventilation and overheating criteria of PSBP FOS & BB 101. The ventilation system has been designed to be capable of achieving a daily average CO2 concentration of no more than 1000ppm and has the capability of boosting to 8l/s/person at any time.

Each unit shall include the following; insulated damper; two low energy internal mixing fans, heater battery, outlet grille and an integral controller.

In winter the NVHR units shall be used for fresh air intake and exhaust. The unit shall mix the incoming cold air with interior air, using low energy fans, prior to the fresh air entering the occupied space in order to minimize the risk of cold draughts. NHVR+ unit shall incorporate a heater battery section.

In summer the space will primarily operate as a buoyancy-driven natural ventilation system, with provision for automatic fan assistance when required. The natural ventilation system shall operate in tandem with the opening windows (supplied and installed by the Main Contractor) and these are sized to work in conjunction with the NVHR unit for summer operation.

During the summer the units shall perform a night time pre-cool of the space via natural ventilation.

Each room where the NVHR+ units are installed shall be automatically controlled via the manufacturers own controller, user interface and combined temperature and CO2 sensor. The controller shall be mounted on the unit. The user interface and sensors shall be wall mounted in the classrooms typically adjacent to the light switch. Generally, 2 No. NVHR units are installed in a single room and the controls shall be configured to operate the 2 No. units in a Master/Slave arrangement.

The user interface shall indicate to occupants when the manually operated windows should be opened/closed.

NVHR+ units shall be installed as shown on the Tender Drawings. The NVHR+ units incorporate an LPHW heater battery section. The units shall be mounted at high level within the occupied spaces. Each unit shall have 15mmØ LPHW connections on the side of the unit. The units can be manufactured in a left or right handed configuration as shown on the Tender Drawings.

The manufacturers own controls and user interface shall be installed (1 per room). The user interface shall incorporate a boost function, disable function, open louvre indicator and +/- 3°C temperature set point dial.

The Contractor shall supply a PICV valve, as per the Heating Installation Section of this specification and as shown on the Tender Drawings. The manufacturer's own central control panel shall be installed in the plantroom. The control panel shall provide a control signal (0- 10V) to provide modulating control of the PICV valves serving the heater batteries.

130 Mechanical ventilation systems

The Contractor shall supply, install, test, commission and demonstrate the mechanical ventilation systems as set out within this specification and as described on the drawings/equipment schedules.

MVHR01

A number of rooms as shown on the drawings and schematics shall require mechanical ventilation due to their internal location or limited window openings. These shall be served by an MVHR unit which shall supply and extract from the room in accordance with the requirements of the overheating strategy report.

The MVHR mechanical ventilation system shall be complete with high efficiency heat recovery, electric heater battery, attenuators, manufacturers own controller with BMS interlink and attenuators to achieve the required acoustic conditions within the rooms.

The MVHR shall be roof mounted and suitable for external installation.

MVHR02

The activity studio shall be mechanically ventilated via an MVHR system which shall supply the hall via high level swirl diffusers

The MVHR mechanical ventilation system shall be complete with high efficiency heat recovery, electric heater battery, attenuators, manufacturers own controller with BMS interlink and attenuators to achieve the required acoustic conditions within the rooms.

The MVHR shall be roof mounted and suitable for external installation.

The MVHR shall be controlled by CO2 and temperature and shall have a local wall mounted controller to provide override and control of the electric heating.

AHU01

The main hall shall be mechanically ventilated via a roof mounted air handling unit, providing high level supply and extract, incorporating a DX refrigerant coil for heating and cooling and shall be as specified on the AHU schedule.

The supply air shall be distributed at high level level via swirl diffusers and extracted at high level.

The AHU shall have a mixing box section. Upon start up the AHU shall mix cold incoming air with return air. As the return air warms up and more heat is recovered, greater percentages of outside air shall be mixed with the return air as is required by the CO2 monitoring. This is to ensure that the DX coil does not have air of less than 12 degrees passing over it. The local temperature controller shall also ensure that the main hall does not drop below 12 degrees to ensure that the return air temperature is suitable for the DX coil.

A BMS outstation shall control the AHU which shall be controlled via CO2 sensors and shall ramp down supply and extract when not required.

A simple wall mounted controller shall be provided within the activity studio to allow a time limited override of the control of space temperature.

WC ventilation

Dirty extract ventilation systems shall remove vitiated air from all WC's/Cloak room spaces and shall be complete with all necessary components to provide a fully operation systems.

Vitiated air shall generally be removed from each space via a low pressure duct system, complete with fire dampers (if required), volume control dampers, and terminal grilles/diffusers/valves.

Make up air shall be drawn from adjacent spaces.

The dirty extract systems shall be controlled by a local PIR and shall generally run in 'boost' mode when any WC area is occupied, and set back to 'trickle' mode when all WC areas are unoccupied.

General requirements

Intake and exhausts shall be 10m apart in accordance with the requirements of BREEAM.

All ductwork shall be insulated in accordance with the building regulations.

Air exhaust and intake shall be via weatherproof louvres and shall be coordinated with the Architect's specification. Intake and exhausts shall be 10m apart in accordance with the requirements of BREEAM.

The supply and extract systems shall shut down in the event of a fire alarm, and restart automatically upon clearance of the fire alarm.

Access panels shall be kept to a minimum but where necessary for access to system fittings the contractor shall confirm to the Architect the location access panels required.

All systems shall be complete with all necessary system components including, but not limited to, fire dampers, smoke dampers, motorised control dampers (volume and shut off), regenerative noise attenuators, in duct attenuators (supply/extract) and cross-talk attenuators (where required between noise sensitive rooms), heater batteries terminating in grilles or diffusers, as necessary.

All ductwork shall be constructed and installed to HVCA classification 'A' (low pressure up to 500Pa), and pressure tested to class 'B' standards.

All kitchen supply and extract ductwork shall be constructed and installed to HVCA classification 'B' (medium pressure), and pressure tested to class 'B' standards.

Ductwork cleanliness shall be in accordance with the requirements PDI level 2 of HVCA TR/19. Cleanliness to be verified and completion report issued in accordance with Section 9 of HVCA TR/19.

Access panels for inspection purposes to be installed in accordance with Table 1 of HVCA TR/19. Access panels for cleaning to be installed in accordance with Table 2 of HVCA TR/19 and the requirements of DW 172 for kitchen extract systems.

Volume control dampers shall be installed at each branch on the ductwork distribution systems, and as indicated on the drawings. Each volume control damper shall have an associated access door for inspection purposes. Volume control dampers shall have rectangular or circular spigots and be sized to match adjoining ductwork. Volume control dampers shall have aerofoil section opposed blade dampers with external blade position indicators.

Fusible link activated fire dampers shall be provided wherever ductwork passes through fire sub-compartment walls, ceilings and floors. Fire dampers shall have rectangular or circular spigots, be sized to match adjoining ductwork and be complete with installation frames for building into brick/block wall structures or wall plates or installation in stud partition walls. All dampers shall be installed in accordance with the manufacturer's recommendations and DW144.

Fire dampers and installation frames shall be incorporated within the appropriate ductwork so that they are positioned mid-way through the enclosing fire compartment wall or floor slab. They shall be grouted into the wall or floor slab.

An access door shall be provided on one side of the damper of a size at least 400 x 400mm, placed on the bottom or side of the duct where the damper is built into a vertical wall. If the size of the duct is less than 425mm on width dimension, then access doors at least 150 x 300mm shall be fitted either side of the fire damper. Similarly, for fire dampers built into floor slabs, the same positions for access doors shall apply, except the doors shall be positioned nearest the fusible link. The position of all access doors shall enable the fusible links to be replaced at a later date. All fire dampers shall be fully compliant and fire rated in accordance the relevant British Standards.

Generally, insulated flexible ductwork shall be used to make final connections between rigid ductwork and spigot connections of grille boxes and to give some tolerance of grille positions in the ceiling grid. Flexible ductwork shall not be used to achieve changes in ductwork direction. Excessive lengths of flexible ductwork shall not be permitted and the maximum length used shall not exceed 600mm.

Flexible ducting shall be clamped to the spigot of the plenum boxes of diffuser using a worm drive type hose clip complying for diameters up to 150mm and a band clip for diameters of greater than 150mm. The clamp and flexible ducting shall be properly taped to make a complete seal. Suitably sized access panels shall be provided adjacent to dampers and generally throughout the system to facilitate inspection and cleaning, as described within DW/144.

The commissioning of the supply and extract ventilation system shall be carried out by a Specialist Contractor in accordance with the requirement specified elsewhere within this specification.

The Contractor shall include for the provision of any necessary noise treatment equipment, in order to ensure that both in-duct and breakout sound levels from ventilation systems (including roof-mounted air handling plant) and condensers/heat pumps do not exceed the internal and external noise level requirements stipulated elsewhere within the Employers Requirements.

AIR HANDLING UNIT SPECIFICATION

All air handling units shall be fully compliant with required SFPs and ERP 2018.

The casework of air handling unit shall be constructed from an aluminium Pentapost frame with 50mm double skin insulated panels.

The AHU shall be complete with all components as detailed in the AHU schedule.

Air handling units shall be provided with adequate access sections and viewing points to facilitate inspection and maintenance. Internal inspection lighting shall be provided, switched externally.

The AHU shall incorporate direct drive high efficiency backward curve fans with EFF2 efficient motors suitable for inverter control.

The fan/motor sets shall be isolated from the casework via anti-vibration isolators and a flexible

connector. Fresh air intake and exhaust motorised dampers shall be provided, which shall automatically close when the system is not operational. All AHUs fans shall be provided with inverters or speed controllers respectively. Fans shall be selected to provide a minimum of 10% spare capacity.

In-duct noise levels shall be reduced through the provision of suitable duct-mounted supply and extract and attenuators, in order to achieve the required sound levels internally.

The AHU shall be controlled by the BMS

THERMAL INSULATION AND IDENTIFICATION

The contractor shall employ an insulation specialist to provide insulation and identification services. The insulation shall be of foil backed phenolic foam. Insulation shall be applied and fixed strictly in accordance with the manufacturers recommendation. The insulation shall be installed to all supply ductwork throughout and to all extract ductwork to heat recovery units.

External ductwork and internal exposed ductwork shall be finished using Venture Clad jacketing system. The jacketing system shall be suitable for the service insulated and ambient conditions (- 20°C to +45°C). The jacketing system shall be applied strictly in accordance with manufacturer's recommendations in order to affect a minimum 10 year guarantee. Jacket system colour and finish to be agreed with CA prior to installation.

The contractor shall provide adequate notice to the CA to allow inspection of services prior to insulation being applied. All services must be identifiable and be provided with direction of flow indication in accordance with the requirements of the relevant British Standard.

160 Kitchen ventilation system

Supply, install, test, commission, demonstrate and set to work the entire complete system as set out within this specification and as described on the drawings/equipment schedules for the kitchen ventilation system.

AHU02

The kitchen shall be ventilated by a dedicated supply and extract AHU. This shall be situated on the roof and be complete with duct mounted attenuators.

The kitchen shall have a dedicated kitchen ventilation control panel and shall be interlocked to prevent operation of the kitchen equipment and appliances without the air flow of the ventilation being proved.

The kitchen supply air shall be heated by LTHW frost and reheat coils as specified on the schedules. The kitchen extract fan shall be a bifurcated out of air stream fan.

Supply and extract shall be ducted to the canopy with the remainder of the supply air supplied via perforated face diffusers to the kitchen and kitchen office and extract from the servery and dishwasher canopy.

Dry Store supply fan:

A supply fan complete with matched attenuators, electric heater battery and manufacturers local wall mounted control panel shall be installed to serve the new dry good store within the kitchen on Level 01. The fan shall initially be controlled to run continuously. The intake shall be via a louvre to the window of the dry store. A suitably sized plenum shall connect to the louvre.

See section 60-10-95/130 for additional general requirements.

65-70-45 Local air conditioning systems

110 Room air conditioning system

Supply, install, test, commission, demonstrate and set to work the entire complete system as set out within this specification and as described on the design intent drawings for the refrigerant based air source heat pump heating and cooling system.

Refrigerant based direct expansion inverter driven heating and cooling systems shall be provided to wall mounted units providing cooling to the IT room and the cooling/heating coil in the AHU.

The IT room shall comprise of a single outdoor condenser on the roof of the building, 1 no wall mounted unit, associated pipework and a single wall mounted controller. The IT room cooling system shall have a run/fault link to the BMS via 3 and 5 way adapters. The DX unit shall operate under the dictates of the wall mounted local controller within the IT room.

The cooling and heating coil in the AHU, external condenser and necessary interfaces shall be provided by the AHU manufacturer. The controls shall be via the BMS

All DX pipework shall distribute and be supported on containment tray.

Refrigeration equipment shall be provided by Mitsubishi Electric, or equal and approved.

REFRIGERANT HEAT PUMP SYSTEMS

Indoor wall mounted units shall be complete with all necessary accessories, including condensate pumps, controls and BMS interface for fault/enable. Air filters shall be incorporated within the units and shall be mould resistant washable resin net type.

The outdoor unit shall have inverter driven compressors, electronically controlled and capable of changing speed linearly to follow the variation in cooling or heating requirements. All external condensers shall be provided with a function for night time set back with reduced sound pressure levels.

Interconnecting refrigeration pipework shall be distributed internally within service risers and ceiling voids as shown on the design drawings. The systems shall operate on R32 refrigerant as specified on the schedules. The systems shall be of the reverse cycle heat pump type, and shall be capable of cooling and heating at external ambient temperatures down to -20°C. The equipment manufacturer shall be responsible for the manufacture of the compressor, refrigerant oil and refrigerant used within the system to maintain integrity of design and optimise efficiency and reliability of equipment. The system shall be capable of maintaining a minimum 30% of its heating duty during coil defrost cycles during low ambient conditions.

REFRIGERANT PIPEWORK

The interconnecting refrigerant piping shall be manufactured from seamless quality phosphorous dioxide soft/medium drawn copper to the relevant standards, fully tested by the eddy current method, dehydrated and capped. The copper tubing shall be of a suitable thickness to be capable of withstanding pressure test as detailed in the relevant British Standard.

The copper tubing shall be suitably selected with a wall thickness capable of withstanding the system operating pressures on Refrigerant R32.

Pipework shall be supported and secured at regular intervals not exceeding 1.5m. Piping should be laid on suitably supported galvanised cable tray, insulated and held in position with plastic coated steel banding. Due care and attention shall be taken at all times to allow pipework to freely expand and contract naturally.

REFRIGERANT PLANT AND PIPEWORK INSTALLATION

The fixing of all direct expansion heat pump equipment, installation of all refrigerant pipework and full commissioning shall be performed by a specialist refrigerant installer who shall be authorised to install the manufacturers equipment (certificate of approval must be submitted to CA prior to commencement on site).

The installation of all internal and external units, refrigerant pipework, inter-connecting wiring,

commissioning and testing shall be carried out by an approved refrigerant systems installer. Pipework shall be in accordance with the relevant British Standards, and in accordance with the manufacturer's design and installation instructions and the unit's installation manual.

Brazing shall be carried out by skilled operatives, in accordance with the HVCA Code of Practice 'Brazing and Bronze Welding of Copper Pipe and Sheet'. During brazing, oxygen free nitrogen shall be passed through the pipework to displace oxygen and ensure that oxidation does not occur.

Longest possible lengths of copper pipe shall be utilised to minimise joints on site.

Appropriate refrigerant tools shall be utilised at all times. The use of hacksaw or any tool that creates filings is prohibited.

Pipework shall remain capped at all times other than when actually being installed to prevent the ingress of moisture and contaminants.

COMMISSIONING AND TESTING OF THE REFRIGERATION SYSTEM

Commissioning shall be carried out by a trained Engineer, and certified by the manufacturer. The entire refrigeration system shall be pressurised with Nitrogen to 38 bar for a period of 24 hours. Leak testing shall be carried out with a calibrated electronic leak detector, or similar if the system fails to hold pressure within testing period.

Upon completion of pressure test the pressure shall be released and vacuum pump installed on the system to remove air and moisture from the system. The system shall be evacuated to – 101.1kPa (- 758mmHg, 2 torr) and held for a period of 2 hours with the vacuum pump switched off. Refrigerant should be charged to the liquid pipe in its liquid state to ensure that the refrigerant composition is assured. The refrigerant charge shall be calculated to the system requirements and in accordance with manufacturer's Design and Installation instruction booklet.

THERMAL INSULATION AND IDENTIFICATION

The Contractor shall employ an insulation specialist to provide insulation and identification services. The insulation shall be of phenolic foam, mineral wool or nitrile rubber type, and shall achieve a BRE Green Guide to Specification rating of A+ wherever achievable, and be BRE Guide BES 6001 compliant.

Insulation thickness shall be in accordance with the TIMSA -HVAC Compliance Guide.

Insulation shall be applied and fixed in strictly in accordance with the manufacturer's recommendations. All valves and fittings shall be provided with suitable insulating jackets.

External pipework and ductwork shall be finished using Venture Clad jacketing system. The jacketing system shall be suitable for the service insulated and ambient conditions (- 20°C to +45°C). The jacketing system shall be applied strictly in accordance with manufacturer's recommendations in order to affect a minimum 10 year guarantee. Jacket system colour and finish to be agreed with CA prior to installation.

The Contractor shall provide adequate notice to the CA to allow inspection of services prior to insulation being applied. All services must be identifiable and be provided with direction of flow indication in accordance with the requirements of the relevant British Standards.

70-50-45 Low voltage site connection systems

110 Incoming low voltage electricity supply

A new Scottish & Southern Electric (SSE) low voltage supply shall be extended from the local infrastructure. The low voltage supply shall terminate within the ground floor plant room.

The new low voltage electricity supply shall be routed below ground and enter the plantroom from below

ground.

A SSE service head cut-out devices, CT chamber and electric meter equipment shall be provided within the plantroom to terminate the low voltage supply.

The Main Contractor shall be responsible for applying and coordinating with the local supply authority (SSE) for the installation of the main low voltage supply in accordance with the main construction programme.

In accordance with the local supply authority (SSE) standards, the Main Contractor shall provide all cable trenching, installation of below ground cable ducts and cable pits in accordance with the local supply authority (SSE) specification requirements, and as described in the NJUG recommendations.

Where cable ducts are required to turn, or where cable lengths exceed 100 metres, dedicated cable pits shall be installed in accordance with the local supply authority (SSE) specification. Where cable ducts cross carriageways, the Main Contractor shall install the cable ducts in accordance with the local supply authority (SSE) specifications.

All cable ducts shall be a 150mm (minimum) internal diameter and shall be installed with 2 number draw wires per duct.

A 140kVA low voltage power supply shall be provided for the School development. The local supply authority (SSE) shall provide a 185WC 400/230v 3Phase 4 wire with a TN-S earthing arrangement up to their cut-out device located within the plant room. From the cut-out a private 4 core LV cable (with separate earth) shall terminate within the main LV switch panel.

The Contractor shall supply and install all metering requirements for the School development in accordance with the local supply authority (SSE) metering specification requirements.

70-65-60 Photovoltaic systems

110 Grid connected photovoltaic system

The Contractor shall supply, install, test and commission a photovoltaic system. The specialist PV contractors shall be a 'Microgeneration Certification Scheme' (MS) approved.

The PV panel array shall be located on the roof, mounted on suitable pitched frames and mounted facing south/south-west.

The PV panels shall be a minimum mono crystalline technology and shall incorporate the necessary DC switch units, DC cabling, Inverters, AC isolators and applicable G99 or appropriate protection relays mounted within a suitable enclosure.

The Contractor shall supply, install, test and commissions remote display unit to indicate the amount of electricity generated by the PV array.

The Contractor shall be responsible for all works associated with integrating the PV system with the building supply and for all works associated with registering the PV system with a G99 meter.

The Contractor shall be responsible for the completion and submission of all relevant forms, associated with registering the PV system.

This is a performance specification for the provision of a PV installation and therefore the following represents the performance criteria to be met by the contractor through development of a detailed design and installation;

PV array to provide minimum target outputs of;

-103,921kWh/annum
-21kWp

The drawings provide an indicative layout and configuration, the contractor shall compile their own detailed design and submit for review by the project team, in accordance with these specification requirements.

Individual panels shall be interconnected in series to form PV 'strings' with individual strings linked to invertors in parallel to form PV arrays.

The PV installation shall comprise a single array located on the roof of the new building as shown on the drawings.

The combined PV installation shall achieve as a minimum the requirements defined herein, in particular the minimum target annual and peak rating output. The target output is linked to the overall building performance and compliance with Building Regulations requirements. The overall target output from the PV installation must therefore not be reduced from the target output identified above.

The new PV array shall be installed onto proprietary framing systems to allow mounting and securing in accordance with the PV panel manufacturers requirements. The contractor shall select the final configuration to suit the quantity and arrangement of PV panels.

The contractor shall install all associated containment for the PV array to allow routing and distribution of AC and DC cabling from the PV panels to the relevant inverter units and PV main distribution board located at roof level.

All containment routed externally at roof level shall be mounted using the proprietary mounting systems noted above and compatible with the roof finish/construction. Containment shall be routed along the rear of the PV panels and mounted to the base section of the PV mounting frames.

The contractor shall apply suitable warning notices and identification to all DC containment systems and wiring to clearly indicate the hazard and their presence within the building.

PV panels shall be mounted in a landscape configuration onto the pitched roof area which is inclined at an angle of inclination 30° from horizontal.

Install a contactor arrangement at the PV distribution board to provide isolation in the event of emergency power isolation of the building normal power supply (by the emergency services). Provide 4 pole contactor at the PV distribution board, N/O type. Contactor coils shall be powered from a suitable radial circuit derived from a local supply at roof plant room level.

When power to the building is energised, the contactor shall be closed and allow power transfer from the PV distribution board to the main LV switchpanel. When normal building power supplies are isolated in the event of an emergency, the contactor shall open and isolate power distribution from the PV distribution boards.

The contactor coil supply shall also be controlled via fire alarm interface unit, to isolate the coil supply and hence open the contactor in the event of fire alarm operation.

Contactors shall be mounted within enclosures adjacent to the PV distribution board, clearly labelled as to their purpose.

G99 relays are to be provided within the main LV panelboard at ground level, to allow synchronization of the PV supply with the main incoming power supply and the exportation of energy if/where a surplus of energy is produced via the PV array.

The contractor shall include for attendance as necessary for the DNO to attend site to witness correct operation of the G99 installation.

System warranties are to be provided with the installation. In addition to the project 12 month warranty, a 10 year warranty shall be provided for the PV panels/array.

During the installation testing, commissioning and demonstration, in addition to the regular testing and demonstration, the contractor shall demonstrate correct operation of the G99 relay installation and demonstrate that the PV array meets (or exceeds) the minimum target output.

The contractor shall clearly record all results within the O&M documentation.

70-70-25 Earthing and bonding systems

110 Earthing and bonding system

The Contractor shall supply, install, test and commission a complete earthing and bonding system.

A complete earthing and bonding system, for the building shall be provided in accordance with the requirements of BS7671 and BS7430.

The DNO shall provide the main incoming earth to the building via a TN-S supply.

The main power distribution earth bar shall be located in the plantroom alongside the main LV panelboard.

The earth bar shall typically enable the following, but not limited to:

- Main circuit protective conductor
- Incoming water pipework
- Incoming gas pipework
- Ventilation ductwork
- Heating circuit pipework
- Cable containment
- Structural steelwork
- Lightning protection system
- Roof mounted external metallic equipment

70-70-40 Inspection and testing low voltage electrical installations

130 Inspection and testing of existing electrical installations

New low voltage electrical installations and additions or alterations to an existing low voltage electrical installations shall be tested in accordance with BS 7671.

70-70-45 Low voltage distribution systems

110 Low voltage distribution system

OVERVIEW

LV DISTRIBUTION SYSTEMS

The Contractor shall provide 1 No. LV main panel board installed in the plant room on the ground, as shown on the drawings.

The Contractor shall supply, install, test and commission a dedicated LV panelboard. The main LV panelboard shall provide dedicated power supplies to the following:

- Disabled refuge panel
- Fire alarm panel

- Kitchen distribution board
- Plant room distribution board
- 2 x Ground Floor power & lighting distribution boards (split board)
- 2 x First Floor power & lighting distribution boards (split board)
- Lift supply
- Mechanical control panel
- PV installation

Spare capacity on the panel boards of 20% shall be provided on both the main LV switch panel for future MCCB connections.

The main LV supply cables shall enter the plant room at an agreed location and coordinated with SSE.

The main LV panelboard shall incorporate a dedicated cabling gland section in which the 4 core XLPE/LSF/SWA Cu cables can be terminated within the panel.

The Contractor shall ensure that the intake cables shall be installed in accordance with the cabling manufacturers bending radius requirements.

The new LV panel board shall incorporate the following:

- Power factor correction
- Digital electrical meter

The Contractor shall verify the physical sizes of the various switchboards and co-ordinate room layouts with mechanical installations.

All outgoing supplies from the Main LV panelboard shall comprise of XLPE/SWA/LSF cabling, routed throughout their length on cable basket or tray systems. Cabling shall be routed via building voids and electrical risers to serve floors via sub main and final distribution equipment as noted on the schematics.

The contractor shall install fire rated sub main supplies to life safety equipment shown on the schematic. Sub mains to life safety equipment shall be routed on cable basket/tray throughout their length.

The contractor shall install sub main supplies to the new lift installations as noted on the schematics.

Sub mains shall be as specified previously, comprising multicore XLPE/SWA/LSF cabling on cable basket/tray. The contractor shall terminate lift supplies into a wall mounted isolator positioned adjacent to each lift control panel. Final position of the lift power supplies shall be coordinated between the electrical contractor and the lift installer.

Final connection to the lift control panel shall be made by the lift contractor, although the electrical contractor shall include for attendance as necessary to complete this activity.

All sub main protective devices from the main LV panelboard shall be MCCB's as described on the associated drawings/equipment schedules.

The Contractor shall ensure the main LV panelboard and all protective devices within the main LV panelboard are from the same manufacturer.

The main incoming protective device shall be a moulded case circuit breaker with adjustable overcurrent, short circuit and restricted earth fault protection. The Contractor shall be responsible for the discrimination and settings of the breaker in accordance with the outgoing main supply protective device located within the main LV switchboard.

The main LV switchboard shall be equipped with a transient voltage surge protection unit. The surge protection unit shall be categorised as a type 'C'.

The main LV switchboard shall be equipped with a detuned harmonic/power factor correction unit.

Indicator lamps shall be provided on all phases indicating healthy status for the main incoming supply.

METERING

The Contractor shall install EDM1 electronic smart meters within the panel board on all outgoing ways.

DISTRIBUTION BOARDS

The Contractor shall supply and install new TP&N split meter distribution boards. The boards shall be located within as detailed on the drawings. The final sizing shall be as generally indicated on the LV schematic and schedules.

Circuits shall be provided with RCBO devices where required, in accordance with the requirements of the relevant British Standards.

The distribution boards shall be equipped with a transient voltage surge protection unit. The surge protection unit shall be categorised as a type 'C'.

The split distribution boards (with sub-metering) shall be utilised to serve all lighting and small power (based upon a zones) and mechanical services and specialist equipment.

A spare capacity of 25% shall be provided at all distribution boards for future use. The electrical installation shall be in accordance with the relevant British Standards.

70-70-75 Small power systems

110 Hard wired low voltage small power system

OVERVIEW

SMALL POWER INSTALLATION

The Contractor shall provide a network of small power accessories incorporating switched single and double socket outlets, switched/unswitched fused connection units, single phase commando units and single and three phase isolators.

The contractor shall install small power installations from the final distribution boards noted on the schematic and drawings and defined within the relevant schedules.

All circuits shall generally be wired as ring circuits with 32A RCBO's unless otherwise stated. Small power circuits shall be wired in a minimum size of 2.5mm².

Accessories within all areas except plantroom shall be finished in white or grey plastic unless otherwise stated.

All accessories shall be selected to ensure compliance with Part M of Building Regulations in respect of contrast with background.

Outlets on the teacher wall in classrooms will be installed within a dado trunking system. The 'hockey stick' arrangement is specified with the Kier Workplace solutions specification.

Socket outlets installed within the plantroom areas shall be surface 'Metalclad' type.

High integrity earthing socket outlets shall be provided on circuits where computers will be in general usage (e.g. server room, admin office, staff work room). This shall be achieved by using accessories with two earth terminals and with the earth ring conductors separately terminated at the distribution board such that failure of any one cable will not result in the total loss of the earth connection at the outlet.

Cleaner's socket outlets shall be provided in circulation areas (based on coverage of maintenance equipment on 10m leads) and individual rooms. All outlets provided for cleaner usage shall be engraved cleaners socket.

Fused connection units shall be provided (where required), typically for the following items of equipment as detailed on the drawings:

- Refrigerators
- Door access controllers
- Local extract fans and NVHR units
- Local water heaters/boilers
- Dishwashers and washing machines

Water heaters/boilers of 3 KW and above should be fed by separate radial circuits.

Electrical supplies and connections to all Mechanical plant items shall be provided as detailed and in conjunction with mechanical Contractor's requirements.

Fused connection units for mechanical equipment and security systems have been indicated on the layouts. Coordinate with the specialist sub-contractors for final locations.

In locations serving hand driers (or other electrical equipment within WC areas such as WC alarms etc.), fused connection units shall be mounted at high level with wiring routed concealed within the building fabric using conduit and conduit box to the equipment to allow wiring to enter the rear of the equipment without being visible. Refer to the layout drawings (and architects setting out) for specific requirements.

Final locations and setting out of all accessories within visible and public locations shall be as defined by the architect.

Final locations and setting out of power supplies within the kitchen to be agreed with kitchen specialist.

CONTAINMENT SYSTEMS

Any new cable containment systems shall be installed in accordance with the relevant British Standards and in conjunction with manufacturers approved installation requirements.

A network of cable trays, cable trunking and cable basket shall be provided within the ceiling voids and risers for the following:

- Lighting and small power cabling
- Telecom/data/ structured cabling
- Fire alarm cabling
- Mechanical controls cabling
- Sub main cables

All sub-main distribution cabling shall be secured on the cable tray system via manufactured cable cleats.

Where multi cables are installed approved manufacturers cable fixings shall be installed.

The Contractor shall be responsible for the co-ordination of all electrical services in conjunction with other sub-Contractor installations throughout the installation.

Where cable containment systems break through dedicated fire barriers the Contractor shall be responsible for maintaining the fire integrity via installing a fire barrier that meets the proposed fire barrier resistance.

The contractor shall provide all containment systems comprising of cable tray, cable basket, trunking and conduit systems to form a complete installation.

Refer to the accompanying drawings for proposed containment types, sizes and routes.

The contractor shall note that great care shall be applied in the installation and routing of all services, containment, equipment and devices.

The contractor shall note that individual conduit locations and routes are not detailed on the drawings and are the responsibility of the contractor to determine within their working drawings.

Sub main cabling and distribution shall be run on galvanised cable tray or basket.

Final circuit wiring shall generally be routed using trunking and conduit systems.

IT wiring systems shall be run on galvanised cable basket.

ELV wiring shall be routed on galvanised cable tray or basket.

The contractor shall agree fully co-ordinated (with other trades) final containment routes and details with the project team prior to installation.

The contractor shall ensure the continuity of all containment systems and shall provide continuity links at each joint position.

All of the trays/trunking/basket shall be sized to allow for the number and type of cables installed with minimum of 20% spare capacity. They shall be co-ordinated with other services in the voids to provide an easily accessible system on completion.

Groups of 6 or less cables running between the primary containment routes and the outlet positions shall be clipped directly to the building fabric, using industry recognised fixing clips and ties. Groups of 6 or more cables shall be clipped to secondary cable tray/basket/trunking.

All new conduits shall be high impact galvanised conduits with a minimum size of 20mm.

All builders work holes shall be agreed and coordinated with the Architect and Structural Engineer.

CABLING

The Contractor shall install, test and commission the distribution of all sub main and final circuit cables shall utilised the new and existing containment systems provided.

The following cabling standards shall be incorporated;

- Sub-main circuits shall be steel wired armoured, multi core cable (XLPE/SWA/LSF) on galvanised steel cable trays.
- Fire alarms and disabled refuge circuits shall be Firetuf Plus enhanced OHLS cabling with red outer sheath on galvanised steel cable baskets/trays.
- Small power and lighting circuits to be single core LSF insulated cabling in trunking and conduit systems.

All cables shall be obtained from BASEEC licensed supplier.

70-80-25 External lighting systems

120 Amenity lighting system

Supply, install, test, commission, demonstrate and set to work the entire complete system as set out within this specification and as described on the drawings/equipment schedules for the Amenity lighting system in accordance with the specification and drawings.

The external lighting installation shall provide lighting levels to enable for safe movement during the hours of darkness along main pedestrian routes and security to discourage vandalism.

The external lighting installation shall be in accordance with the requirements of the relevant British Standards, CIBSE Lighting Guide 6 'The Outdoor Environment', CIBSE Publication 'Lighting the

Environment: A Guide to Good Urban Lighting', 'Secure by Design' Guidance, and BS5489 Part 1:2013+A2:2008.

The control of the external lighting shall be via time clock with manual override located adjacent the External distribution board.

The luminaires shall be positioned to minimise light pollution and visual discomfort building users in accordance with the 'Dark Skies' principles.

The final locations of luminaires shall be coordinated with the Architecture and landscaping scheme.

The MUGA will be accessible to the community outside of school hours. Control of these lights is from and IP65 rated manual switch with a timer. 5 minutes prior to the timer running out and turning the lights of the MUGA lighting will dim to 50% but can be reset by pressing the manual switch.

The MUGA lighting will still be controlled by the overall time clock located adjacent to the External distribution board.

70-80-35 General lighting systems

110 Hard wired general lighting system

LUMINAIRES

The lighting installation and proposed illumination levels shall be in line with the aesthetic appearance required for each area, and shall be in accordance with the following:

- a) SLL Code for Lighting 2012
- b) SLL Lighting Guide 03 The visual environment for display screen use
- c) SLL Lighting Guide 05 Lecture, Teaching & Conference Room
- d) SLL Lighting Guide 07 Internal Lighting.

The contractor shall supply and install lighting, wiring and associated controls as defined on the accompanying drawings.

Refer to the luminaire schedule for details of all luminaires, which comprise a mix of surface mounted and suspended luminaires within areas without exposed slabs and recessed luminaires within areas provided with ceilings.

All luminaires shall be provided complete with all lamps, louvres and accessories.

LED Lamps have been selected with high frequency ballasts, a minimum colour-rendering index of 80 to 90 and a minimum correlated colour temperature (CCT) of 4000K unless otherwise stated.

Luminaires within classrooms, offices, LRC, group rooms, or any areas with retractable switches are dimmable.

Lighting circuits shall be wired in a minimum size of 1.5sqmm with protection by 6A type C MCB's. Light switches shall generally be finished white plastic, unless otherwise stated.

The minimum surface reflectance shall be based on CIBSE Lighting Guide; Ceiling 70%, Wall 50% and Floors 30%.

LIGHTING CONTROL

The Contractor shall incorporate automatic lighting controls to minimise energy consumption and utilise natural daylight where possible.

Lighting consumes significant amounts of electricity. In order to satisfy the requirements of Part L requirements, automatic lighting controls shall be provided which shall include the use of:

- a) Presence detection (automatic on and off, through use of PIR's, and adjustable time control)
- b) Automatic daylight dimming (automatic adjustment of perimeter internal lighting levels, dependent upon the amount of daylight penetrating into the internal space)

Lighting shall be connected to and controlled by multiple controllers which will be linked via IP to integrate to a single complete system. The automatic lighting controls shall be provided with local override control facilities where appropriate.

Classroom lighting is zoned to allow for occupant control. Zoning is in accordance with BREEAM New Construction 2018 where the teaching wall zone can be switched separately to the rest of the classroom.

Circulation corridor lighting control shall typically be automatic via occupancy sensors, standard or long range depending on the area of coverage required.

Manual control shall be provided to defined areas as indicated by the tender drawings.

WC areas shall be controlled from ceiling mounted presence detection to minimise energy use.

Stair case areas shall be controlled via presence detectors at each main landing level. Presence detection by any sensor will operate the stair lighting at all levels within the staircase.

Particular attention shall be given to the commissioning of the automatic lighting control systems.

Lighting level checks in all areas shall be carried out and documented as part of the lighting control systems commissioning.

The contractor shall coordinate the final position of all soffit mounted equipment and accessories and shall make appropriate inclusion for the detailed setting out. Reference shall be made to the Architects construction information at the appropriate time.

All wiring for lighting systems shall emanate from the relevant lighting final distribution board. Wiring to all lighting shall be via single core LSF insulated cabling in trunking and conduit systems.

Note that lighting to the new lift shaft, lift cars and within lift control panels shall be undertaken by the lift installation contractor.

EMERGENCY LIGHTING SYSTEM

An emergency lighting system shall be provided throughout the building in accordance with BS 5266-1 (2016) and BS EN 1838 (2013). In order to ensure escape routes and emergency provisions remain tenable even in the event of a mains power failure, emergency lighting luminaires incorporate minimum 3-hour duration battery packs.

Emergency lighting is provided in the following areas:

- All escape routes, staircases and internal corridors;
- Windowless accommodation and open plan areas of more than 60m²;
- Sanitary accommodation with a floor area in excess of 8m²;
- Electrical rooms, plant rooms and control panel locations;
- Refuge areas;
- The kitchen;
- The main hall and studio area.

Dedicated emergency escape and fire exit doors shall be provided with over-door 3 hour rated illuminated escape signs to comply with any Building Control requirements.

Emergency lighting shall be in accordance with the British Standard BS5266; Part 1 category M/3 and SLL Lighting Guide 12.

Ensure that all luminaires notated as emergency are Industry Committee on Emergency Lighting (ICEL)

approved whether detailed in the schedule of luminaires or not.

For the purpose of this specification the following emergency luminaire definitions apply:

- i) Defined escape route lighting. Design standard: 1 lux (min), operation in 5 seconds.
- ii) Open area (anti-panic area) lighting. Design standard: 0.5 lux (min), to defined areas, which excludes a border of 0.5m, operation in 5 seconds.

The types of luminaire are defined within the Schedule of Luminaires.

Luminaires are predominantly stand-alone LED type, recessed mounted, although surface mounted in the main hall.

A small number of standard luminaires are to be fitted with battery/inverter conversion packs from the manufacturer's standard range as noted in the luminaire schedule. These apply to the plant room, wall mounted stair positions and the wall mounted external luminaires.

Emergency luminaires to plant areas shall be surface mounted.

75-45-20 Data distribution systems

110 Data distribution system

ICT specification by Kier Workplace Solutions. This specification is only for data containment.

The Contractor shall install throughout the School development wall and ceiling mounted data outlets linked to the ICT server room using approved data cables.

In order to maximize flexibility it is proposed that the cabling shall be used for either voice or data.

Quantities and locations for data points have been agreed with the IT specialist.

All data outlets and ICT cabinets shall be arranged such that no UTP cable is more than 90m in length.

The Contractor shall install containment for the structured cabling to enable the installation of Cat 6 structured cabling in accordance with School Employer's Requirement specification.

The cabling shall be installed on basket with the final drops within galvanised steel conduits. The ends of the conduits shall be fitted with an 'Olive' ring to protect the cable.

The cabling shall be terminated at both ends and tested to EIA/TIA latest standards. Unique cable references shall also be installed at either end of the cable for ease of identification.

The cabling shall be installed to the point of use via fully recessed single outlet back box and terminated into a RJ45 outlet plate. The plate shall be white plastic in finish and labelled with a unique reference.

The Cat 6 cabling shall be installed back to the ICT server room and terminated into patch panels contained within the cabinet.

The final Active equipment (servers, switches, etc.) installation shall be provided separately as part of the fit-out by the School's specialist ICT consultant.

75-45-85 Telecommunications systems

110 Telecommunications system

The Main Contractor shall be responsible for co-ordinating with Openreach BT the issue of sufficient cable duct for the telecommunication below ground installation in accordance with the main construction programme.

Incoming ducting shall be free issued from Openreach BT and shall be installed by the Main Contractor. The Main Contractor shall install the cable duct installation in accordance with both British Telecom specification requirements and as described in the NJUG recommendations. The Main Contractor shall install an additional cable duct system for an alternative network provider.

Where cable ducts are required to turn, cable lengths exceed 100 metres or where cable ducts are proposed to enter a building, dedicated cable pits shall be installed in accordance with British Telecom specification requirements. Where cable ducts cross carriageways the Main Contractor shall install the cable ducts in accordance with British Telecom specification requirements.

All cable ducts shall be 90mm (minimum) internal diameter and shall be installed with 2 number draw wires per duct.

The positioning of the incoming services and routing shall be coordinated by the Contractor to enter the building as required by the internal wire ways.

The minimum number of lines provided to the School is indicated in the Kier Workplace Solutions specification, including as a minimum:

- 1 No. REDCARE line per Fire and Security detection panels
- 1 No. REDCARE line per lift
- ISDN lines
- Broadband line

There is no requirement for additional personal lines installed for the use of the School.

The Contractor shall be required to liaise with the Fire and Security specialist to ensure that a sufficient time is allowed for the procurement of the required lines.

75-60-05 Access control systems

110 Access control system

The contractor shall supply, install and commission an electronic access control system. The access control system shall be provided to enable to restrict access into the school during operational hours.

The system shall be interfaced with the Fire Alarm system to over-ride the system to allow safe escape from the building. A cause and effect strategy has been provided to determine the operation of the access control system under fire alarm conditions.

There is an existing access control system used at the old site that the school plans on reusing elements of. There are 5 door controllers from the old site that shall be reused as well access control server .

There are 9 access controlled doors/gates at the new school so an additional 4 door access controllers shall be required. This includes one access control point by the MUGA as indicated on the Terrafirma drawing FS0280-TFC-V2-00-DR-L-1004 as well as external gates to the North and East of the building.

The internal lobby doors shall be controlled from the reception desk. This shall consist of magnetic lock on the double doors with a release button within the reception office.

The external east gate shall have a release button in the main hall, adjacent to the IP phone used for the intercom. Location TBA with the architect. This shall consist of magnetic lock on the double gates with a release button within the main hall.

Each new access controlled door shall comprise of:

- 1/2 Maglock, positioned at the head of the door
- Request to exit push button
- Emergency break glass unit (green)
- 1/2 Status monitoring contacts
- Proximity card/token reader.

The contractor shall coordinate with the main contractor for the installation of all equipment, in particular the installation of maglocks and corresponding maglock 'plate' onto the door frames and doors respectively. The contractor shall include for all costs necessary to provide a complete and fully operational access control installation.

The contractor shall install new TechResponse door controllers to operate and control each door/gate position. Door controllers shall be mounted within the ceiling void adjacent the respective door positions.

Door controllers shall be provided with local 230V fused connection unit and RJ45 network point with CAT 6 cabling back to the control equipment.

All components shall be fully recessed throughout the building with wiring concealed throughout its length within building voids.

The contractor shall install all fused connection units and interconnecting wiring necessary to complete all aspects of the installation.

Electronic access control required at ground floor for the platform lift. Allow for the following devices to be coordinated with the lift installation:

- 1 Maglock, positioned at the head of the door
- Request to exit push button
- Emergency break glass unit (green)
- 1 Status monitoring contacts
- Proximity card/token reader.

120 Audio intercom system

The contractor shall supply, install and commission a complete audio intercom system.

The intercom system shall be SIP protocol so the intercoms can be linked to IP phones.

The intercom by the entrance shall be a single button type that can link to the Main Admin office.

The intercom by the side gate shall have an integrated keypad so it can be programmed to call a number of points, including but not limited to:

- kitchen,
- main admin office,
- main hall,
- staff room

75-60-10 Closed circuit television systems

110 CCTV system

The contractor shall employ the security specialist contractor to complete the design and supply, install, commission a complete CCTV system.

An internal CCTV camera shall be provided to monitor the main reception lobby.

External building mounted CCTV cameras shall be provided to give full coverage of the building perimeter and bike stores in accordance with the Employers Requirement specification.

All cameras shall be Power over Ethernet (POE) where technically possible.

75-60-40 Intruder detection and alarm systems

110 Intruder detection and alarm system

The contractor shall employ the security specialist contractor to complete the design and supply, install, commission a complete intruder detection and alarm system.

An intruder alarm specialist shall be provide an intruder alarm system to cover the school.
Movement detection shall be provided to all rooms with glazing.

The systems shall be fitted with internal and external audible warning devices designed to operate in the event of all alarm activations. The external unit shall also include flashing strobe effect warning light.

Setting and un-setting of the alarm shall be via presenting fob at the alarm keypad.
Provision shall be made for the security system to be linked to an auto dialler/GSM/GPRS to allow notification of alarm activation when the school is unoccupied.

The intruder alarm system shall comply with:

- BS EN50131-1: DD243:2002 and PD 6662(2004) for a grade 3 system
- Loss Prevention Council Security Recommendations
- Secure by Design Principles, and conform to current
- ACPO (Association of Chief Police Officers) alarm policy.

The system shall be installed to NSI Gold Standard.

The intruder alarm system shall employ sequential detection methods for verification of the alarm prior to contacting the designated contacts via the auto dialler.

The system shall comprise of the following:

- Dual technology detectors, having a narrow confinement beam of operation within corridors and wide beam in other areas with perimeter glazing.
- Door contacts to all external doors shall monitor the state of doors during operating hours and monitor forced entry outside operating hours. They shall be set into the door framing. Door contacts shall be capable of 'door open' indicators when alarm is unset.

The intruder alarm system shall also facilitate part of the schools lockdown procedure by means of a panic push button located within the reception area.

If the panic button is pressed twice within a pre-determined timeframe, the intruder alarm system shall auto dial the relevant authority to notify them of an incident.

75-65-30 Fire detection and alarm systems

110 Fire detection and alarm system

The contractor shall employ the services specialist fire alarm contractor to complete the design and supply, install, commission a complete fire alarm and detection system.

A complete fire alarm system shall be provided to serve the building affording protection to a Type L2/M system as defined by BS5839.

The complete system shall be designed in accordance with Fire Officers, Building Control, and Landlord's Insurer's requirements. The system shall be fully Open Protocol.

All fire alarm system devices shall be based on a combined heat/smoke detector, sounder and beacon heads to minimise the number of different devices being required.

The installation shall incorporate the following features:

- New fire alarm panel located at the main entrance (to incorporate a minimum of 4 No. zones)
- Manual break glass call points
- Multi-sensor detectors (heat and smoke)
- Flashing beacons
- beam detectors
- Interface units for all mechanical plant, access control and lift
- Self-test, test override switch and monitoring facilities
- Auto dialler linked to local fire service (Redcare/GSM/GPRS)

The building shall be split into fire alarm zones as required.

Mounted adjacent to the panel shall be a detailed drawing noting zone layout and distribution of detection equipment.

The fire alarm shall be raised by a series of electronic sounders located throughout the building. In plantrooms where ambient sound levels are high, within any areas where visitors are unsupervised such as toilets, flashing beacons shall be provided where appropriate. The alarm needs to be audible and visual to comply with Part M requirements.

Facilities shall be provided to allow the fire alarm system to be regularly tested without operating specific interfaces such as the gas shut off valves and any other mechanical systems causing shut-down.

The cause and effect strategy has been provided as a separate schedule.

A minimum battery backup capacity of 72hrs shall be allowed for.

The fire alarm system shall be wired using FP200 sheathed cabling throughout.

The tender drawings are design intent. It shall form part of the contractors design responsibility to have included for all necessary devices (including sounder levels), equipment and hardware and / or software upgrades to provide a complete installation in accordance with the relevant British Standards and Building Regulations.

75-65-35 Gas detection and alarm systems

110 Fixed gas detection and alarm system

The contractor shall employ the services specialist HVAC contractor to complete the design and supply, install, commission a complete fixed gas detection and alarm system.

The tender drawings are design intent only. It shall form part of the contractors design responsibility to have included for all necessary devices, equipment and hardware and / or software upgrades to provide a complete installation in accordance with the relevant British Standards and Building Regulations.

120 Flow sample gas detection and alarm system

The contractor shall employ the services specialist HVAC contractor to complete the design and supply, install, commission a complete flow sample gas detection and alarm system.

The tender drawings are design intent only. It shall form part of the contractors design responsibility to

have included for all necessary devices, equipment and hardware and / or software upgrades to provide a complete installation in accordance with the relevant British Standards and Building Regulations.

75-65-95 Water leak detection and alarm systems

120 Water leak detection and alarm system

Mechanical subcontractor to complete the design and supply, install, commission a water leak detection and alarm system.

The tender drawings are design intent only. It shall form part of the contractors design responsibility to have included for all necessary devices, equipment and hardware and / or software upgrades to provide a complete installation in accordance with the relevant British Standards and Building Regulations.

75-70-05 Assistance call systems

110 Assistance call system

The contractor shall supply, install and commission a complete Assistance Call system.

An assistance call system shall be provided within the assisted WC's. The emergency alarm shall be in accordance with Part M of the Building Regulations.

The assisted WC shall comprise control and power supply unit mounted within the ceiling void of the corresponding disabled facility, linked to a ceiling mounted pull cord with integral reassurance LED. Pull cords shall be 3m length with two ring pull units.

A wall mounted reset unit shall be positioned within the WC and the alarm calls shall be cancelled by using the reset unit.

The system shall also have and an over door audible alarm and visible indicator outside the WC.

The system shall operate on the basis that when the alarm is activated, the over door indicator shall flash and sound the alarm. A central alarm shall also be generated at a assistance alarm main panel in the main admin office.

120 Disabled Refuge Emergency voice communication system

The contractor shall install a disabled refuge facility to the refuge positions in the first floor stair cores.

The refuge provision shall comprise a wall mounted communication panel in each refuge location to provide 2 way voice communication from the refuge position to a control panel wall mounted at the ground floor entrance adjacent to the main fire alarm panel (in the main entrance/reception area).

75-75-05 Building monitoring and management systems

110 Electricity metering

All metering shall be in accordance with the requirements of the current edition of Part L of the Building Regulations.

All metering shall be monitored by the BMS.

130 Water metering

A water meter with pulsed output shall be provided on the mains cold water supply within the plantroom.

150 Building monitoring and management system

Refer to system clauses for description of operation. BMS is a contractor design portion (CDP) item.

160 Electrical connections

All distribution boards shall be provided with combined termination/metering units.

75-75-50 Mechanical engineering services control and management systems

110 Water supply systems control

Gas Fired Hot Water Heater

The hot water generation shall be enabled/disabled by a timeclock signal from the BMS; this shall initially be set to start at 7.00 and stop at 18.00 (both adjustable).

Between the start/stop times the hot water generation plant shall be controlled to provide hot water flow at a pre-set value, initially set at 60°C (adjustable). The plant shall be controlled via immersion temperature sensors mounted in the storage vessel.

The Gas fired water heater shall include an integral continuously running high output anti-stratification pump. A flow switch shall be provided within the generator pipework to indicate alarm of pump failure onto the BMS and the respective plantroom mechanical control panel.

The following control and monitoring functions shall be required for the hot water heater:

- Hot water storage temperature (high and low level)
- Hot Water secondary return pump enable
- Hot Water secondary return pump fail
- Hot Water secondary return pump hours run
- Hot water return temperature
- Anti-stratification pump enable
- Anti-stratification pump fail
- Anti-stratification pump hours run

Hot water flow sensor on the secondary flow and hot water return sensor on the secondary return shall provide indication of temperature onto the respective mechanical control panels.

Domestic hot water shall be circulated around the system by a single head pump set. Pump flow failure is to be recorded on the BMS using differential pressure switch across the unit.

The Gas fired water heater shall have its own direct acting high temperature limit valve with digital output for BMS of high limit trip condition.

An indicator lamp shall be included on the control panel to show trip condition of each high temperature limit valve.

Power to the secondary return circulating pump set is derived from a local isolator supplied & installed under the electrical contract with final connection from the isolator to the unit by the controls specialist.

Packaged Cat.5 Break Tank & Booster Set:

The BMS shall monitor the non-potable cold water Cat.5 packaged break tank/booster unit. The unit is a packaged self contained type comprising break tank, booster pump set, pressure vessel, and associated

valves. The packaged unit operates under the dictates of its integral control system with a common fault output to the BMS.

Power to the packaged unit is derived from a local isolator supplied & installed under the electrical contract with final connection from the isolator to the unit by the electrical contractor.

Water Conditioner:

The incoming cold water main supplies shall be fitted with a water conditioner. This shall be enabled by the BMS system which shall monitor the supply to the unit. The panel shall be fitted with visual indication on the 'WATER CONDITIONER ON' and 'WATER CONDITIONER FAULT'

Power to the water conditioner is derived from a local isolator supplied & installed under the electrical contract with final connection from the isolator to the unit by the electrical contractor.

Metering:

The mains water meter shall be provided by the meter supplier complete with a pulsed output to enable water usage to be logged by the BMS.

120 Heating systems control BOILERS & CHP PLANT:

Sequence of Control:

Demand for heating will be determined by either (i) the optimum start/stop controller or (ii) where there is a demand for heating on any of the secondary LTHW circuits (signalled by the operation of a control valve).

The lead boiler is to be provided with a pump module controller which will operate the respective shunt/primary pump arrangement and prove flow prior to firing the boiler.

The secondary circulating pump/s will be enabled and prove flow prior to firing the boiler.

The boiler shall then use its own integral electronic controls to modulate the fully modulating burner to maintain the primary LTHW flow water temperature at 80°C with a return temperature of 60°C.

If the temperature sensor in the flow header registers a condition less than 75°C (after a 15min time lag - adjustable), the BMS will send a signal to enable the second module/boiler. This cascade process will continue until either the flow temperature is satisfied or all boiler modules have been enabled. Similarly, under part load conditions, if the temperature sensor registers an over-heat (85°C+), the BMS will knock off modules as required after a pre-set period. Each boiler is interfaced with its own shunt pump and will shut it off after a pre-set time after boiler has been disabled.

To ensure positive flow through the primary circuit low loss header a flows sensor shall be provided as indicated on the schematic. Upon detection of backflow, the primary pump of the sequentially next duty boiler shall start.

The lead gas fired boiler shall be varied on a pre-set number of hours run, initially set at 170 (adjustable), to ensure even usage of the central plant.

The reverse process shall then be used to reduce the capacity of the system with the CHP being the last to shut down.

Each boiler shall incorporate its own integral temperature and safety controls which shall cut the supply to the boiler if overheating occurs. The boilers come complete with an advanced menu driven microprocessor comprising comprehensive operation and diagnostic facility. The boilers will be set-up to maintain a constant 80°C primary flow in the main header. A volt free common alarm shall be provided

from each boiler to indicated fault condition on the mechanical control panel.

Each boiler shall be interlocked with its respective shunt pump set to prevent firing of the boilers on pump/water flow failure.

Each boiler shall be interlocked with the pressurisation unit to prevent firing of the boilers in the event of unit failure. On boiler plant shut down, the shunt pump shall run on for 15 minutes to dissipate residual heat from the boiler.

The heating primary circulating pumps shall also run on for 15 minutes once the heating has been shut down by the controller.

The boilers will be set up as a master /slave to sequence and modulate their output to suit design conditions, whilst maintaining the CHP unit as the lead "boiler" at all times.

Power to each boiler, shunt/primary pump/s and secondary pumps sets are derived from the mechanical control panel via local isolator. The isolator is installed under the electrical contract, with final connection from the isolator undertaken by the controls specialist.

Control and monitoring functions:

The following shall be controlled and monitored for each boiler:

- Boiler enable
- Hours run
- Primary Water flow
- Gas consumption
- Primary inlet temperature
- Primary outlet temperature
- High temperature cut-out for each boiler
- Low temperature cut out for each boiler
- Control circuit live
- All internal faults/alarms generated by the boiler control panels

Emergency Plant Shut Down:

refer to clause 75-75-50-180 for details

Heating System Pressurisation Set:

The unit shall be supplied complete with its own integral controls to pressurise the system and provide cold water make-up. The panel shall be interlocked through the BMS so that any alarm signal on the unit isolates the boilers and pumps.

The following control and monitoring functions shall be required for this system:

- Supply Live
- High Pressure Alarm (Critical)
- Low Pressure Alarm (Critical)
- Hours Run
- Pump Starts per Hour (Alarm)
- All other alarms generated by the pressurisation set control panel

Power to the pressurisation set will be derived direct from the electrical distribution board via a local isolator . The isolator is installed under the electrical contract, with final connection from the isolator undertaken by the controls specialist.

Frost Protection System:

There shall be two-stage frost protection on all external LTHW circuits. Under the first stage, if the outside air temperature falls below a pre-set value, initially set at 6.0°C (adjustable), the pumps serving that circuit shall be enabled. Under the second stage, if the outside air temperature falls below a pre-set value, initially set at 2.0°C (adjustable), the electric trace heating shall be enabled. This shall then maintain the pipework system at 5.0°C under its own thermostatic controls.

The above strategy shall override any system timeclocks, which may be in place.

The following control and monitoring functions shall be required for this system:

- Stage one enable signal
- Stage two enable signal
- Trace Heating system fault (Critical)
- External ambient temperature

Power to the trace heating set will be derived direct from the electrical distribution board via a local isolator. Provision of power and final terminations to the trace heating will be undertaken by the electrical contractor.

Constant Temperature Pumps (primary & secondary):

The flow temperature set point of each CT circuit shall be set by a numeric point (nominally 80°C).

The pumps shall only run when there is demand for them to operate and the static pressure of the circuit served is in normal condition.

The pumps shall have integral inverter driven direct - coupled motors to give capacity control of the circuit. The pump set is to be interlocked with the operation of the respective circuits' LTHW 2-port shut-off valves such that if the secondary circuit calls for heating the BMS system shall enable the pump set.

If there is no load demand on the CT circuit from other plant e.g. VT circuit or AHUs and the outside air temperature is greater than a pre-set numeric value (nominally 16°C) then the CT set point is to be reset to zero, the control valve closed and the CT pumps switched off after a 10 minute overrun for heat dissipation.

Each circulating pump shall be enabled by a separate digital output from the BMS system, unless its inverter driven in which case signal shall be analogue based.

When there are duty and standby pumps their duty selection shall be by a numeric point having automatic weekly duty changeover.

In the event of a lead pump failure the duty shall automatically changeover to the standby pump.

A pump trip input shall be provided from the overload contacts of each pump and configured to alarm when on.

A differential pressure switch shall be provided on each pump set and connected as an input to monitor flow conditions. This input is to be configured to alarm when the flow has failed and the pump is enabled with visual indication on control panel fascia of 'FLOW FAILURE' and 'FLOW PROVEN' for each pump.

Temperature sensor inputs shall be provided in the common flow and common return of each CT circuit.

The minimum flow shall be 25% of any pump to prevent overheating in the pump.

Three position OFF/AUTO/MANUAL selector switch shall be provided for each set of pumps with run and trip display lamps on the motor control panel.

The start and stop times for the system shall be optimised by the BMS based on the previous 7 days performance. Initially the system shall be set to start and stop at 8.00am and 18.00 (both adjustable).

The following control and monitoring functions shall be required for each CT heating circuit:

- CT heating pump enable
- CT heating pump failure
- CT heating pump auto-changeover
- CT heating circuit flow temperature
- CT heating circuit return temperature

CT heating circuit water flow rate
External ambient temperature

Power to the secondary CT pump sets are derived from the mechanical control panel via local isolator. The isolator and final connection from the isolator is to be undertaken by the controls specialist.

Variable Temperature Secondary Pumps:

All control and monitoring functions for the variable temperature heating circuits shall be from the associated mechanical control panel.

The start and stop times for the system shall be optimised by the BMS based on the previous 7 days performance. Initially the system shall be set to start and stop at 8.00am and 18.00 (both adjustable).

When the outside air temperature is below a pre-set minimum value initially set at 16.0°C (adjustable) the VT heating systems shall be enabled. The flow temperature shall be varied by modulation of a 3-port control valve to match a pre-set schedule against the outside air temperature. The flow temperature set point of each VT circuit shall be set by a numeric point whose value is calculated based upon a compensated schedule, outside air temperature and the average space temperature for the zone. The compensated schedule shall be 80°C flow at -4.5°C outside air and 40°C flow at 16°C outside air.

Each circulating pump shall be enabled by a separate digital output from the BMS system, unless its inverter driven in which case signal shall be analogue based.

When there are duty and standby pumps their duty selection shall be by a numeric point having automatic weekly duty changeover.

In the event of a lead pump failure the duty shall automatically changeover to the standby pump.

A pump trip input shall be provided from the overload contacts of each pump and configured to alarm when on.

A differential pressure switch shall be provided on each pump set and connected as an input to monitor flow conditions. This input is to be configured to alarm when the flow has failed and the pump is enabled with visual indication on control panel fascia of 'FLOW FAILURE' and 'FLOW PROVEN' for each pump. Temperature sensor inputs shall be provided in the common flow and common return of each VT circuit.

The minimum flow shall be 25% of any pump to prevent overheating in the pump.

Three position OFF/AUTO/MANUAL selector switch shall be provided for each set of pumps with run and trip display lamps on the motor control panel.

All VT circuits shall have a common 'summer shut-off' numeric which diverts the three port valve to bypass the emitters and shuts off all VT pumps when the outside air temperature is greater than its pre-set value (nominally 16°C). The summer shut-off feature shall have a 1°C differential between pump shut off and pump switch on.

The following control and monitoring functions shall be required for each VT heating circuit:

VT heating pump enable
VT heating pump failure
VT heating pump auto-changeover
3-port control valve operation
VT heating circuit flow temperature
VT heating circuit return temperature
VT heating circuit water flow rate
External ambient temperature

Power to the secondary VT pump sets are derived from the mechanical control panel via local isolator. The isolator and final connection from the isolator is to be undertaken by the controls specialist.

Control and monitoring functions:

The following shall be controlled and monitored for each pump set listed above:

Flow failure of each pump via pressure differential switch across the pump set. (Critical Alarm).

Auto Changeover of duty pump on flow failure.

Hours run for each pump.

Power Absorbed for each pump

Secondary flow temperature

Secondary return temperature

Speed of duty pumps

System Pressure

Water Flow Rate

System Flow and Return Temperatures

Door Curtains:

All control and monitoring functions shall be from an outstation mounted immediately adjacent to the door curtain. Where more than one door curtain is being used in parallel a single outstation shall control them all.

The door curtains shall be enabled/disabled by a Timeclock signal from the BMS, the start/stop times shall initially be set as 8.00am and 18.00(both adjustable). These times shall be optimised based on the previous 7 days performance to enable fast morning warm up.

The output from the door curtains shall be controlled to maintain a constant discharge temperature, initially set at 35°C (adjustable), by modulation of the 2-port control valve on the LTHW flow to the coil. Where more than one unit is being used in parallel a single 2-port control valve may be used to control all of the units. The unit heating shall be deactivated once the outside air temperature reaches a pre set value, initially set at 20°C (adjustable).

The following control and monitoring functions are required for each door curtain:

Enable signal from Timeclock

2-port control valve operation

Discharge air temperature

Unit fan failure

Room temperature

Outside air temperature

Power to the door curtain is derived from the the electrical distribution board via a local isolator . The isolator is installed under the electrical contract, with final connection from the isolator undertaken by the electrical contractor.

Hot Water Generation:

Refer to clause 75-75-50/110

Heat Meters:

Heat meters to be provided as indicated on the schematic. The heat meters will be connected to the BMS network to enable data collection for analysis/monitoring and interrogation.

The meter will have the facility to log/monitor the following and communicate via pulsed output:

Instantaneous heat consumption Instantaneous flow rate

Total heat consumption

Flow temperature

Return temperature

145 Natural ventilation control

The NVHR systems shall be controlled by the proprietary local wall mounted controller supplied by Breathing Buildings or equal and approved. See section 65-10-95/110 "natural ventilation systems" for further controls descriptions.

The manufacturer's own control panel shall be installed in the plantroom and shall have a fault/enable to the BMS.

155 Mechanical ventilation systems control

Start-up and operation

Air Handling Unit AHU01

The AHU will provide fresh air to the main hall. The AHU will operate when the specific timezone is in occupancy.

When the AHU is called to operate and the external air temperature is above 12°C, the inlet damper shall open. When the damper is confirmed as 90% open (end switch) then the supply fan will be energised. When airflow is proved for the supply fan then the extract damper will open. When the damper is confirmed as 90% open (end switch) the duty extract fan will be energised.

When the AHU is called to operate and the external air is below 12°C the mixing box damper shall open fully and the AHU shall initially operate as a fully recirculating system until the air temperature within the hall is above 16°C (adjustable). Once the return air temperature is above the setpoint, the mixing box damper shall bleed in external air. The percentage of external air shall be maximised while still achieving 12°C across the DX coil. The fan speed shall be controlled by the CO2 requirements within the space.

The main hall temperature sensor shall ensure that the space air temperature is maintained at a minimum of 12°C at all times to ensure that the AHU can run in recirc mode to allow the DX coil to operate. If 12°C is detected, the AHU shall operate in full recirc mode to bring the space air temperature up to 14°C (adjustable)

The dx heating coil battery will be controlled to provide a constant room temperature of 21°C (user adjustable).

The thermal wheel is used to give free cooling and heating. If the air-handling unit is in a heating mode and the return air temperature is higher than the outside air temperature, the thermal wheel will use the return air to heat the supply air. If the air-handling unit is in a cooling mode and the return air temperature is lower than the outside air temperature, the thermal wheel will utilise the return air to cool the supply air.

The dx coil, supply and extract air temperatures are logged by the BEMS.

Air Handling Unit AHU02

The AHU will provide supply and extract air to the kitchen. The AHU shall operate under the dictates of the kitchen ventilation control panel situated within the kitchen. The kitchen appliances shall be interlocked with the kitchen ventilation to prevent any use until the supply and extract airflow have been proven.

When the AHU is called to operate the inlet damper shall open. When the damper is confirmed as 90% open (end switch) then the supply fan will be energised. When airflow is proved for the supply fan then the extract damper will open. When the damper is confirmed as 90% open (end switch) the duty extract fan will be energised.

Undercurrent detectors shall monitor the supply and extract fans for airflow and an alarm condition shall be raised on the BEMS if a flow failure occurs

The supply and extract fans shall be fitted with Inverters. The fan speed is controlled to provide a constant pressure in the supply and extract ducts.

When the AHU is no longer required the fans will stop and all associated dampers will close.

The frost battery control valve will modulate to give a constant 4°C off-coil temperature. The temperature after the frost battery will be monitored by a frost thermostat and will shut down the supply and extract fans and close the air inlet dampers if the temperature falls below 2°C. If the frost thermostat is activated an alarm will be raised on the BEMS. The frost battery control valve will modulate to the fully open position and the thermostat will reset itself when the temperature rises to a safe level.

The heating coil battery will be controlled to provide a constant supply air temperature of 21°C (user adjustable).

The frost, cooling coil, supply and extract air temperatures are logged by the BEMS.

General Requirements

Undercurrent detectors shall monitor the supply and extract fans for airflow and an alarm condition shall be raised on the BEMS if a flow failure occurs.

The supply and extract fans shall be fitted with Inverters. The fan speed is controlled to provide a constant temperature and CO2 level within the main hall.

When the AHU is no longer required the fans will stop and all associated dampers will close.

The fans are interlocked with the fire system and will be disabled when the fire system is activated.

Inverters and control equipment are not to be mounted on the roof but located inside the building within allocated areas (not store cupboards, public space or cleaner's cupboards). If located outside the building it is essential that environmental protection is installed.

Dirty filter monitoring

Differential pressure switches will monitor the panel, bag and extract filters. In the event of a high differential pressure being detected across the filter bank, the filter dirty lamp will be illuminated on the control panel fascia and an alarm condition shown on the BEMS.

Fireman's switch

The control system shall be provided with a 3-position fireman's switch. This can be utilised to run the extract fan during a fire alarm active situation to assist with smoke clearance. The operation of the switch is listed below:

"Auto - AHU runs under normal BEMS control

"Off - Supply and extract fans prevented from operation

"Manual - extract fan will operate.

Inverter control

All AHU fans shall be fitted with Inverters complete with communications cards to enable the monitoring of energy use and the following running conditions:

"Auto

"Run/off

"Hz control

"Kwhr.

190 Gas fired heating system control strategy

Emergency Plant Shut Down:

The gas supply to the boilers and kitchen shall be isolated by shutting the gas solenoid valve when any of the following items of equipment operate:

Emergency shut off in Boiler Room

Emergency shut off in kitchen

Thermal Link No. 1 above boiler

Thermal Link No. 2 above boiler
Thermal Link No. 3 above boiler
Thermal Link No. 3 above gas fired water heater
Gas Detection System (refer to below)
Fire Alarm System (via hard-wired interface provided by specialised fire alarm contractor)

A gas leak detection system is to be provided, with one sensor head located above each boiler. In the event of leak detection, the gas solenoid fire valve shall close and the boilers will shut off. The mechanical control panel will indicate a "GAS LEAK DETECTED" status indication in addition to "GAS SOLENOID VALVE CLOSED" indication.

Visual indication of an emergency plant shut-down shall be shown on the mechanical control panel along with an Audible alarm. The operation of any of the above signals shall also generate an alarm on the Fire Alarm Panel, labelled as "Heating Plant Emergency Shut-down".

In all shut down scenarios above, the gas solenoid valve shall remain closed until the reset buttons on the fascia of the control panel is depressed and the alarm cleared.

Metering:

The gas meter shall be provided by the meter supplier complete with a pulsed output to enable gas usage to be logged by the BMS. A gas check meter shall be provided to the kitchen

75-85-45 Lightning protection systems

110 Lightning protection system

The contractor shall employ the services specialist lightning protection contractor to complete the design and supply, install, commission a complete lightning protection system.

The lightning protection specialist shall provide a complete lightning protection system.

A lightning protection risk assessment shall be carried out by the lightning protection specialist to identify the category of lightning protection system required.

On accompanying drawings it has been assumed that the structural class of lightning protection system class IV.

Upon confirming the requirement for lightning protection system, surge protection devices shall be installed on all incoming supplies if necessary, the provision for a roof collector system (network of lightning tape or roof cladding system), down conductor tapes or use of the building structure and earth pits.

All roof mounted equipment including PVs and handrails shall be bonded to the lightning protection system.

Lightning protection system connections to the building foundations or structure shall be coordinated with the Civil/Structural Engineers and the Architect.

The tender drawings are design intent. It shall form part of the contractors design responsibility to have included for all necessary devices (including sounder levels), equipment and hardware and / or software upgrades to provide a complete installation in accordance with the relevant British Standards and Building Regulations.

80-45-90 Vertical lifting platform and homelift systems

140 Vertical lifting platform system

Complete the supply, install, test, commission, demonstrate and set to work the entire complete system as set out within this specification for 1No. electric platform lift.

The Contractor shall be responsible for the provision of the lift installations, and all associated services.

Services shall include a new sub main power supply and telephone line, which shall be in accordance with the requirements of the lift manufacturer's specification.

Allow for the integral emergency button to connect to a local sounder.

The contractor shall ensure that lift telephone lines are operational prior to commissioning of the lifts.

Electronic access control required at ground floor.

Specification

End of RIBA Stage 4 - Technical Design

16/05/2019 - 11:04

Revision details:

System/Section	Modified
Above ground wastewater drainage system with internal stacks (50-10-05/120)	No
Incoming water supply (55-40-40/110)	No
Cold water supply system (55-40-40/120)	No
Direct hot water storage supply system (55-40-40/150)	No
Incoming gas supply (55-60-55/110)	No
Low temperature hot water heating system (60-45-40/110)	No
Natural ventilation system (65-10-95/110)	No
Mechanical ventilation systems (65-10-95/130)	No
Kitchen ventilation system (65-10-95/160)	No
Room air conditioning system (65-70-45/110)	No
Incoming low voltage electricity supply (70-50-45/110)	No
Grid connected photovoltaic system (70-65-60/110)	No
Earthing and bonding system (70-70-25/110)	No
Inspection and testing of existing electrical installations (70-70-40/130)	No
Low voltage distribution system (70-70-45/110)	No
Hard wired low voltage small power system (70-70-75/110)	No
Amenity lighting system (70-80-25/120)	No
Hard wired general lighting system (70-80-35/110)	No
Data distribution system (75-45-20/110)	No
Telecommunications system (75-45-85/110)	No
Access control system (75-60-05/110)	No
Audio intercom system (75-60-05/120)	No
CCTV system (75-60-10/110)	No
Intruder detection and alarm system (75-60-40/110)	No
Fire detection and alarm system (75-65-30/110)	No
Fixed gas detection and alarm system (75-65-35/110)	No

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Flow sample gas detection and alarm system (75-65-35/120)	No
Water leak detection and alarm system (75-65-95/120)	No
Assistance call system (75-70-05/110)	No
Disabled Refuge Emergency voice communication system (75-70-05/120)	No
Electricity metering (75-75-05/110)	No
Water metering (75-75-05/130)	No
Building monitoring and management system (75-75-05/150)	No
Electrical connections (75-75-05/160)	No
Water supply systems control (75-75-50/110)	No
Heating systems control (75-75-50/120)	No
Natural ventilation control (75-75-50/145)	No
Mechanical ventilation systems control (75-75-50/155)	No
Gas fired heating system control strategy (75-75-50/190)	No
Lightning protection system (75-85-45/110)	No
Vertical lifting platform system (80-45-90/140)	No

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

System outline

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

- **System performance:** 50-10-05/210 Design of above ground wastewater drainage systems.
- **System manufacturer:** Submit proposals.
- **Floor drainage:**
 - **Preparation to existing floors:** Cutting out chases in existing concrete;
Cutting out holes in existing concrete;
and Cutting out holes in existing timber floors.
 - **Floor channels and gullies:** 90-05-20/302 Floor channels and 90-05-20/306 Floor gullies.
 - **Covers and gratings:** 90-05-20/308 Covers and gratings for floor gullies and 90-05-20/304 Covers and gratings for floor channels.
 - **Supports:**
 - Bedding:** Contractor's design.
 - Backfill:** Contractor's design.
 - Fixings:** Included.
- **Sanitary pipework:**
 - **Small diameter branch discharge pipework:**
 - Traps:** 90-10-60/410 Sanitary appliance traps.
 - Pipelines and fittings:** 90-10-20/330 Chlorinated polyvinylchloride (PVC-C) above ground wastewater branch discharge pipelines;
90-10-20/350 Stainless steel above ground drainage pipelines;
90-10-20/346 Copper above ground drainage pipelines;
90-10-20/336 Polypropylene above ground wastewater branch discharge pipelines;
90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipelines;
90-10-20/334 Modified unplasticized polyvinyl chloride (MUPVC) above ground wastewater branch discharge pipelines;
and 90-10-20/348 High density polyethylene (HDPE) above ground drainage pipelines type A.
 - Accessories for jointing:** 45-75-90/412 PTFE thread sealing tape.
 - Supports:** 90-10-20/340 Brackets and clips for above ground drainage pipelines.
 - Fixings:** Included.
 - **Large diameter branch discharge pipework:**
 - Pipelines and fittings:** 90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipelines;
90-10-20/342 Cast iron above ground drainage pipelines to BS 416-1;
and 90-10-20/344 Cast iron above ground drainage pipelines to BS EN 877.
 - Accessories for jointing:** Submit proposals.
 - Supports:** 90-10-20/340 Brackets and clips for above ground drainage pipelines.
 - Fixings:** Included.
 - Insulation:** 90-90-40/330 Mineral wool pipe section insulation type A.
 - **Discharge stack pipework:**

Pipelines and fittings: 90-10-20/342 Cast iron above ground drainage pipelines to BS 416-1;

90-10-20/344 Cast iron above ground drainage pipelines to BS EN 877;

90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipelines;

and 90-10-20/348 High density polyethylene (HDPE) above ground drainage pipelines type B.

Accessories for jointing: Submit proposals.

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

Fixings: Included.

Insulation: 90-90-40/330 Mineral wool pipe section insulation type A.

- **Ventilating pipework:**

- **Ventilating branch pipework:**

Pipelines and fittings: Cast iron above ground drainage pipelines to BS 416-1;

Cast iron above ground drainage pipelines to BS EN 877;

and 90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipelines.

Accessories for jointing: Submit proposals.

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

Fixings: Included.

- **Ventilating stack pipework:**

Pipelines and fittings: Cast iron above ground drainage pipelines to BS 416-1;

Cast iron above ground drainage pipelines to BS EN 877;

and 90-10-20/354 Unplasticized polyvinyl chloride (PVC-U) above ground drainage pipelines.

Accessories for jointing: Submit proposals.

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

Fixings: Included.

- **Prefabricated branch and stack pipework:**

- **Pipelines and fittings:** Submit proposals.

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

- **Fixings:** Included.

- **Insulation:** 90-90-40/330 Mineral wool pipe section insulation type A.

- **Overflow pipework:**

- **Pipelines and fittings:** 90-10-20/346 Copper above ground drainage pipelines.

- **Accessories for jointing:** 45-75-90/412 PTFE thread sealing tape.

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

- **Fixings:** Included.

- **Pipework identification:** 90-90-55/430 Identifying pipework type A.

- **Fire stopping:**

- **Floor penetrations:** 45-45-70/433 Flexible intumescent gap sealer and 90-10-60/405 Pipe sleeves type A.

- **Wall penetrations:** 45-45-70/433 Flexible intumescent gap sealer and 90-10-60/405 Pipe sleeves type A.

- **System accessories:** Access fittings;

90-10-90/400 Air admittance valves;

90-10-60/437 Discharge and ventilating stack terminations;

and 90-10-60/395 Masking plates type A.

- **Execution:** 50-10-05/612 Applying above ground wastewater drainage internal pipework identification;
50-10-05/618 Installing above ground wastewater drainage prefabricated discharge pipework assemblies;
50-10-05/614 Installing above ground wastewater drainage discharge branch pipework generally;
50-10-05/622 Access to above ground wastewater drainage systems for testing and maintenance ;
50-10-05/605 Removing above ground wastewater drainage systems;
50-10-05/616 Installing above ground wastewater drainage discharge stack pipework generally;
50-10-05/610 Installing above ground wastewater drainage systems generally;
and 50-10-05/620 Electrical continuity of above ground wastewater drainage pipework.
- **System completion:** 50-10-05/810 Testing above ground wastewater drainage systems generally;
50-10-05/830 Above ground wastewater drainage system siphonage and back pressure tests;
50-10-05/840 Above ground wastewater drainage system pre-handover checks;
50-10-05/850 Above ground wastewater drainage system submittals;
50-10-05/860 Documentation;
and 50-10-05/820 Above ground wastewater drainage system pipework airtightness test.

System performance

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

- **Design:** Complete the design of the above ground wastewater drainage system.
- **Standards:** To BS EN 12056-1, BS EN 12056-2, relevant parts of BS EN 12056-4, BS EN 12056-5 and in accordance with BS EN 12056-2 National Annexes NA-NG.
- **System configuration:**
 - **Form:** System III, single discharge stack system with full bore discharge branch pipes.
 - **Configuration:** Primary ventilated stack system;
- **Design discharges:**
 - **Design discharge types:** Commercial kitchen wastewater;
Domestic wastewater;
and Trade effluent.
 - **Design discharge content:** Blackwater;
Greywater;
and Design discharge temperatures and content as attached report.
- **Requirements:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

55-40-40/110 Incoming water supply

System outline

55-40-40/110 Incoming water supply

- **System performance:** 55-40-40/210 Design and detailing hot and cold water systems and 55-40-40/215 Incoming water analysis.
- **Water company:** Project Specific
- **Volume flow rate:** Refer to associated drawings and schedules
- **Position of incoming mains water supply:** Refer to associated drawings
- **Valves:** 90-10-90/310 Draw off taps and stop valves;
90-10-90/314 Stop valves for potable water;
90-10-90/316 Underground stop valves;
and 90-10-90/318 Backflow prevention devices.
- **System completion:** 55-40-40/850 Water quality tests type A.

System performance

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

Shared by: 55-40-40/110 Incoming water supply; and 55-40-40/120 Cold water supply system.

- **Design:** Complete the design and detailing of the hot and cold water supply.
- **Standard:** To BS 8558 or BS EN 806-2.
In accordance with HSE publication L8 'The control of legionella bacteria in water systems. Approved code of practice and guidance'. In accordance with HSG274 Part 2 The control of legionella bacteria in hot and cold water systems.
In accordance with The Water Supply (Water fittings) Regulations 1999
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturer's literature.

55-40-40/215 Incoming water analysis

- **Physical characteristics:**
 - **Temperature:** To Be advised by Water Supply Company
 - **pH value:** To Be advised by Water Supply Company
 - **Conductivity:** To Be advised by Water Supply Company
 - **Colour:** To Be advised by Water Supply Company
 - **Turbidity:** To Be advised by Water Supply Company
 - **Total dissolved solids:** To Be advised by Water Supply Company
 - **Total residual chlorine:** To Be advised by Water Supply Company
 - **Total hardness:** To Be advised by Water Supply Company
- **Organic quality indicators:**
 - **Permanganate value (PV):** To Be advised by Water Supply Company
 - **Total organic carbon (TOC):** To Be advised by Water Supply Company
- **Major anions:**
 - **Nitrite nitrogen:** To Be advised by Water Supply Company

- **Nitrate nitrogen:** To Be advised by Water Supply Company
- **Natural fluoride:** To Be advised by Water Supply Company
- **Chloride:** To Be advised by Water Supply Company
- **Sulfate:** To Be advised by Water Supply Company
- **Reactive silica:** To Be advised by Water Supply Company
- **Phosphate:** To Be advised by Water Supply Company
- **Major cations:**
 - **Ammonia:** To Be advised by Water Supply Company
 - **Total hardness:** To Be advised by Water Supply Company
 - **Alkalinity:** To Be advised by Water Supply Company
 - **Calcium:** To Be advised by Water Supply Company
 - **Magnesium:** To Be advised by Water Supply Company
 - **Sodium:** To Be advised by Water Supply Company
 - **Potassium:** To Be advised by Water Supply Company
- **Trace metals:**
 - **Iron:** To Be advised by Water Supply Company
 - **Aluminium:** To Be advised by Water Supply Company
 - **Manganese:** To Be advised by Water Supply Company
 - **Zinc:** To Be advised by Water Supply Company
 - **Copper:** To Be advised by Water Supply Company
 - **Lead:** To Be advised by Water Supply Company
 - **Cadmium:** To Be advised by Water Supply Company
 - **Chromium:** To Be advised by Water Supply Company
 - **Mercury:** To Be advised by Water Supply Company
- **Bacteriological characteristics:**
 - **Colony count, 72 h at 22°C:** To Be advised by Water Supply Company
 - **Colony count, 24 h at 37°C:** To Be advised by Water Supply Company
 - **Coliforms:** To Be advised by Water Supply Company
 - **E.coli:** To Be advised by Water Supply Company

55-40-40/120 Cold water supply system

System outline

55-40-40/120 Cold water supply system

- **System performance:** 55-40-40/210 Design and detailing hot and cold water systems;
55-40-40/220 Cold water supply;
55-40-40/250 Pipeline sizes for hot and cold water systems;
and 55-40-40/255 Draw off requirements for hot and cold water systems.
- **Arrangement:** Mains fed with added hydraulic pressurisation vessels to boost mains pressure.
- **Water meters:** 90-65-55/470 Water meters.
- **Storage tank or cistern:** Cat 5 non-potable break tank and pumpset for Irrigation and wash down purposes only.
- **Water treatment plant:** 90-15-95/400 Magnetic water conditioners.
- **Pipelines:**
 - **Below ground:** 90-10-65/365 Polyethylene (PE) pipelines for water supply.
 - **Above ground:** 90-10-65/310 Copper pipelines type A.
- **Pipeline accessories:**
 - **Expansion devices:** Not applicable
 - **Gauges:** 90-10-60/375 Pressure and altitude gauges and 90-10-60/380 Temperature gauges type A.
 - **Accessories:** 90-10-60/405 Pipe sleeves type A;
90-10-60/420 Tundishes type A;
and 90-10-60/395 Masking plates type A.
- **Valves:**
 - **Isolating valves:** 90-10-90/330 Ball valves type A.
 - **Check valves:** 90-10-90/352 Lift type check valves.
 - **Regulating valves:** Not applicable
 - **Mixing valves:** 90-10-90/366 Low pressure thermostatic mixing valves and 90-10-90/370 Thermostatic mixing valves.
 - **Draining devices:** 90-10-90/374 Draining taps type A.
 - **Accessories:** 90-10-90/360 Test points type B and 90-10-90/318 Backflow prevention devices.
- **Thermal insulation:**
 - **Pipelines:** 90-90-40/360 Phenolic foam insulation type A and 90-90-40/330 Mineral wool pipe section insulation type A.
 - **Tanks:** As manufacturers standard.
- **Vibration isolation:** Not applicable
- **Sanitary appliances:** As specified by architect and required by BREEAM
- **Drinking water outlets:** As specified by architect and required by BREEAM
- **Flush control devices:** 90-15-35/470 Flush control devices.
- **Water coolers:** As specified by architect and required by BREEAM
- **Controls:** Refer to Controls section
- **Accessories:** 90-10-85/310 Electrical resistance surface trace heating and 90-90-60/390 Services supports.

- **Plant and equipment identification:** 90-90-55/430 Identifying pipework type A;
90-90-55/440 Warning marker tapes;
90-90-55/480 Mechanical plant and equipment identification labels generally type A;
90-90-55/490 Valve charts and schematics generally type A;
and 90-90-55/495 Valve identification labels generally type A.
- **Execution:** 55-40-40/620 Installing hot and cold water systems generally;
55-40-40/650 Hydraulic pressure testing of hot and cold water supply systems;
55-40-40/660 Flushing hot and cold water systems;
and 55-40-40/670 Disinfection of hot and cold water systems.
- **System completion:** 55-40-40/810 Commissioning of hot and cold water supply systems;
55-40-40/820 Inspection and test records;
55-40-40/830 Demonstrations;
55-40-40/840 Documentation;
55-40-40/850 Water quality tests type A;
55-40-40/860 Spares;
55-40-40/870 Operating tools;
and 55-40-40/880 Maintenance.

System performance

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

Shared by: 55-40-40/110 Incoming water supply; and 55-40-40/120 Cold water supply system.

- **Design:** Complete the design and detailing of the hot and cold water supply.
- **Standard:** To BS 8558 or BS EN 806-2.
In accordance with HSE publication L8 'The control of legionella bacteria in water systems. Approved code of practice and guidance'. In accordance with HSG274 Part 2 The control of legionella bacteria in hot and cold water systems.
In accordance with The Water Supply (Water fittings) Regulations 1999
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturer's literature.

55-40-40/220 Cold water supply

- **Incoming mains water supply:**
 - **Site factors:** Identify possible problems and submit report.
- **Type of system:** Direct mains fed and Pumped from a break cistern for CAT 5 purposes.
- **Design parameters:** To BS 8558 and To BS EN 806-2.
- **Daily consumption:** Submit proposals.
- **Storage capacity:** Refer to project specific requirements

55-40-40/250 Pipeline sizes for hot and cold water systems

- **Sizing:** Calculate sizes to meet simultaneous demand for the building in accordance with BS EN 806-3.
- **Proposals:** Submit calculation sheets showing pipe sizes and Submit drawings with pipe sizes shown.
- **Performance:**
 - **Water velocity (maximum):** 1.5 m/s for hot water and 1.5 m/s for cold water.
 - **Filling time (maximum) for cold water storage cistern:** 1 Hour

55-40-40/255 Draw off requirements for hot and cold water systems

- **Dish-washing machines:**
 - **Type of supply:** Boosted cold and Cold from mains.
 - **Discharge rate (design):** 0.15 L/s unless BREEAM / Particular specification requires otherwise
- **Handbasins (pillar or mixer taps):**
 - **Type of supply:** Hot and cold.
 - **Discharge rate (design):** 0.1 L/s unless BREEAM / Particular specification requires otherwise
- **Handbasin (spray or spray mixer taps):**
 - **Type of supply:** Hot and cold.
 - **Discharge rate (minimum):** 0.05 L/s unless BREEAM / Particular specification requires otherwise
- **Kitchen sinks (G^{1/2}):**
 - **Type of supply:** Hot and cold from mains.
 - **Discharge rate (design):** 0.2 L/s unless BREEAM / Particular specification requires otherwise
- **Kitchen sinks (G^{3/4}):**
 - **Type of supply:** Hot and cold from mains.
 - **Discharge rate (design):** 0.3 L/s unless BREEAM / Particular specification requires otherwise
- **Kitchen sinks (G1):**
 - **Type of supply:** Hot and cold from mains.
 - **Discharge rate (design):** 0.6 L/s unless BREEAM / Particular specification requires otherwise
- **Shower heads:**
 - **Type of supply:** Hot and cold.
 - **Discharge rate (minimum):** 0.2 L/s unless BREEAM / Particular specification requires otherwise
- **Washbasins (pillar or mixer taps):**
 - **Type of supply:** Hot and cold.
 - **Discharge rate (design):** 0.15 L/s unless BREEAM / Particular specification requires otherwise
- **Washing machines:**
 - **Type of supply:** Hot and cold.
 - **Discharge rate (design):** 0.2 L/s unless BREEAM / Particular specification requires otherwise
- **WC cisterns (to fill in 2 minutes):**
 - **Type of supply:** Boosted cold;
Cold from cistern;
and Cold from mains.
 - **Discharge rate (design):** 0.13 L/s unless BREEAM / Particular specification requires otherwise

55-40-40/150 Direct hot water storage supply system

System outline

55-40-40/150 Direct hot water storage supply system

- **System performance:** 55-40-40/240 Centralized hot water storage system.
- **Storage unit:** 90-15-35/450 Storage water heaters, gas fired.
- **Electric immersion heater:** Not Required
- **Flues:** 90-40-30/310 Metal flues and chimneys type B.
- **System:** Unvented.
- **Capacity:** 374 litres
- **Pumps:** 90-10-70/340 Canned rotor pumps type B.
- **Pipelines:** 90-10-65/310 Copper pipelines type D.
- **Pipeline accessories:**
 - **Expansion devices:** 90-10-60/330 Lateral expansion compensators type B.
 - **Gauges:** 90-10-60/370 Pressure gauges and 90-10-60/380 Temperature gauges type B.
 - **Accessories:** 90-10-60/405 Pipe sleeves type B;
90-10-60/420 Tundishes type B;
90-10-60/400 Pipeline strainers type B;
and 90-10-60/395 Masking plates type B.
 - **Pipeline supports:** Contractor's design.
- **Valves:**
 - **Isolating valves:** 90-10-90/330 Ball valves type B.
 - **Check valves:** 90-10-90/352 Lift type check valves.
 - **Regulating valves:** 90-10-90/356 Double regulating valves type B.
Thermostatic Balancing Valves - reverse acting
Refer to system description
 - **Mixing valves:** 90-10-90/370 Thermostatic mixing valves.
 - **Draining devices:** 90-10-90/374 Draining taps type B.
 - **Accessories:** 90-10-90/360 Test points type C.
- **Thermal insulation:**
 - **Pipelines:** 90-90-40/360 Phenolic foam insulation type B and 90-90-40/330 Mineral wool pipe section insulation type B.
 - **Cylinders:** As Manufacturers Standard - to be factory applied.
- **Outlets:** Refer to Architectural specification and BREEAM specific requirements
- **Controls:** Refer to controls specification
- **Accessories:**
- **Plant and equipment identification:** 90-90-55/480 Mechanical plant and equipment identification labels type B;
90-90-55/430 Identifying pipework type B;
90-90-55/440 Warning marker tapes;
90-90-55/495 Valve identification labels type B;
and 90-90-55/490 Valve charts and schematics type B.
- **Execution:** 55-40-40/620 Installing hot and cold water systems generally;
55-40-40/630 Installing unvented hot water storage discharge pipes;

55-40-40/650 Hydraulic pressure testing of hot and cold water supply systems;
55-40-40/660 Flushing hot and cold water systems;
and 55-40-40/670 Disinfection of hot and cold water systems.

- **System completion:** 55-40-40/830 Demonstrations;
55-40-40/850 Water quality tests type B;
55-40-40/840 Documentation;
55-40-40/820 Inspection and test records;
55-40-40/860 Spares;
55-40-40/870 Operating tools;
55-40-40/810 Commissioning of hot and cold water supply systems;
and 55-40-40/880 Maintenance.

System performance

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

- **System design:** Design the system to meet the following requirements.
- **Storage capacity:**
 - **Standard:** In accordance with CIPHE Plumbing engineering services design guide.
 - **Type of building:** Refer to project specific design requirements
 - **Number of people:** Refer to project specific design requirements
- **Primary heat source:** Capable of raising temperature of water from 10°C to 60°C within one hour. Unless otherwise specified.
- **Temperature range of stored hot water:** 60–65°C.
- **Water supply:** Mains water service

Ω End of system

55-60-55/110 Incoming gas supply

System outline

55-60-55/110 Incoming gas supply

- **Gas transporter:** Arrange for incoming service from gas transporter. Undertake all liason and necessary co-ordination.
- **Gas supplier:** Liasise with client to establish selected gas supplier. Arrange for installation with gas suppliers meter installer.
- **Volume flow rate:** Refer to associated drawings and schedules.
- **Position of meter:** Refer to associated drawings.

Ω End of system

60-45-40/110 Low temperature hot water heating system

System outline

60-45-40/110 Low temperature hot water heating system

- **System performance:** 60-45-40/225 Design temperature schedule;
60-45-40/250 System operating parameters for heating systems;
60-45-40/260 Heating system capacity;
60-45-40/270 Heating and hot water supply system capacity;
60-45-40/275 Variable flow pipework systems;
60-45-40/280 Chemical treatment for heating systems;
and 60-45-40/210 Design of heating systems.
- **Arrangement:** Refer to the relevant schematics and system descriptions.
- **Heat source:** 90-40-05/340 Gas fired condensing boilers.
- **Fuel:** Natural gas.
- **Flues and chimneys:** 90-40-30/310 Metal flues and chimneys type A.
- **Pressurization units:** 90-10-70/400 Pressurization units.
- **Pumps:** 90-10-70/340 Canned rotor pumps type A.
- **Water treatment plant:**
 - **Equipment:** 90-15-95/350 Dosing pots and 90-15-95/370 Filtration units.
 - **Chemicals:** 90-15-95/335 Bacteria and biofouling inhibitors for closed circuit systems and 90-15-95/317 Corrosion inhibitors for closed circuit systems.
- **Pipelines:** 90-10-65/415 Steel pipelines.
- **Pipelines accessories:**
 - **Venting devices:** 90-10-60/310 Automatic air vents and 90-10-60/610 Air bottles.
 - **Expansion devices:** 90-10-60/330 Lateral expansion compensators type A and 90-10-60/325 Axial expansion compensators.
 - **De-aerators:** 90-10-60/340 Pressure differential de-aerators and 90-10-60/345 Temperature differential de-aerators.
 - **Separators:** 90-10-60/355 Combined air and dirt separators and 90-10-60/360 Dirt separators.
 - **Gauges:** 90-10-60/375 Pressure and altitude gauges and 90-10-60/380 Temperature gauges type A.
 - **Accessories:** 90-10-60/395 Masking plates type A;
90-10-60/400 Pipeline strainers type A;
90-10-60/420 Tundishes type A;
and 90-10-60/405 Pipe sleeves type A.
- **Valves:**
 - **Isolating valves:** 90-10-90/334 Cast iron or steel ball valves and 90-10-90/332 Butterfly valves.
 - **Check valves:** 90-10-90/350 Carbon steel globe stop and check valves and 90-10-90/354 Swing type check valves.
 - **Regulating valves:** 90-10-90/356 Double regulating valves type A and 90-10-90/358 Flow measuring devices.
 - **Radiator valves:** 90-10-90/364 Thermostatic radiator valves.
 - **Draining devices:** 90-10-90/378 Three-way vent cocks and 90-10-90/374 Draining taps type A.

- **Accessories:** 90-10-90/360 Test points type A.
- **Thermal insulation:** 90-90-40/360 Phenolic foam insulation type A.
- **Vibration isolation:** 90-90-95/350 Pad mountings;
90-90-95/360 Inertia bases;
90-90-95/380 Flexible hoses;
90-90-95/390 Rubber bellows;
90-90-95/370 Isolation hangers;
and 90-90-95/330 Spring isolators.
- **Heat emitters:** 90-40-35/310 Air curtains;
90-40-35/405 Radiators;
90-45-05/320 Fan coil units;
and 90-45-50/340 Low temperature hot water heating coils.
- **Controls:** Refer to controls section of this document.
- **System accessories:** 90-90-60/380 Roof equipment support systems and 90-90-60/390 Services supports.
- **Plant and equipment identification:** 90-90-55/430 Identifying pipework type A;
90-90-55/480 Mechanical plant and equipment identification labels generally type A;
90-90-55/490 Valve charts and schematics generally type A;
90-90-55/495 Valve identification labels generally type A;
and 90-90-55/390 Equipment labels and warning notices type A.
- **Execution:** 60-45-40/620 Installing water based heating systems;
60-45-40/670 Installing water treatment for heating systems;
60-45-40/650 Filling and pressure testing of water based heating systems;
and 60-45-40/660 Flushing and pre-commission cleaning of heating systems.
- **System completion:** 60-45-40/810 Commissioning water heating systems;
60-45-40/830 Commissioning boiler plant;
60-45-40/840 Performance testing;
60-45-40/860 Documentation;
60-45-40/870 Operating tools;
60-45-40/880 Servicing and maintenance;
and 60-45-40/845 Demonstrations.

System performance

60-45-40/210 Design of heating systems

- **Design:** Complete the design of the heating systems. All temperatures shall be in accordance with the schedule of temperatures
- **Method:** In accordance with CIBSE AM 11. The contractor shall complete full thermal CIBSE Method calculations using a recognised computer package, Hevacomp, IES or similar, for the Engineer to review. The model shall be made available to the Engineer for review.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Computer calculations:**
 - **Submittals:** U-values and CIBSE method heat loss calculations for each room.
 - **Format:** Electronic

60-45-40/225 Design temperature schedule

- **Room:** Refer to project specific requirements or where not given in accordance with CIBSE guide A or agreed industry standard

- **Temperature °C:** Refer to project specific requirements or where not given in accordance with CIBSE guide A or agreed industry standard
- **Air changes per hour:** Refer to project specific requirements or where not given in accordance with CIBSE guide A or agreed industry standard

60-45-40/250 System operating parameters for heating systems

- **Design flow temperature:** Maximum 80°C.
- **Temperature difference across primary heating circuit:** 20°C minimum value unless connecting to existing system where existing temperature differential shall be used.
- **Temperature difference across primary hot water circuit:** 20°C minimum value on LTHW side unless connecting to existing system where existing temperature differential shall be used.
- **Water velocity:** Maximum 1.5 m/s.

60-45-40/260 Heating system capacity

- **Output of total heating surface area in a space:** As near as practicable to, but not less than, the design heat loss for that space.
- **Boiler output:** Total calculated heat loss, including emission from the system pipelines. Preheat margin to be calculated and included.
- **Boiler load (maximum):** Submit proposals.
- **Calculation allowances:**
 - **Usage:** 15%.
 - **Exposure:** 15%.

60-45-40/270 Heating and hot water supply system capacity

- **Output of total heating surface area in a space:** As near as practicable to, but not less than, the design heat loss for that space.
- **Boiler output (minimum):** Total calculated heat loss, including emission from the system pipelines, and sufficient to meet the hot water supply requirements. Preheat margin can be counted against domestic hot water sizing where controls allow.
- **Calculation allowances:**
 - **Usage:** 15%.
 - **Exposure:** 15%.

60-45-40/275 Variable flow pipework systems

- **Design options:** Incorporating differential pressure control valves or two port control valves and DPCV's. Where system is exclusively radiators TRV's are acceptable without further pressure controls (except pressure reducing valve for minum pump flow).

60-45-40/280 Chemical treatment for heating systems

- **Treatment:** In accordance with BSRIA BG 50/2013.
- **Fill water pre-treatment:**
 - **Water conditioning:** Fill system with inhibitor and biocide treated and softened water. Dosing pot to be provided for subsequent top up of water treatment - sized by specialist.
 - **Microbiological control:** Biocide dosing.
- **Chemical treatment:**
 - **Corrosion inhibition:** Organic film-forming.
 - **Bacteria and biofouling inhibition:** Treatment for sulfate reducing bacteria; Treatment for nitrite reducing bacteria; and Pseudomonads.

- **Scale inhibition:** Yes
- **Non-chemical treatment:**
 - **Filtration:** Strainers;
Dirt separators;
and Magnetic filtration.
 - **Deaeration:** Passive deaeration.

Ω End of system

65-10-95/110 Natural ventilation system

System outline

65-10-95/110 Natural ventilation system

- **System performance:** [65-10-95/235 Natural ventilation design](#).
- **Ventilation inlet openings:** Windows and NVHR units
- **Actuators:** [90-65-50/314 Linear actuators](#); [90-65-50/316 Damper actuators type A](#); and Lever arm.
- **Supply points:** [90-45-20/320 Diffusers](#); [90-45-20/380 Grilles](#); and [90-45-20/310 Air transfer grilles](#).
- **Exhaust path:** [90-45-25/315 Circular sheet metal ductwork and fittings](#); [90-45-25/325 Flat oval sheet metal ductwork and fittings](#); and [90-45-25/365 Rectangular sheet metal ductwork and fittings](#).
- **Ventilation outlet openings:** [45-25-50/305 Aluminium louvre panel units](#).
- **Accessories:** See equipment schedules
- **Controls:** See equipment schedules
- **Ventilation opening control:** On/ off; Bank control; Sensor controlled; and Key switch.
- **Identification of ductwork and equipment:** [90-90-55/420 Identifying ductwork](#) and [90-90-55/480 Mechanical plant and equipment identification labels generally type A](#).
- **Execution:** [65-10-95/610 Removing ventilation system](#) and [65-10-95/620 Installing natural ventilation systems](#).
- **System completion:** [65-10-95/830 Inspection and test records](#); [65-10-95/820 Performance testing](#); [65-10-95/840 Demonstrations](#); [65-10-95/850 Documentation for ventilation systems](#); [65-10-95/860 Spares and consumables](#); [65-10-95/870 Maintenance](#); and [65-10-95/810 Commissioning of air distribution systems](#).

System performance

65-10-95/235 Natural ventilation design

- **Strategy:** Single side ventilation – single opening; Single side ventilation – double opening; Mechanically assisted; and Night ventilation.
- **Requirements:**
 - **Size of openings:** Refer to overheating report
 - **Actuators and linkages:** Submit proposals.
 - **Control strategy:** Submit proposals.

- **Environmental considerations:**
 - **Weather loadings:** Snow and Wind.
 - **Protection:** Noise ingress;
Rain ingress;
and Insect screens.
- **Hazard considerations:** Clashes with curtains and blinds;
Clashes with shutters and sunscreens;
and Injuries from unexpected operation.

Ω End of system

65-10-95/130 Mechanical ventilation systems

System outline

65-10-95/130 Mechanical ventilation systems

- **System performance:** Performance to be in line with Energy Strategy and no worse than as stated in Approved Document L2 Non-domestic Building Services Compliance Guide and ERP Regulations
- **Location of plant:** Refer to drawings
- **External air intake:** 45-25-50/305 Aluminium louver panel units.
- **Air filters:** 90-45-10/380 Bag filters;
90-45-10/360 Panel filters;
and 90-45-15/310 Air handling unit.
- **Heat recovery:** 90-45-15/310 Air handling unit;
90-45-45/320 Plate recuperators;
and 90-45-45/350 Thermal wheels.
- **Air handling units:** 90-45-15/310 Air handling unit.
- **Supply fans:** 90-45-30/310 Axial flow fans and 90-45-30/360 Roof mounted fans.
- **Acoustic treatment:** 90-45-15/310 Air handling unit;
90-45-75/310 Air transfer and cross talk attenuators;
90-45-75/320 Circular silencers;
and 90-45-75/330 Rectangular silencers.
- **Air ductwork and accessories:**
 - **Ductwork:** 90-45-25/315 Circular sheet metal ductwork and fittings;
90-45-25/365 Rectangular sheet metal ductwork and fittings;
and 90-45-25/320 Fire rated and smoke extract ductwork and fittings.
 - **Accessories:** 90-45-25/465 Pressure control flaps;
90-45-25/440 Insect guards;
90-45-25/460 Non-return dampers;
90-45-25/470 Pressure relief dampers;
90-45-25/400 Access doors;
90-45-25/445 Intumescent fire and smoke dampers;
90-45-25/430 Flexible ductwork;
90-45-25/482 Smoke dampers;
and 90-45-25/420 Fire and smoke dampers.
- **Thermal insulation on supply air ductwork:** 90-90-40/360 Phenolic foam insulation type A.
- **Vibration isolation mountings:** 90-90-95/370 Isolation hangers and 90-90-95/330 Spring isolators.
- **Reheat batteries:** 90-45-50/320 Electric heater batteries and 90-45-50/340 Low temperature hot water heating coils and DX heating and cooling coils
- **Room supply air terminal devices:** 90-45-20/330 Displacement ventilation diffusers;
90-45-20/380 Grilles;
90-45-20/350 Linear diffusers;
90-45-20/360 Swirl diffusers;
90-45-20/310 Air transfer grilles;
and 90-45-20/320 Diffusers.
- **Accessories:** 90-90-60/380 Roof equipment support systems and 90-90-60/390 Services supports.

- **Controls:** Refer to controls specification section
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels generally type A.
- **Testing:** 90-45-25/785 Air leakage testing of medium pressure ductwork;
90-45-25/780 Air leakage testing of high pressure ductwork;
and 90-45-25/790 Air leakage testing of plant items.
- **Execution:** 65-10-95/630 Installing ductwork on air handling units.
- **System completion:** 65-10-95/830 Inspection and test records;
65-10-95/820 Performance testing;
65-10-95/840 Demonstrations;
65-10-95/850 Documentation for ventilation systems;
65-10-95/860 Spares and consumables;
65-10-95/870 Maintenance;
and 65-10-95/810 Commissioning of air distribution systems.

Ω End of system

65-10-95/160 Kitchen ventilation system

System outline

65-10-95/160 Kitchen ventilation system

- **System performance:** 65-10-95/210 Design of ventilation systems;
65-10-95/240 Ductwork design;
65-10-95/250 Fan performance;
65-10-95/255 Variable duty fan performance;
65-10-95/260 Attenuator performance;
and 65-10-95/290 Submittals.
- **Room extract air terminal devices:** 90-45-10/370 Primary grease filters;
90-45-10/390 Secondary grease filters;
90-45-20/470 Ventilated ceilings for kitchens;
and 90-45-25/340 Kitchen canopies.
- **Air ductwork and accessories:**
 - **Ductwork:** 90-45-25/320 Fire rated and smoke extract ductwork and fittings.
 - **Accessories:** 90-45-25/400 Access doors;
90-45-25/460 Non-return dampers;
90-45-25/440 Insect guards;
and 90-45-25/410 Bird guards.
- **Thermal insulation on extract air ductwork:** 90-90-40/320 Metal mesh faced mineral wool mattresses and 90-90-40/340 Mineral wool slabs insulation.
- **Vibration isolation mountings:** 90-90-95/330 Spring isolators and 90-90-95/370 Isolation hangers.
- **Acoustic treatment:** 90-45-75/320 Circular silencers and 90-45-75/330 Rectangular silencers.
- **Extract fans:** 90-45-30/310 Axial flow fans;
90-45-30/320 Centrifugal fans;
90-45-30/340 Mixed flow fans;
and 90-45-30/360 Roof mounted fans.
- **External exhaust air terminals:** 45-25-50/305 Aluminium louvre panel units.
- **Accessories:** 90-90-60/380 Roof equipment support systems and 90-90-60/390 Services supports.
- **Controls:** Refer to Controls specification section.
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels type B.
- **Testing:** 90-45-25/785 Air leakage testing of medium pressure ductwork;
90-45-25/780 Air leakage testing of high pressure ductwork;
and 90-45-25/790 Air leakage testing of plant items.
- **Execution:** 65-10-95/630 Installing ductwork on air handling units and 65-10-95/650 Cleaning of kitchen extract systems.
- **System completion:** 65-10-95/810 Commissioning of air distribution systems;
65-10-95/820 Performance testing;
65-10-95/830 Inspection and test records;
65-10-95/840 Demonstrations;
65-10-95/850 Documentation for ventilation systems;
65-10-95/860 Spares and consumables;
and 65-10-95/870 Maintenance.

System performance

65-10-95/210 Design of ventilation systems

- **Method:** In accordance with CIBSE guides. Conduct full dynamic thermal analysis where stated.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Computer calculations:**
 - **Submittals:** Fan sizing calculations.
 - **Format:** Electronic

65-10-95/240 Ductwork design

- **Air velocity:**
 - **Standard:** As CIBSE Guide B2.

65-10-95/250 Fan performance

- **Standard:** In accordance with BS 6583.
- **Flow rate:** To achieve design plus 10%
- **System pressure:** To achieve design plus 15%
- **Operation:** Continuous or Intermittent.
- **Specific fan power:** In accordance with value stated in Energy Strategy Document.
As minimum in compliance to Approved Document L - Domestic/Non-domestic Building Services Compliance Guide, as applicable.
- **Classification:** 1 W/l/s or less AND in full compliance to Non-domestic Building Services Compliance Guide

65-10-95/255 Variable duty fan performance

- **Turn down ratio:** Submit proposals.
- **Static pressure at full volume:** To achieve design plus 15%
- **Static pressure at minimum volume:** Submit proposals.
- **Means of varying fan duty:** Variable speed centrifugal - inverter driven

65-10-95/260 Attenuator performance

- **Performance requirements:**
 - **Standards:** To BS EN ISO 7235 and BS EN ISO 11691.
 - **Insertion loss:** 40 Pa maximum unless agreed with the Engineer

65-10-95/290 Submittals

- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Calculations:**
 - **Submit U-values and heat gain calculations for each room:**
Format: CIBSE method calculation using IES or HEVACOMP.
 - **Submit fan and duct sizing calculations:**
Format: electronic

65-70-45/110 Room air conditioning system

System outline

65-70-45/110 Room air conditioning system

- **System performance:** 65-70-45/210 Design of local air conditioning system;
65-70-05/230 Design parameters for air conditioning systems;
and 65-70-05/240 Ductwork design.
- **System manufacturer:** Refer to equipment schedules and detailed design requirements. Manufacturer to be from the approved list as appended within this specification, If the contractor is to deviate from this list submit to Engineers agreement and it is contractors duty to ensure compliance with the design criterion.
- **Air conditioning units:** 90-45-05/350 Room air conditioning units;
90-45-05/360 Split coil room air conditioning units;
and 90-45-05/370 Split coil remote air cooled condensing units.
- **Refrigerant pipeline:** 90-10-65/390 Refrigerant pipelines and fittings.
- **Pipeline insulation:** 90-90-40/350 Nitrile rubber insulation.
- **External louvres:** Not applicable
- **Controls:** Submit proposals.
- **Condensate pipelines:** 90-10-65/310 Copper pipelines type D.
- **Accessories:** 90-90-60/380 Roof equipment support systems and 90-90-60/390 Services supports.
- **Identification of ductwork and equipment:** 90-90-55/420 Identifying ductwork and 90-90-55/480 Mechanical plant and equipment identification labels type B.
- **Execution:** 65-70-45/620 Installing local air conditioning refrigeration.
- **System completion:** 65-70-05/810 Commissioning of air distribution systems65-70-05/820 Performance testing65-70-05/830 Inspection and test records65-70-05/840 Demonstrations65-70-05/850 Documentation65-70-05/860 Spares and consumables65-70-05/870 Maintenance

System performance

65-70-45/210 Design of local air conditioning system

- **Design:** Complete the design of the local air conditioning system.
- **Standard:** Performance to BS EN 13779.
- **Method:** In accordance with CIBSE Applications Manual AM 11.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Calculations:**
 - **Submittals:** U-values and heat gain calculations for each room.
 - **Format:** IES or HEVACOMP.

70-50-45/110 Incoming low voltage electricity supply

System outline

70-50-45/110 Incoming low voltage electricity supply

- **System performance:** 70-50-45/210 Design of incoming low voltage electricity supply;
70-50-45/220 Supply characteristics;
and 70-50-45/230 Connecting generators to the public supply network.
- **Nature of current:** Alternating.
- **Phase:** Three phase 4 wire.
- **Voltage:** 400 V.
- **Electricity distributor:** SSE Power Distribution
- **Electricity supplier:** SSE Power Distribution
- **Metering:** HH Metering
- **Execution:** 70-50-45/630 Management of electricity distributor;
70-50-45/660 Earthing arrangement;
and 70-50-45/640 Location of incoming point of supply.
- **System completion:** 70-50-45/810 Site supply characteristics.

System performance

70-50-45/210 Design of incoming low voltage electricity supply

- **Standards:** In accordance with BS 7671 and the Electricity Distributor's guidelines.
- **Design:** Complete the design of the low voltage supply.
- **Requirement:** Submit detailed design drawings showing equipment positions and routes, technical information and calculations.
- **Evidence of agreement with Electricity Distributor:** Submit.

70-50-45/220 Supply characteristics

- **Anticipated maximum demand (kV·A):** As per design intent load assessment or submit proposal.
- **Earthing type:** TN-C-S and TN-S.
- **Maximum prospective short-circuit current:** As per design intent load assessment or submit proposal.
- **Maximum external earth fault loop impedance:** Confirm with the DNO, typically 0.35 ohm.
- **Overcurrent device at incoming point of supply:**
 - **Type:** As per design intent load assessment or submit proposal.
 - **Rating:** As per design intent load assessment or submit proposal.
- **Spare capacity:** 25% of maximum demand, unless otherwise stated..

70-50-45/230 Connecting generators to the public supply network

- **Standard:** To ENA 59/2-1 and To ENA G83/1-1.

70-65-60/110 Grid connected photovoltaic system

System outline

70-65-60/110 Grid connected photovoltaic system

- **System performance:** 70-65-60/210 Design of photovoltaic systems;
70-65-60/220 Structural and weatherproofing considerations;
and 70-65-60/230 Photovoltaic arrays.
- **System manufacturer:** Submit proposals.
- **Input source:** 90-50-80/310 Photovoltaic modules.
- **Mounting:** 90-90-60/320 Ballasted mounting frame for solar modules and 90-90-60/330 Free standing mounting frame for solar modules.
- **d.c. side equipment:** 90-50-45/450 Switches, disconnectors, switch-disconnectors and fuse combination units type A;
90-60-25/490 PV array junction boxes;
and 90-50-45/396 PV generator junction boxes.
- **Power conditioning units (PCUs):**
- **a.c. isolation switches:** .
- **Energy meters:** 90-65-55/340 Energy meter.
- **Cable type:** Submit proposals.
- **Cable sizes:** Submit proposals.
- **Rewireable installation:** Submit proposals.
- **Concealed installation:** Submit proposals.
- **Cable containment:** Submit proposals.
- **Transient over-voltage surge suppression devices:** Submit proposals.
- **Execution:** 70-65-60/620 Installation generally;
70-65-60/630 Installing PV module arrays;
70-65-60/660 Installing d.c. isolation switches;
70-65-60/670 Installing PV array junction boxes;
70-65-60/680 Installing PV generator junction boxes;
70-65-60/690 Installing a.c. isolation switches;
70-65-60/730 Installing energy meters;
70-65-60/740 Connection to electricity distribution network;
70-65-60/750 Earthing and equipotential bonding;
70-65-60/760 Connection to lightning protection system;
and 70-65-60/770 Labelling.
- **System completion:** 70-65-60/820 Documentation.

System performance

70-65-60/210 Design of photovoltaic systems

- **Design:** Complete the design of the photovoltaic system.
- **Standards:** In accordance with BS 7671, BS IEC 62548 and ER G99.
- **Testing and commissioning:** Incorporate adequate measures to allow full testing and commissioning of the completed system.

- **Proposals:** Submit proposals.
- **Approvals:** Obtain written approval of the Electricity Distributor.

70-65-60/220 Structural and weatherproofing considerations

- **Modifications to existing structures:**
- **Supports and fixings:**
 - **Requirement:** No impairment to the thermal and weatherproofing performance of the building fabric.
 - **Arrangement of fixings or proposed supporting structure:** Submit proposals.
 - **Submittals to include:** Submit proposals.
 - **Timing of submittals:**

70-65-60/230 Photovoltaic arrays

- **Nominal output:**
 - **Peak power:** 21kWp
 - **Number of strings:**
 - **String voltage (maximum):**

Ω End of system

70-70-25/110 Earthing and bonding system

System outline

70-70-25/110 Earthing and bonding system

- **System performance:** 70-70-25/210 Design of earthing and bonding systems;
70-70-25/220 Electricity distributor's requirements;
70-70-25/230 Equipotential bonding in buildings with information technology equipment;
70-70-25/240 Functional earthing design;
70-70-25/250 Generator earthing design;
70-70-25/255 Mobile generator earthing;
70-70-25/260 High integrity earthing design;
70-70-25/270 Design for hazardous areas;
70-70-25/280 Design for the safe use and handling of flammable liquids;
and 70-70-25/290 Design to minimize undesirable static electricity.
- **Main incoming earth:** Establish with the Electricity Distributor.
- **Main earth electrode type:** 90-75-50/330 Earth rods.
- **Main equipotential bonding:**
 - **Connect the following to the main earthing terminal:** Submit proposals.
 - **Cable type:** 90-75-50/390 Copper tape.
 - **Size:** To BS 7671, Regulation 544.1.1.
- **Supplementary equipotential bonding:**
 - **Bond the following:** Supplementary equipotential bonding may be required for installations and locations of increased shock risk.
 - **Cable type:** Submit proposals.
 - **Size:** Minimum of 2.5 mm² if sheathed or where mechanical protection is provided, otherwise 4 mm².
- **Circuit protective conductors:**
 - **Conductor type:** Cable armour;
Cable armour and auxiliary;
and Core of cable.
 - **Size:** To BS 7454;
To BS 7671, Regulation 543.1.3;
and To BS 7671, Regulation 543.1.4.
- **Earth terminal:** 90-75-50/310 Earth bars.
- **Earthing of metal fencing around substations:** Required
- **Accessories:** 90-55-15/320 Anti vandal capping;
90-75-50/350 Earthing and bonding clamps;
and 90-75-50/460 Soil conditioning agents.
- **Electrical identification:** 90-90-55/390 Equipment labels and warning notices type A.
- **Execution:** Dissimilar metals
Earthing and bonding of street furniture
General installation
Identification of functional earthing
Installing earth conductor joints and connections
Installing main earthing conductor
Installing main equipotential bonding conductors
Installing supplementary bonding conductors

Installing surface barriers around earth rods
Measurement of characteristics of existing installations
Notices and labels
Removing earthing and bonding systems

- **System completion:** cleaning of the installed system;
testing the installed system;
submittals (e.g. operation and maintenance manuals);
spares;
training;
maintenance by the Contractor during the defects liability period

System performance

70-70-25/210 Design of earthing and bonding systems

- **Standards:** To BS 7671 and in accordance with BS 7430.
- **Design:** Complete the design of the earthing and bonding systems.
- **Size of main earthing conductor:** To BS 7454;
To BS 7671, Regulation 543.1.3;
and To BS 7671, Regulation 543.1.4.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

70-70-25/220 Electricity distributor's requirements

- **Evidence of compliance:** Submit, in accordance with the requirements of the Electricity Distributor.

70-70-25/230 Equipotential bonding in buildings with information technology equipment

- **Standard:** To BS EN 50310.
- **Objectives:** Installation shall be in accordance with BS 7671 and BS EN 50310

70-70-25/240 Functional earthing design

- **Standard:** To BS 6701.
- **Objectives:** Installation shall be in accordance with BS 7671 and BS 6701
- **Connection type:** Direct to main earth bar;
To a separate dedicated earth-electrode network;
and To a separate functional earth bar connected directly to the main earth bar.

70-70-25/250 Generator earthing design

- **Standard:** To BS 7430 and in accordance with the Electricity Distributor's requirements.
- **Independent earth electrode network:** Provide.
- **Individual earth electrode resistance (maximum):** 20 ohm.
- **Generator operation:** Changeover supply;
Dependent upon mains electricity supply;
Independent of mains electricity supply;
and Parallel with mains electricity supply.
- **Earth connection to generator:** Provide.

70-70-25/255 Mobile generator earthing

- **Mobile generator earthing:** Provide an earthing system capable of being connected to a mobile generator.
- **Mobile generator position:** Submit proposals.

70-70-25/260 High integrity earthing design

- **Scope:** As per Regulations 543.7.1 and 543.7.2

70-70-25/270 Design for hazardous areas

- **Standard:** To BS EN 60079-14.

70-70-25/280 Design for the safe use and handling of flammable liquids

- **Design:** In accordance with HS(G) 140.

70-70-25/290 Design to minimize undesirable static electricity

- **Design:** In accordance with BS 5958-1 and In accordance with PD CLC/TR 50404.

Ω End of system

70-70-40/130 Inspection and testing of existing electrical installations

System outline

70-70-40/130 Inspection and testing of existing electrical installations

- **General requirements:**
 - **Electrical test engineer:** Electrical installation contractor and Independent of installation contractor.
Approval: National Inspection Council for Electrical Installation Contracting (NICEIC).
Evidence of approval: Submit.
 - **Test equipment calibration:** UKAS approved.
- **Areas to be tested:** Existing.
- **Scope of survey:** Existing.
- **Execution:** 70-70-40/610 Test equipment calibration and 70-70-40/620 Inspection and testing electrical installations generally.
- **System completion:** 70-70-40/880 Electrical installation condition report.

Ω End of system

70-70-45/110 Low voltage distribution system

System outline

70-70-45/110 Low voltage distribution system

- **Connection to low voltage supply:** Project specific to be completed by the engineer.
- **Switchgear:** 90-50-45/390 Cable distribution cabinets;
90-50-45/420 Cubicle switchboards;
70-70-45/510 Custom built cubicle switchboards;
90-50-45/410 Distribution boards and consumer units;
and 90-50-45/450 Switches, disconnectors, switch-disconnectors and fuse combination units type C.
- **Distribution circuit cabling:**
 - **Types:** ;
90-55-15/343 Fire resistant, insulated and sheathed armoured cables;
90-55-15/347 PVC insulated cables for switchgear and control gear;
90-55-15/351 Thermosetting insulated cables;
90-55-15/353 Thermosetting insulated and PVC sheathed armoured cables;
90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables;
90-55-15/355 Thermosetting insulated metal screened LSZH sheathed multicore cables;
and 90-55-15/342 Fire resistant, insulated and sheathed cables.
- **Cable accessories:** 90-55-10/320 Cable bands;
90-55-10/310 Cable cleats;
90-55-10/315 Cable ties;
90-10-65/445 Plastic ducts for buried electric cables;
90-55-15/332 Underground concrete cable protection covers;
90-55-15/321 Underground plastics cable protection covers;
and 90-55-15/333 Underground cable marker tape.
- **Containment:** 90-55-10/305 Channel cable supports;
90-55-10/325 Cable baskets;
90-55-10/330 Cable ladders;
90-55-10/335 Cable trays;
90-55-10/380 Rigid conduit type A;
and 90-55-10/410 Cable trunking and cable ducting systems.
- **Containment accessories:** 45-50-05/310 Expansion anchors;
45-50-10/335 Hexagon head stainless steel nuts and bolts;
45-50-12/340 Stainless steel anchor rods;
45-50-12/360 Stainless steel anchor sockets;
45-50-60/400 Coach screws;
45-50-60/410 Hexagon head stainless steel screws;
45-50-67/350 Masonry plugs;
90-55-10/460 Conduit fittings type A;
and 90-55-10/470 Intumescent linear gap seals type B.
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Accessories:** ;
;
90-50-45/350 Fire barrier units;
90-50-45/490 Switchgear mounting framework;
90-60-30/410 Transient overvoltage surge suppression devices for mains power supplies;
90-60-40/360 Automatic power factor correction equipment;

90-60-40/410 Uninterruptible power supply (UPS) unit;
90-60-40/420 Uninterruptible power supply (UPS) remote alarm and indicator panels;
90-90-60/310 Battery shelving racks;
and Harmonic Filters as clause 90-60-40.

- **Electrical identification:** 90-90-55/390 Equipment labels and warning notices type A;
90-90-55/395 Electrical diagrams generally;
and 90-90-55/320 Electrical shock treatment signs type A.
- **Execution:** 70-70-45/630 Electrical property measurement of low voltage systems.
- **System Completion:** 70-70-45/811 Inspecting, testing and commissioning automatic power factor correction equipment and 70-70-45/820 Documentation.

System performance

70-70-45/215 Low voltage distribution circuit cables generally

- **Standard:** In accordance with BS 7671.
- **Proposed selection of low voltage distribution cables:** Submit drawings, technical information, calculations and manufacturer's literature.
- **Conductor sizes (minimum):**
 - **Distribution circuit cables:** As indicated on the distribution board schedules or as determined through the calculation method.
- **Cable sizes not stated:** Minimum cable sizes for lighting cabling to be 1.5mm² and minimum cable sizes for small power cabling to be 2.5mm². Submit proposals.
- **Format:** Amtech and Hevacomp or as agreed with the Engineer.

70-70-45/220 Selection of conduit, trunking and ducting

- **Standard:** In accordance with BS 7671.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature. The drawings indicates the design intent for the primary containment routes. The contractor shall submit full calculations for all containment selected based on the contractors final routes selected.
- **Conduit, trunking and ducting sizes not stated:** Submit.

70-70-45/225 Grading study

- **Scope:** Complete for the low voltage distribution system (including existing, if any).
- **Fault calculations:** Include fault impedance and short circuit fault current analysis.
- **Protective devices:** Coordinate the selection and adjustment of protective device settings to achieve discrimination throughout the fault level range. Grade so that a fault on any outgoing branch circuit is cleared by the switching device installed in the faulted branch circuit without affecting the other outgoing branch circuits. Demonstrate discrimination using time-current coordination curves with single line diagrams, in the study report.
- **Manufacturers' details and recommended settings:** Include in study report.
- **Study report:**
 - **Format:** Microsoft word or equivalent for the report and all calculations in approved software format described above.
 - **Number of copies:** Electronic copies.

70-70-45/230 Input power supply characteristics

- **Supply impedance:** As advised by the DNO.
- **Earthing type:** As advised by DNO (new supply) or as indicated on the NICEIC test certificates (for existing installations)
- **Nominal voltage:** Single phase 230 V a.c. $\pm 10\%$ and Three phase 400 V a.c. $\pm 10\%$.
- **Nominal frequency:** 50 Hz.
- **Type of protective device in the input supply circuit:** Type B MCB to BS EN 60898-1;
Type C MCB to BS EN 60898-1;
Type D MCB to BS EN 60898-1;
MCCB to BS EN 60947-2;
and Fuse type gG to BS EN 60269-1.

70-70-45/245 Performance of power factor correction equipment

- **Power factor when corrected:** 0.95 lagging.
- **Capacitor bank size and number of stages:** Capacitor bank size as indicated on the design drawings. No. of stages to be in line with manufacturers standard arrangement.
- **Power factor equipment sizing calculations:** Submit proposals.

Ω End of system

70-70-75/110 Hard wired low voltage small power system

System outline

70-70-75/110 Hard wired low voltage small power system

- **System performance:** 70-70-75/215 Low voltage small power cables generally;
70-70-75/220 Selection of conduit, trunking and ducting generally;
70-70-75/210 Design of low voltage small power systems;
and 70-70-75/230 Multi-gang power outlets.
- **Origin of supply:** As indicated on the drawings and schedules or as described with this specification.
- **Final circuit cabling:**
 - **Types:** 90-50-45/320 Power busbar trunking;
90-55-15/342 Fire resistant, insulated and sheathed cables;
90-55-15/343 Fire resistant, insulated and sheathed armoured cables;
90-55-15/344 Mineral insulated cables;
90-55-15/354 Thermosetting insulated and LSZH sheathed armoured cables;
and 90-55-15/351 Thermosetting insulated cables.
- **Cable accessories:** 90-55-10/310 Cable cleats;
90-55-10/315 Cable ties;
and 90-55-10/320 Cable bands.
- **Containment:** 90-55-10/325 Cable baskets;
90-55-10/335 Cable trays;
90-55-10/350 Buried conduit;
90-55-10/360 Flexible conduit;
90-55-10/380 Rigid conduit type A;
90-55-10/410 Cable trunking and cable ducting systems;
and 90-55-10/390 Proprietary trunking.
- **Containment accessories:** 90-55-10/430 Service outlet boxes;
90-55-10/440 Service outlet poles;
90-55-10/450 Raised access floor service outlets;
90-55-10/460 Conduit fittings type B;
and 90-55-10/470 Intumescent linear gap seals type A.
- **Rewireable installation:** Required.
- **Concealed installation:** Required except where detailed otherwise on the Architectural drawings. Where services are to be exposed the finish shall be in accordance with the Architectural specification.
- **Final connections:** Required inclusive of all items supplied under the main contract works.
- **Partial installation:** Required where identified on the drawings and schedules as "for future use by others"
- **Outlets:** 90-60-25/315 Electrical accessories and 90-60-25/365 Multi-gang power outlets.
- **Controls and starters:** 90-65-25/370 Emergency stop buttons.
- **Accessories:** 90-50-45/330 Tap-off units;
90-50-45/340 Feed units;
90-50-45/350 Fire barrier units;
90-60-30/410 Transient overvoltage surge suppression devices for mains power supplies;
90-60-40/410 Uninterruptible power supply (UPS) unit;
and 90-60-40/420 Uninterruptible power supply (UPS) remote alarm and indicator panels.

- **Electrical identification:** 90-90-55/320 Electrical shock treatment signs type A;
90-90-55/390 Equipment labels and warning notices type A;
and 90-90-55/395 Electrical diagrams generally.
- **Execution:** 70-70-75/650 Partial installation;
70-70-75/630 Installing cabling to socket outlets;
70-70-75/640 Installing final connections to fixed equipment;
70-70-75/610 Removing small power systems;
and 70-70-75/620 Small power installation.
- **System completion:** 70-70-75/840 Maintenance;
70-70-75/830 Spares;
70-70-75/813 Inspecting, testing and commissioning UPS equipment;
70-70-75/812 Inspection, testing and commissioning of harmonic filters;
and 70-70-75/820 Documentation.

System performance

70-70-75/210 Design of low voltage small power systems

- **Provision of small power:** For fixed and portable equipment requiring power.
- **Design:** Complete for the low voltage small power systems.
- **Standards:** In accordance with BS 7671 and To BS 8488 (where pre-fabricated wiring is to be used within the small power system).
- **Diversity:** In accordance with IET Guidance note 1.
- **Spare capacity throughout the small power system:** 20%.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

70-70-75/215 Low voltage small power cables generally

- **Standard:** To BS 7671.
- **Proposed selection of low voltage cables:** Submit drawings, technical information, calculations and manufacturers' literature.
- **Conductor sizes (minimum):**
 - **Power final circuits:** Minimum cross sectional area of 1.5 mm² for lighting circuits and 4 mm² for small power circuits unless otherwise stated within the schedules.
- **Cable sizes not stated:** Submit proposals.
- **Format:** Amtech and Hevacomp or as agreed with the Engineer.

70-70-75/220 Selection of conduit, trunking and ducting generally

- **Standard:** To BS 7671.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Conduit, trunking and ducting sizes not stated:** Submit proposals.

70-70-75/230 Multi-gang power outlets

- **Quantity:** 1 No. 6 gang PDU per workstation.

70-80-25/120 Amenity lighting system

System outline

70-80-25/120 Amenity lighting system

- **System performance:** 70-80-25/250 Lighting performance;
70-80-25/240 Luminaire and lamp maintenance properties;
70-80-25/220 Amenity lighting design;
70-80-25/230 Maintenance factor calculations;
70-80-25/280 Conduit, trunking and ducting generally;
and 70-80-25/270 Lighting cables generally.
- **System manufacturer:** As per the luminaire schedule.
- **Electrical supply:** As indicated on the Main LV Schematic, on the distribution board schedule, as indicated on the drawings or as described above.
- **Final circuit cabling:**
 - **Type:** , XLPE/SWA/LSZH.
- **Containment:** 90-55-10/330 Cable ladders and 90-55-10/335 Cable trays.
- **Containment accessories:** 90-55-10/470 Intumescent linear gap seals type A.
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Trenches, pipeways and pits:** Required.
- **Low voltage switchgear:** 90-50-45/390 Cable distribution cabinets.
- **Luminaire supports:**
 - **Type:** 90-60-45/350 Aluminium column luminaire brackets;
90-60-45/330 Aluminium lighting pedestals;
90-60-45/370 Aluminium luminaire brackets;
90-60-45/340 Steel lighting pedestals;
90-60-45/360 Steel column luminaire brackets;
90-60-45/380 Steel luminaire brackets;
90-60-45/320 Steel lighting columns;
and 90-60-45/310 Aluminium lighting columns.
 - **Painting:** Anti-graffiti textured finish and Factory finish.
- **Concrete bases to columns and pedestals:** Required.
- **luminaires:** As per the luminaire schedule
- **Controls:**
 - **Types:** 90-65-05/430 Photoelectric control units and 90-65-25/380 Time switches.
 - **Configuration:** External lighting to operate as indicated on the drawings. Where this is not indicated on the drawings the contractor shall allow for the required number of control groups for the proposed number of luminaires with a maximum of 10 No. luminaires in any one group.
- **System accessories:** 90-50-45/392 Street Lighting Electrical cut outs;
90-60-50/470 Separated extra-low voltage lighting transformers;
and 90-50-45/394 Enclosures type B.
- **Electrical identification:** 90-90-55/395 Electrical diagrams generally and 90-90-55/320 Electrical shock treatment signs type A.
- **Execution:** 70-80-25/700 Installing lighting columns;
70-80-25/720 Cleaning;

70-80-25/670 Concrete bases;
70-80-25/710 Column and pedestal labelling;
70-80-25/630 Modifying existing external lighting systems;
70-80-25/610 Removing external lighting systems;
70-80-25/680 Setting components in concrete bases;
70-80-25/620 Installing roadway and amenity lighting systems generally;
and 70-80-25/690 Setting components in earth.

- **System completion:** 70-80-25/820 Documentation;
70-80-25/830 Spares;
70-80-25/840 Maintenance;
70-80-25/817 Photometric survey of amenity lighting systems;
70-80-25/810 Inspection and testing;
and 70-80-25/812 Commissioning.

System performance

70-80-25/220 Amenity lighting design

- **Design:** Complete the design of the amenity lighting system.
- **Standards:** In accordance with CIBSE Lighting Guide LG6;
In accordance with ILE Guidance notes for the reduction of obtrusive light GN01;
and To BS 5489-1.
- **Lighting class:** To BS EN 13201-2, S1.
- **Average power density energy consumption (maximum):** As per the energy strategy.
- **Initial circuit luminous efficacy (minimum):** 60 luminaire lumens per circuit watt
- **Proposals:**
 - **Submit the following information:** Luminaire layout drawings. Luminaire photometric data including flux fraction ratios, polar intensity curves and utilisation factors. Lamp and luminaire technical information. Road surface reflectance values. Computer generated point calculations with contribution from inter-reflected light;
Maintenance factor calculations. Schedule of design and calculated maintained average illuminance values. Schedule of design and calculated uniformity values;
and Power density and efficacy of the installation.

70-80-25/230 Maintenance factor calculations

- **Luminaire maintenance strategy:** Planned maintenance on a 18 month cycle.
- **Lamp replacement strategy:** Planned maintenance on a 18 month cycle.
- **Maintenance factors:** 0.8

70-80-25/240 Luminaire and lamp maintenance properties

- **Lamp replacement method:** Planned replacement on a 18 month cycle.
- **Lamp lumen maintenance factor:** 0.8
- **Lamp survival factor:** Submit proposals in line with manufacturers standard.
- **Luminaire maintenance class:** Submit proposals in line with manufacturers standard.
- **Luminaire cleaning interval:** 18 months.
- **Luminaire maintenance factor:** 0.8

70-80-25/250 Lighting performance

- **Luminaire lumens per circuit watt:** Minimum of 60 luminaire lumens per circuit watt.

- **Task area:** At ground level
- **Maintained average illuminance level (lx):** In accordance with CIBSE SLL Code for Lighting
 - **Uniformity (minimum):** 0.15.
 - **Colour rendering class (Ra):** 80-89.

70-80-25/270 Lighting cables generally

- **Standard:** To BS 7671.
- **Proposed selection of low voltage cables:** Submit drawings, technical information, calculations and manufacturers' literature.
- **Conductor sizes (minimum):**
 - **Lighting circuits:** As indicated on the in the distribution board schedules.
 - **Final connection:** As per manufacturers recommendations
- **Cable sizes not stated:** Minimum of 6mm²
- **Format:** Full cable calculations to be submitted in Amtech for cable sizes not stated.

70-80-25/280 Conduit, trunking and ducting generally

- **Standard:** To BS 7671.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Conduit, trunking and ducting sizes not stated:** Submit proposals. Ducting to be used shall be a minimum of 150mm diameter twin wall HDPE flexible ducting. All conduit shall be a minimum of 32mm diameter galvanised steel conducting. Trunking shall only be used in local instances as agreed with the Engineer.

Ω End of system

70-80-35/110 Hard wired general lighting system

System outline

70-80-35/110 Hard wired general lighting system

- **System Performance:** 70-80-35/220 Escape route lighting;
70-80-35/225 Open area lighting;
70-80-35/240 Lighting performance;
70-80-35/270 Lighting cables generally;
70-80-35/280 Conduit, trunking and ducting generally;
70-80-35/245 Maintenance factor calculations;
and 70-80-35/250 Luminaire and lamp maintenance properties.
- **Final circuit cabling:** 90-55-15/352 Thermosetting insulated and PVC sheathed cables (XLPE/ PVC singles);
90-55-15/351 Thermosetting insulated cables;
and 90-55-15/345 PVC insulated cables.
- **Containment:** 90-55-10/380 Rigid conduit type A and 90-55-10/410 Cable trunking and cable ducting systems.
- **Containment accessories:** 45-50-05/310 Expansion anchors;
45-50-10/335 Hexagon head stainless steel nuts and bolts;
45-50-12/340 Stainless steel anchor rods;
45-50-12/360 Stainless steel anchor sockets;
45-50-60/400 Coach screws;
45-50-60/410 Hexagon head stainless steel screws;
45-50-67/350 Masonry plugs;
90-55-10/460 Conduit fittings type A;
90-55-10/460 Conduit fittings type B;
90-55-10/470 Intumescent linear gap seals type A;
and 90-55-10/470 Intumescent linear gap seals type B.
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Luminaire types:** As indicated on the drawings and described within the luminaire schedule.
- **Connections to luminaires:** 90-50-45/380 Lighting distribution boxes and 90-60-25/430 Luminaire supporting couplers.
- **Lighting controls:** 90-65-05/415 Daylight sensors;
90-65-05/425 Mains voltage occupancy detectors;
90-60-25/325 Light switches;
and 90-60-25/330 Dimmer switches and controls.
- **Accessories:**
- **Electrical identification:** 90-90-55/390 Equipment labels and warning notices type B and 90-90-55/320 Electrical shock treatment signs type B.

System performance

70-80-35/220 Escape route lighting

- **Position:** In accordance with BS EN 1838
- **Minimum horizontal illuminance at floor level on centre line of escape route (lx):** 1.

- **Uniformity ratio (maximum: minimum illuminance):** Less than 40:1 along the centre line of the escape route.
- **Disability glare:** In accordance with BS EN 1838, table 1.

70-80-35/225 Open area lighting

- **Position:** In accordance with BS EN 1839

70-80-35/240 Lighting performance

- **Task area:** As indicated on the lighting performance schedule
- **Maintained average illuminance level (Ix):** As indicated on the lighting performance schedule
- **Glare index (maximum):** As indicated on the lighting performance schedule
- **Uniformity (minimum):** As indicated on the lighting performance schedule
- **Colour rendering class (Ra):** As indicated on the lighting performance schedule
- **Colour temperature (K):** As indicated on the lighting performance schedule
- **Means of control:** As indicated on the lighting performance schedule

70-80-35/245 Maintenance factor calculations

- **Luminaire maintenance strategy:** As indicated on the lighting performance schedule.
- **Lamp replacement strategy:** As indicated on the lighting performance schedule.
- **Maintenance factors:** As indicated on the lighting performance schedule.

70-80-35/250 Luminaire and lamp maintenance properties

- **Lamp replacement method:** As indicated on the lighting performance schedule
- **Lamp lumen maintenance factor:** As indicated on the lighting performance schedule
- **Lamp survival factor:** As indicated on the lighting performance schedule
- **Luminaire maintenance class:** As indicated on the lighting performance schedule
- **Luminaire cleaning interval:** As indicated on the lighting performance schedule
- **Luminaire maintenance factor:** As indicated on the lighting performance schedule
- **Room surface cleaning interval:** As indicated on the lighting performance schedule
- **Room surface maintenance factor:** As indicated on the lighting performance schedule

70-80-35/270 Lighting cables generally

- **Standard:** To BS 7671.
- **Proposed selection of low voltage cables:** Submit drawings, technical information, calculations and manufacturer's literature.
- **Conductor sizes (minimum):**
 - **Lighting circuits:** 1.5 mm² minimum or as defined on the distribution board schedule.
 - **Final connection:** 0.75 mm² minimum or as defined on the distribution board schedule.
- **Cable sizes not stated:** Submit proposals.
- **Format:** Amtech or Hevacomp.

70-80-35/280 Conduit, trunking and ducting generally

- **Standard:** To BS 7671.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

- **Conduit, trunking and ducting sizes not stated:** Submit proposals. Ducting to be used shall be a minimum of 150mm diameter twin wall HDPE flexible ducting. All conduit shall be a minimum of 32mm diameter galvanised steel conducting. Trunking shall only be used in local instances as agreed with the Engineer.

Ω End of system

75-45-20/110 Data distribution system

System outline

75-45-20/110 Data distribution system

- **System Performance:** 75-45-20/260 Connections with other systems;
75-45-20/230 Channel performance;
75-45-20/210 Design of data distribution systems;
75-45-20/240 Telecommunications outlets;
and 75-45-20/250 Resilience.
- **Applications:** CSMA/ CD 1000Base-T (ISO/IEC 8802-3 gigabit ethernet);
Voice (analogue);
and Voice (digital).
- **Cabling hierarchy:**
 - **Campus distributors (CD):** 90-70-25/320 Balanced twisted-pair cabling patch panels and 90-70-25/310 Data equipment cabinets. As indicated on the drawings where provided.
 - **Campus backbone cabling:** 90-55-15/371 Optical fibre cables. As indicated on the drawings where provided.
 - **Building distributors (BD):** 90-70-25/310 Data equipment cabinets and 90-70-25/320 Balanced twisted-pair cabling patch panels. As indicated on the drawings where provided.
 - **Building backbone cabling:** 90-55-15/366 Balanced twisted-pair cables type A and 90-55-15/371 Optical fibre cables. As indicated on the drawings where provided.
 - **Floor distributors (FD):** 90-70-25/310 Data equipment cabinets and 90-70-25/320 Balanced twisted-pair cabling patch panels. As indicated on the drawings where provided.
 - **Horizontal cabling:** 90-55-15/366 Balanced twisted-pair cables type A and 90-55-15/371 Optical fibre cables. As indicated on the drawings where provided.
 - **Consolidation points (CP):** 90-70-25/320 Balanced twisted-pair cabling patch panels. As indicated on the drawings where provided.
 - **Consolidation point cabling:** 90-55-15/366 Balanced twisted-pair cables type A. As indicated on the drawings where provided.
 - **Telecommunications outlets (TO):** 90-60-25/455 Balanced twisted-pair cable outlets and 90-60-25/460 Fibre optic cable outlets.
 - **Work area cabling:** 90-55-15/372 Patch cords.
- **Cabling topology:**
 - **Campus backbone:** As indicated on the drawings where provided.
 - **Building backbone cabling:** As indicated on the drawings where provided.
 - **Horizontal cabling:** As indicated on the drawings where provided.
- **Containment:** 90-55-10/325 Cable baskets;
90-55-10/335 Cable trays;
and 90-55-10/380 Rigid conduit type A.
- **Containment accessories:**
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Transient over-voltage surge suppression devices:** 90-60-30/430 Transient overvoltage surge suppression for data and Telecom supplies on copper cabling where the source of the cabling is external to the building.
- **System accessories:**

- **Execution:** 75-45-20/620 Installing information technology cabling generally;
75-45-20/625 Installing copper information technology cabling;
75-45-20/645 Installing connecting hardware;
75-45-20/610 Removing data distribution systems;
75-45-20/630 Hardware connections generally;
75-45-20/650 Installing cabinets;
75-45-20/615 System installer;
75-45-20/635 Spare cabling;
75-45-20/670 Labelling;
75-45-20/655 Installing wall mounted equipment;
75-45-20/665 Installing telecommunications outlets;
75-45-20/640 Installing optical fibre cabling;
and 75-45-20/660 Connection to the public telephone network.
- **System completion:** 75-45-20/840 Maintenance;
75-45-20/830 Spares and consumables;
75-45-20/810 Testing and inspection of data distribution systems;
75-45-20/850 System manufacturer's warranty;
and 75-45-20/820 Documentation for data distribution systems.

System performance

75-45-20/210 Design of data distribution systems

- **Design:** Complete the design of the data distribution system.
- **Standards:** To BS EN 50173-1;
To BS EN 50173-2;
To BS EN 50173-3;
To BS EN 50173-4;
To BS EN 50173-5;
To BS EN 50174-1;
To BS EN 50098-1;
To BS EN 50098-2;
To ISO/IEC 11801;
and To TIA/ EIA-568-B.1.
- **Requirement:** Submit proposals including detailed design drawings indicating cabinet general arrangement, cabling topology schematics, distribution point layouts, equipment room layout, interconnection diagrams and work area layout drawings. Include technical information, calculations and manufacturers' literature.

75-45-20/230 Channel performance

- **Standard:** To BS EN 50173-1.
- **Balanced twisted-pair cabling class (minimum):** F.
- **Optical fibre class (minimum):** OF-300;
OF-500;
and OF-2000 as required by the distribution path and indicated on the drawings where provided.

75-45-20/240 Telecommunications outlets

- **Requirements:** Submit proposals in line with the wiring devices selection and or Architects finishing schedule.

75-45-20/250 Resilience

- **Spare capacity:** As described within the IT specification and indicated on the drawings where

provided. Where no drawings have been provided a minimum space capacity of 25% on the backbone cabling and 10% on the horizontal cabling.

75-45-20/260 Connections with other systems

- **Requirements:** The following systems shall be connected to the data distribution installation:
 - BMS
 - Fire Alarm
 - CCTV
 - AV
 - Lighting Control
 - Access Control
 - Clock
 - Other Third Party systems as defined in the specification and drawings

Ω End of system

75-45-85/110 Telecommunications system

System outline

75-45-85/110 Telecommunications system

- **System performance:**
- **System manufacturer:**
- **Type of system:**
- **Method of operation:**
- **Connection to public telephone network:** Required.
- **Distribution panels:**
- **Cable type:**
- **Cabling topology:**
 - **Backbone cabling:**
 - **Horizontal cabling:**
- **Containment:**
 - **Type:**
 - **Rewireable installation:** Required.
 - **Concealed installation:** Required.
 - **Draw wires:** Provide in conduit drops.
- **Telecommunications outlets:**
- **Terminal devices:**
- **Payphones:**
- **Operator consoles:**
- **Transient over-voltage surge suppression devices:**
- **System accessories:**
- **Execution:**
- **System completion:**

Ω End of system

75-60-05/110 Access control system

System outline

75-60-05/110 Access control system

- **System performance:** 75-60-05/220 Access control points.
- **System manufacturer:** A member of British Security Industry Association and A Gold member of National Security Inspectorate.
- **Standards:** To BS EN 50133-1 and in accordance with BS EN 50133-7.
- **Operation in the event of mains failure:** Access points open generally unless otherwise specified on the drawings or in the fire strategy.
- **Tokens:** 90-75-05/310 Multiple technology cards.
- **Readers:** 90-75-05/370 Smart card readers and writers.
- **Standby battery supply (minimum):** 24 h.
- **Locking mechanisms:** 90-75-05/410 Magnetic locks and strike plates type A.
- **Controls:** 90-65-10/310 Personal computers and 90-75-05/430 Access control system controllers.
- **System accessories:** 90-75-05/480 Emergency break glass units and 90-75-05/470 Request to exit buttons.
- **Cable type:** .
- **Containment:** 90-55-10/410 Cable trunking and cable ducting systems and 90-55-10/380 Rigid conduit type B.
- **Rewireable installation:** Required.
- **Concealed installation:** Required unless otherwise noted on the drawings.
- **Execution:** 75-60-05/620 Installing access control systems and 75-60-05/630 Equipment labelling and system diagrams.
- **System completion:** 75-60-05/810 Testing and commissioning access control systems generally ;
75-60-05/820 Documentation;
75-60-05/830 Spares and consumables;
and 75-60-05/840 Maintenance.

System performance

75-60-05/220 Access control points

- **Recognition classification:** To BS EN 50133-1, class 2.
- **Access classification:** To BS EN 50133-1, class lass B.
- **Environmental classification:** To BS EN 50133-1, class I and To BS EN 50133-1, class III as indicated on the drawings.
- **Number of transactions (minimum):** 500 per 24 h.

Ω End of system

75-60-05/120 Audio intercom system

System outline

75-60-05/120 Audio intercom system

- **System performance:** 75-60-05/210 Design of access control and audio intercom systems.
- **System manufacturer:** 2N
Manufacture to be from the approved list as appended within this specification, If the contractor is to deviate from this list the it is their duty to prove compliance with the design criterion. Submit proposals.
- **Entrance panel:** 90-75-05/450 Intercom entrance panels.
External gate
- **Audio communication:** Two way.
- **Remote door opening via handset:** 90-75-05/460 Intercom remote handsets and 90-75-05/410 Magnetic locks and strike plates type B.
- **Cable type:** 90-55-15/366 Balanced twisted-pair cables type B.
- **Containment:** 90-55-10/380 Rigid conduit type C.
- **Rewireable installation:** Required.
- **Concealed installation:** Required unless otherwise indicated on the drawings.
- **Execution:** 75-60-05/630 Equipment labelling and system diagrams.
- **System completion:** 75-60-05/870 Audio intercom system testing and commissioning.

System performance

75-60-05/210 Design of access control and audio intercom systems

- **Design:** Complete the design of the access control system and Complete the design of the audio intercom system.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Ω End of system

75-60-10/110 CCTV system

System outline

75-60-10/110 CCTV system

- **System performance:** 75-60-10/210 Design of CCTV systems;
75-60-10/215 Remote monitoring;
75-60-10/220 CCTV zone;
75-60-10/240 Digital storage;
and 75-60-10/250 Integration with other alarm and security systems.
- **System manufacturer:** Manufacture to be from the approved list as appended within this specification, If the contractor is to deviate from this list the it is their duty to prove compliance with the design criterion.Submit proposals.
- **Standards:** In accordance with ACPO policy on police response to security systems;
In accordance with BS 8418;
In accordance with BS 8495;
In accordance with BS EN 50132-7;
and In accordance with Home Office Scientific Development Branch CCTV operational requirements manual.
- **Purpose:**
- **Format:** Digital and Internet protocol (IP).
- **Automatic activation of cameras:** Required.
- **Video motion detection:** Required.
- **Video based detection system:** Not Required unless otherwise indicated on the drawings.
- **Remote monitoring:** Required.
- **Surveillance equipment:** 90-75-10/310 Cameras and 90-75-10/320 Covert cameras.
- **Camera housings:** Internal and external to suit installation contractor to submit proposals.
- **Controller:** 90-75-10/340 Control matrix.
- **Uninterruptible power supply:** Not Required unless otherwise indicated on the drawings.
- **Telemetry transmitters:** 90-75-10/350 Telemetry transmitters.
- **Telemetry receivers:** 90-75-10/360 Telemetry receivers.
- **Data storage:** 90-75-10/370 Digital video recorders and 90-75-10/380 Network video recorders.
- **Cable type:** 90-55-15/366 Balanced twisted-pair cables type A.
- **Containment:** Internally cable containment to be galvanised metal trunking and conduit concealed within ceiling voids and the building fabric. Externally cables shall be run within under ground ducts.
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Infrared illuminators:** 90-75-10/440 Infra-red illuminators only for external installations.
- **System accessories:** 90-90-55/340 CCTV signage.
- **Execution:** 75-60-10/620 Installing closed circuit television systems;
75-60-10/610 Removing CCTV systems;
and 75-60-10/700 Installing signage.
- **System completion:** 75-60-10/810 Closed circuit television system testing and commissioning
and 75-60-10/850 Training.

System performance

75-60-10/210 Design of CCTV systems

- **Design:** Complete the design of the CCTV system.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Number of monitors:** Camera: monitor ratio (maximum) 4:1.
- **Waveform:** Consultative Committee for International Radio (CCIR) PAL colour, 625 scan lines/frame, 25 frames/second where analogues cameras are to be installed and full HD for IP based CCTV cameras.
- **Include proposals for the following:** Areas to be covered;
Level of detail provided;
Lighting levels required;
Integration of the CCTV system with other security systems;
Monitoring of the system;
Display screen equipment (DSE);
Recording facilities and the recording storage medium;
Provision for future system expansion;
Type of maintenance required;
and Quality of recorded video images.

75-60-10/215 Remote monitoring

- **Standard:** In accordance with BS 8418.
- **Remote video response centre (RVRC):**
 - **Registration:** A member of British Security Industry Association;
A Gold member of National Security Inspectorate;
and A member of Security Systems and Alarms Inspection Board.
 - **Location:** Submit proposals.
- **Audio challenge facility:** Required.

75-60-10/220 CCTV zone

- **Purpose:** Access control;
Property protection;
Safety;
and Surveillance.
- **Target to be observed:** Individuals and Traffic.
- **Purpose of the observation:** Identification and Detection.
- **Image quality:** Suitable for use as evidence.
- **Number of cameras:** Submit proposals or as indicated on the drawings and schedules where provided.
- **Camera operating mode:** Fixed and Pan, tilt and zoom as indicated on the drawings and schedules where provided.

75-60-10/240 Digital storage

- **Rate per camera (minimum):** 25 frames/s.

75-60-10/250 Integration with other alarm and security systems

- **Objectives:** As defined within the project specific specification.

- **Systems to be integrated:** Access control system and Intruder detection and alarm system.

Ω End of system

75-60-40/110 Intruder detection and alarm system

System outline

75-60-40/110 Intruder detection and alarm system

- **System performance:** 75-60-40/220 System setting and unsetting;
75-60-40/257 Prevention of setting for grade 3 systems;
75-60-40/263 Supplementary processing of signals for grade 3 or 4 systems;
and 75-60-40/292 Event recording for grade 3 systems.
- **System manufacturer:**
- **Power supply:**
- **Detectors:**
- **Cabling and containment:**
 - **Cable type:**
 - **Containment:**
 - **Rewireable installation:** Required.
 - **Concealed installation:** Required.
- **Warning devices:**
 - **Internal:** 90-75-40/380 Internal warning devices.
 - **External:**
 - **Signalling method:**
- **Control and indicating equipment (CIE):**
- **Execution:**
- **System completion:**

System performance

75-60-40/220 System setting and unsetting

- **Design the system to accommodate the following entry and exit routes:**
 - **Entry:** Through entrance/waiting area. Set/unset at panel in corridor outside main admin office.
 - **Exit:**

75-60-40/257 Prevention of setting for grade 3 systems

- **Conditions preventing system setting:**

75-60-40/263 Supplementary processing of signals for grade 3 or 4 systems

- **System status, set:**
 - **Response to hold-up signal or message:** External audible alarm and Internal audible alarm.
 - **Response to tamper signal or message:** External audible alarm and Internal audible alarm.
 - **Response to fault signal or message:** Internal audible alarm.
- **System status, unset:**

- **Response to hold-up signal or message:**
- **Response to tamper signal or message:** Internal audible alarm.

75-60-40/292 Event recording for grade 3 systems

- **Event recording functions:**

Ω End of system

75-65-30/110 Fire detection and alarm system

System outline

75-65-30/110 Fire detection and alarm system

- **System performance:** 75-65-30/210 Design of fire detection and alarm systems;
75-65-30/220 Performance of fire detection and alarm systems;
75-65-30/230 System category L2;
75-65-30/235 System category L5;
75-65-30/245 Detection zones;
75-65-30/250 Alarm zones;
75-65-30/255 Actuation of fire protection systems;
75-65-30/260 Integration with other alarm and security systems;
75-65-30/275 Alarm filtering;
75-65-30/280 External alarm signalling;
75-65-30/285 Remote signalling;
and 75-65-30/270 Interface isolation for testing purposes.
- **System manufacturer:** All equipment shall be provided by an approved manufacturer as per the approved manufacturers list appended to this document. All equipment shall be LPCB LPS 1014 and EN 54 certified.
- **Format:** The fire alarm system shall be of an automatic analogue addressable type.
- **Category:** In accordance with BS 5839-1, L1;
In accordance with BS 5839-1, L2;
In accordance with BS 5839-1, L3;
In accordance with BS 5839-1, L4;
and In accordance with BS 5839-1, L5.
- **Detection devices:**
 - **Atmosphere:** Normal atmospheric conditions generally with explosive rated devices being provided for the following areas as a minimum:
Gas intake room
Fuel Store Rooms
Chemical store rooms.
 - **Types:** 90-75-30/330 Manual call points.
- **Equipment interconnectivity:** 90-55-15/344 Mineral insulated cables and 90-55-15/343 Fire resistant, insulated and sheathed armoured cables.
- **Cable containment:**
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Internal alarms:**
 - **Primary:**
 - **Secondary:** 90-75-30/365 Vibrating pillow pads and 90-75-30/370 Vibrating radio pagers.
- **External alarms:** To alarm receiving centre (ARC) and To landlord's fire detection and alarm system.
- **Controls:** 90-75-30/380 Fire detection and alarm control and indicating equipment (CIE);
90-75-30/390 Mimic panels;
and 90-75-30/385 Fire detection and fire alarm power supply equipment.
- **System accessories:** 90-75-30/405 Automatic door release mechanisms;
90-75-30/410 Remote indicators;
and 75-65-30/560 Zone diagrams.

- **Execution:** 75-65-30/605 Removing fire detection and alarm systems;
75-65-30/620 Working in areas protected by fire detection and alarm systems;
75-65-30/640 Installing interfaces to other equipment and systems;
75-65-30/645 Installing all zone evacuation controls;
75-65-30/615 Modifying existing fire detection and alarm systems;
75-65-30/630 Installing cabling;
and 75-65-30/625 Radio communications survey.
- **System completion:** 75-65-30/810 Testing and commissioning generally;
75-65-30/805 System information;
75-65-30/808 System soak testing;
75-65-30/811 Modifications to existing fire detection and alarm systems;
75-65-30/806 Device identification and testing;
75-65-30/807 Standby battery testing;
75-65-30/850 Verification certificate;
75-65-30/860 Acceptance certificate;
75-65-30/809 Measurement of sound pressure levels;
and 75-65-30/812 Testing actuation, integration and interfacing with alarm and security systems.

System performance

75-65-30/210 Design of fire detection and alarm systems

- **System designer:** The contractor shall engage the services of a suitably competent Fire Detection and Alarm system designer. The designer shall be a registered designer with a recognised body such as the Fire Industry Association.
- **Standards:** Complete the design of the fire detection and alarm system in accordance with BS 5839-1.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature. The design drawings shall indicate as a minimum all devices, device identification tags, cabling routes and schematic details.
- **System design certificate:** Submit with design proposals.

75-65-30/220 Performance of fire detection and alarm systems

- **Areas to be protected:** As determined by the fire risk assessment, as per the room data sheets, as indicated on the drawings.
- **System objectives:** have of 10% spare capacity on the system when complete
- **Spare system capacity:** Minimum of 15% loop loading.
- **Number of devices per zone (maximum):** As determined by the loop loading calculations and manufacturers information.

75-65-30/230 System category L2

- **Objectives:** As set out in BS 5839
- **Coverage:** As set out in BS 5839

75-65-30/235 System category L5

- **Objectives:** As set out in BS 5839
- **Coverage:** As set out in BS 5839

75-65-30/245 Detection zones

- **Zoning:** Submit proposals.

75-65-30/250 Alarm zones

- **Alarm zoning:** As required by the fire risk assessment. The contractor shall Submit proposals as part of the technical submittal for the project.
- **Mode of operation:** As required by the fire risk assessment.
- **All zone evacuate control:** As required by the fire risk assessment.

75-65-30/255 Actuation of fire protection systems

- **Standard:** To BS 7273-1 for total flooding gaseous suppression systems and To BS 7273-3 for pre-action sprinklers where required.
- **Objectives:** Submit proposals.

75-65-30/260 Integration with other alarm and security systems

- **Objectives:** To ensure that in the event of a fire condition the other alarm systems operate as required by the risk assessment.
- **Systems to be integrated:** The contractor shall interface the fire detection and alarm system with following as a minimum
Any and all life safety systems;
BMS;
Intruder Alarm systems;
Access Control;
Vertical Transportation Systems;

75-65-30/270 Interface isolation for testing purposes

- **Isolation of systems and equipment:** Design system so that the actuation, integration and interfacing can be isolated during fire alarm testing.
- **Means of isolation:** Separate key switch for each connection and/or Via CIE as indicated on the drawings.

75-65-30/275 Alarm filtering

- **Objective:** The system shall be designed such that the Client, with prior agreement with the Local Fire Authority shall have the ability to filter the alarm signals as required.
- **Arrangement:** The system shall have the capability of implementing a staff alarm investigation period and time related system filtering. The contractor shall confirm this in their technical submittal and shall Submit proposals.

75-65-30/280 External alarm signalling

- **Objective:** The system design shall incorporate an external alarm signal complete within integral tone generator and LED strobe element. The external sounder shall automatically silence after a maximum of 30 minutes. Where external plant areas and internal courtyards/terraces are provided the contractor shall provide external alarm signalling.

75-65-30/285 Remote signalling

- **Means of signal transmission:**
 - **Primary:** Automatic – via private communication circuits.
 - **Secondary:** Automatic – via cellular radio communications (including GSM).
- **Transmission path monitoring:** Required for hard wired systems.
- **Signals to be transmitted to ARC:** Submit proposals as required by the Client service provider.
 - **Separately identifiable, include the following:** Pre-alarm.
Alarm.

Alarm Silenced.
Fault.
Device isolated.
Zone isolated.

Ω End of system

75-65-35/110 Fixed gas detection and alarm system

System outline

75-65-35/110 Fixed gas detection and alarm system

- **System performance:**
- **System manufacturer:**
- **Type of protection:**
- **Control panel:**
- **Connection cable to sensors:**
 - **Cable type:**
 - **Containment:**
 - **Containment accessories:**
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Detectors:**
- **Alarm indication:**
- **System accessories:**
- **Execution:**
- **System completion:**

Ω End of system

75-65-35/120 Flow sample gas detection and alarm system

System outline

75-65-35/120 Flow sample gas detection and alarm system

- **System performance:**
- **System manufacturer:**
- **Type of protection:**
- **Control panel:**
- **Sample tube:**
- **Detectors:**
- **Alarm indication:**
- **System accessories:**
- **Execution:**
- **System completion:**

Ω End of system

75-65-95/120 Water leak detection and alarm system

System outline

75-65-95/120 Water leak detection and alarm system

- **System performance:**
- **System manufacturer:**
- **Areas to be protected:**
- **Programmable control unit:**
- **Pulsed output water meter:**
- **Connection cable to programmable control unit:**
 - **Cable type:**
 - **Containment:**
 - **Rewireable installation:** Required.
 - **Concealed installation:** Required.
- **Meter cabinets:** Required.
- **Isolating valve:**
 - **Type:**
- **Alarm indication:**
 - **Internal:**
 - **External:**
- **Execution:**
- **System completion:**

Ω End of system

75-70-05/110 Assistance call system

System outline

75-70-05/110 Assistance call system

- **System Performance:** 75-70-05/210 Design of assistance call systems and 75-70-05/230 Integration with other alarm and security systems.
- **System manufacturer:** Submit proposals.
- **Operating voltage:** 12 V d.c.
- **Zones:** Submit proposals.
- **Equipment interconnectivity:** Submit proposals.
- **Call actuator:** Submit proposals.
- **Alarm indication:** Submit proposals.
- **Reset unit:** Submit proposals.
- **Power supply unit:** Submit proposals.
- **Circuit monitoring:** Submit proposals.
- **Cabling:**
 - **Types:** 90-55-15/346 PVC insulated cables for interconnecting wiring.
- **Containment:** 90-55-10/410 Cable trunking and cable ducting systems.
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **Execution:** 75-70-05/620 Radio communications surveys and 75-70-05/630 Installing assistance call systems.
- **System completion:** 75-70-05/810 Testing and commissioning assistance call systems generally;
75-70-05/825 Calibration certificates;
and 75-70-05/830 Documentation for assistance call systems.

System performance

75-70-05/210 Design of assistance call systems

- **Design:** Complete the design of the assistance call system.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

75-70-05/230 Integration with other alarm and security systems

- **Objectives:** Submit proposals.
- **Systems to be integrated:** Submit proposals.

Ω End of system

75-70-05/120 Disabled Refuge Emergency voice communication system

System outline

75-70-05/120 Disabled Refuge Emergency voice communication system

- **System Performance:** 75-70-05/220 Design of emergency voice communication systems.
- **System manufacturer:** Submit proposals in line with the approved manufacturers and suppliers list appended to this specification.
- **Operating voltage:** Manufacturers Standard
- **Zones:** Submit proposals.
- **Equipment interconnectivity:** Wired.
- **Call actuator:** 90-70-05/340 Disabled refuge outstations.
- **Disabled refuge master station:** 90-70-05/370 Disabled refuge master station.
- **Alarm indication:**
- **Power supply unit:** 90-70-05/390 Power supply units.
- **Circuit monitoring:** Open circuit and short circuit.
- **Cabling:**
 - **Type:** 90-55-15/342 Fire resistant, insulated and sheathed cables
- **Containment:** 90-55-10/410 Cable trunking and cable ducting systems , 90-55-10/325 Cable baskets, 90-55-10/360 Flexible conduit and 90-55-10/380 Rigid conduit type A
- **Rewireable installation:** Required.
- **Concealed installation:** Required.
- **System accessories:** None.
- **Execution:** 75-70-05/610 Removing assistance call systems and 75-70-05/640 Installing emergency voice communication systems.
- **System completion:** 75-70-05/825 Calibration certificates;
75-70-05/835 Documentation for emergency voice communication systems;
75-70-05/840 Maintenance;
75-70-05/850 Verification certificate;
and 75-70-05/860 Acceptance certificate.

System performance

75-70-05/220 Design of emergency voice communication systems

- **System designer:** System manufacturer.
- **Design:** Complete the design of the emergency voice communication system in accordance with BS 5839-9.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Communication strategy:** Initiated from the outstation.
- **System design certificate:** Submit with design proposals.

75-75-05/110 Electricity metering

System outline

75-75-05/110 Electricity metering

- **System Performance:** 75-75-05/210 Design type A and 75-75-05/215 Meter data type A.
- **Number and location of meters:** Refer to E61 range of drawings
- **Monitoring period:** Half hourly.
- **Reporting:** Graphical;
Spreadsheet;
Stored;
and Weekly.

System performance

75-75-05/210 Design type A

- **Design:** Complete the design of the building monitoring and management system.
- **Standards:**
 - **Communications network:** To BS EN 50174-1.
 - **Communications protocol:** To BS EN ISO 16484-5.
 - **Documentation of plant and application specific functions:** To BS EN ISO 16484-3.
- **Requirements:** Submit proposal including detailed design drawings, technical information, calculations and manufacturers' literature.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

75-75-05/215 Meter data type A

- **Software functions:**

Ω End of system

75-75-05/130 Water metering

System outline

75-75-05/130 Water metering

- **System Performance:**
- **Number and location of meters:**
- **Monitoring period:**
- **Reporting:**

Ω End of system

75-75-05/150 Building monitoring and management system

System outline

75-75-05/150 Building monitoring and management system

- **System Performance:** 75-75-05/210 Design type B;
75-75-05/215 Meter data type B;
75-75-05/217 Water supply systems monitoring and management;
75-75-05/225 Gas supply systems monitoring and management;
75-75-05/235 Fire fighting systems monitoring and management;
75-75-05/240 Heating systems monitoring and management;
75-75-05/247 Ventilation systems monitoring and management;
75-75-05/250 Air conditioning systems monitoring and management;
75-75-05/257 Low voltage supply monitoring and management;
;
and 75-75-05/273 Detection and alarm systems monitoring and management.
- **Water supply systems linked to BMMS:** Cold water;
Direct hot water storage;
- **Gas supply systems linked to BMMS:** Natural gas.
- **Heating systems linked to BMMS:** Low temperature hot water.
- **Cooling systems linked to BMMS:** Variable refrigerant flow system.
- **Ventilation systems linked to BMMS:** Natural;
Mechanical supply;
Mechanical extract;
Toilet extract;
and Kitchen extract.
- **Air conditioning systems linked to BMMS:** Local.
- **High voltage electricity supply systems linked to BMMS:** Incoming electricity supply.
- **Low voltage electricity supply systems linked to BMMS:** Incoming electricity supply and Low voltage small power system.
- **Lighting systems linked to BMMS:** No link to BMMS.
- **Communication systems linked to BMMS:** No link to BMMS.
- **Television and data systems linked to BMMS:** No link to BMMS.
- **Security systems linked to BMMS:** No link to BMMS.
- **Detection and alarm systems linked to BMMS:** Gas detection and alarm system and Water leak detection and alarm system.
- **Protection systems linked to BMMS:** No link to BMMS.
- **Display and information systems linked to BMMS:** No link to BMMS.
- **Transport systems linked to BMMS:** No link to BMMS.
- **Communications network type:** Wide area network;
Wired local area network;
and Wireless local area network.
- **Equipment:** 90-65-50/460 Field controllers and 90-50-45/394 Enclosures type B.
- **Computer components:** 90-65-10/310 Personal computers;
90-65-10/320 Keyboard;

90-65-10/330 Monitors;
and 90-65-10/350 Printers.

- **Execution:** 75-75-05/610 Removing building monitoring and management systems;
75-75-05/620 Installation of building monitoring and management systems;
75-75-05/640 Installation of cables;
75-75-05/650 Installation of sensors;
and 75-75-05/630 Installation of field controllers.
- **System Completion:** 75-75-05/810 Inspection and testing;
75-75-05/820 Commissioning;
and 75-75-05/830 Documentation.

System performance

75-75-05/210 Design type B

- **Design:** Complete the design of the building monitoring and management system.
- **Standards:**
 - **Communications network:** To BS EN 50174-1.
 - **Communications protocol:** To BS EN ISO 16484-5.
 - **Documentation of plant and application specific functions:** To BS EN ISO 16484-3.
- **Requirements:** Submit proposal including description of operations, detailed design drawings, technical information, calculations and manufacturers' literature.
- **Requirement:** Submit proposals including description of operations, detailed design drawings, technical information, calculations and manufacturers' literature.

75-75-05/215 Meter data type B

- **Software functions:** Acceptance of data from other sources;
Automatic production of routine reports;
Automatic production of sub-billing;
Comprehensive input of tariff definitions;
Display of additional electrical data such as power factor, frequency, reactive power;
Historical analysis of energy consumptions;
Immediate warning of exceptions, such as parameters exceeding preset limits;
Instant access on demand to data from individual meters;
Retrieval, checking and collation of metered data;
and Review of data in flexible format, allowing comparison between different time periods and meter locations.

75-75-05/217 Water supply systems monitoring and management

- **Input:** tank level sensors
supply pressure
tank temperature
leak detection status
- **Control mode:** pressure control
tank level control
pump low water interlock
- **Output:** pump enable
solenoid valve enable
alarms

75-75-05/225 Gas supply systems monitoring and management

- **Input:** Alarm status,
kitchen ventilation interlock status
meter inputs
- **Control mode:** monitoring only
- **Output:** Solenoid valve shut-off
alarms

75-75-05/240 Heating systems monitoring and management

- **Input:** flow temperature
return temperature
thermostat demand signals
external temperature
system differential pressure
pump status
meter inputs
fire alarm status
gas pressure
- **Control mode:** time scheduling
variable temperature control
constant temperature control
boiler sequencing
pump auto-changeover
burner modulation
pump speed control
- **Output:** boiler enable
pump enable
pump speed
control valve set point

75-75-05/247 Ventilation systems monitoring and management

- **Input:** room temperature
supply temperature
return temperature
external temperature
room CO₂
room presence detector
wind speed
rain input
snow input
fan status
supply pressure
extract pressure
fire alarm status
heating system status
- **Control mode:** time scheduling
variable air volume control
constant air volume control
room temperature control
room CO₂ control
- **Output:** fan speed
VAV damper position
motorised damper position

fire and smoke damper position
alarms

75-75-05/250 Air conditioning systems monitoring and management

- **Input:** room temperature
supply temperature
return temperature
external temperature
room CO2
room humidity
room presence detector
wind speed
rain input
snow input
fan status
supply pressure
extract pressure
fire alarm status
- **Control mode:** time scheduling
variable air volume control
constant air volume control
room temperature control
room humidity control
room CO2 control
- **Output:** fan speed
VAV damper position
motorised damper position
cooling valve position
heating valve position
humidifier enable
alarms

75-75-05/257 Low voltage supply monitoring and management

- **Input:** Current;
Monitoring contactors;
and Voltages.
- **Control mode:** Critical start up scheduling and Load shedding.
- **Output:** Distribution circuits.

75-75-05/273 Detection and alarm systems monitoring and management

- **Input:** Fire alarm,
leak detection
Gas alarm.
- **Control mode:** Monitoring and shut off
- **Output:** Shut down plant, with extract fan running and outlet dampers open.
shut off solenoid valve
Shut down all plant

75-75-05/160 Electrical connections

System outline

75-75-05/160 Electrical connections

- **Equipment interconnectivity:** Wired.
- **Electrical connections:**
 - **Cables:** As Specialist's recommendations.
 - **Containment:** Cable basket and Cable trays section Y63.
- **Rewireable installations:** Submit proposals.
- **Concealed installations:** Required.

Ω End of system

75-75-50/110 Water supply systems control

System outline

75-75-50/110 Water supply systems control

- **System performance:** 75-75-50/201 Design and 75-75-50/212 Time control.
- **Objectives:** Submit proposals.
- **Start and stop control:** 75-75-50/211 Pump overrun; 90-65-25/380 Time switches; 75-75-50/205 Hand off auto switch; and 75-75-50/203 Domestic hot water demand.
- **Pressurization control strategies:** 75-75-50/228 Pump pressurization unit control strategy.
- **Distribution control strategies:** 75-75-50/232 Domestic hot water non-storage calorifier control strategy.
- **Pumps control strategies:** 75-75-50/237 Variable speed pumps control strategy and 75-75-50/235 Constant speed pumps control strategy.
- **Additional functions:** 75-75-50/295 Data logging and 75-75-50/296 Plant monitoring.
- **Equipment:** 90-65-50/310 Valve actuators; 90-65-50/350 Motorized valves; 90-65-50/320 Alarms; and 90-65-50/340 Control panels.
- **Sensors:** 90-65-50/400 Flow in pipe sensors; 90-65-50/420 Pressure sensors; and 90-65-50/430 Water temperature sensors.
- **Execution:** 75-75-50/610 Removing mechanical engineering services control and management systems.
- **System completion:** 75-75-50/850 Keys; 75-75-50/810 Inspection and testing; 75-75-50/840 Spares; 75-75-50/860 Documentation; 75-75-50/830 Commissioning of automatic control systems; 75-75-50/820 Start up and commissioning; and 75-75-50/870 Servicing and maintenance.

System performance

75-75-50/201 Design

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; 75-75-50/155 Mechanical ventilation systems control; and 75-75-50/190 Gas fired heating system control strategy.

- **Submit including the following information:** Operation statements, point schedules, control logic diagrams, network topology schematics, panel diagrams and fascia drawings, method statements for testing and commissioning, method statements for witness testing and graphics.

75-75-50/203 Domestic hot water demand

Shared by: 75-75-50/110 Water supply systems control; and 75-75-50/120 Heating systems control.

- **Demand for hot water:**

- **Operation:** Start valves, pumps and heat generator plant when signal received.
- **Demand signal:** Temperature below storage set point.

75-75-50/205 Hand off auto switch

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; and 75-75-50/155 Mechanical ventilation systems control.

- **Operation:**
 - **Hand:** Plant operates as normal regardless of sensors and controllers but satisfying safety features and interlocks.
 - **Off:** Plant prevented from operating regardless of sensors and controllers. Position plant for shut-down.
 - **Auto:** Plant dependent on sensors and controllers.

75-75-50/211 Pump overrun

Shared by: 75-75-50/110 Water supply systems control; and 75-75-50/120 Heating systems control.

- **Operation:** Activate when heating plant has been operating, distributing to primary and secondary circuits.
- **Period:** 5m.

75-75-50/212 Time control

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; 75-75-50/155 Mechanical ventilation systems control; and 75-75-50/190 Gas fired heating system control strategy.

- **Time clock:** Automatically change between GMT and British summer time and allow for leap years and Provide clock and calendar programmed with periods of normal operation.
- **Extension of plant operation:**
 - **Action:** Allow manual override, for normal operation, activated by push button switch.
 - **Period:** 1 hr.
- **Winter mode:**
 - **Time period:** Between 1 October and 30 April.
 - **Outside temperature:** Above 17°C for at least 30 minutes.

75-75-50/228 Pump pressurization unit control strategy

Shared by: 75-75-50/110 Water supply systems control; and 75-75-50/120 Heating systems control.

- **Spill valve:**
 - **Operation:** The packaged pressurization unit controls operate a spill valve when the pressure sensor, positioned in the water pipeline, detects primary water pressure above pre-set level.
 - **Pre-set level:** Submit proposals.
- **Pressurization pumps:**
 - **Operation:** The packaged pressurization unit controls operate the pressurization pumps when the pressure sensor detects pressure drops below the set point until the pressure set point is achieved.
 - **Set point:** Submit proposals.
- **High pressure switch:** When activated disable boiler and close fuel valve. Allow primary and secondary pumps to continue for run on period.
- **Low pressure switch:**
 - **Operation:** When activated disable boiler and close fuel valve, disable primary and secondary pumps. Raise a low pressure alarm. Hard wire interlocks.

- **Reset:** Manual.

75-75-50/235 Constant speed pumps control strategy

Shared by: 75-75-50/110 Water supply systems control; and 75-75-50/120 Heating systems control.

- **Arrangement:** Duty and standby.
- **Plant shut down:**
 - **Operation:** Turn pumps off and fully close valves serving loads.
 - **Long shutdown period:** Run pumps for 5 minutes on a daily basis when shut down is longer than 2 days.
- **Operation:** Run pumps on receipt of signal.
- **Duty and standby:**
 - **Change lead pump:** Weekly.
- **Prove flow:**
 - **Operation:** Use a flow measurement device to prove flow. Start standby pump and raise alarm if flow is not proved in specified time.
 - **Specified time:** 15 s.
 - **Failure:** If flow is not proved after standby pump start, raise alarm.
 - **Reset:** Manual.

75-75-50/237 Variable speed pumps control strategy

Shared by: 75-75-50/110 Water supply systems control; and 75-75-50/120 Heating systems control.

- **Arrangement:** Run and standby
- **Plant shut down:**
 - **Operation:** Turn pumps off and fully close valves serving loads closed.
 - **Long shutdown period:** Run pumps for 5 minutes on a daily basis when shut down is longer than 2 days.
- **Running of plant:**
 - **Operation:** Run pumps on receipt of signal. Modulate pumps to obtain design differential set point between flow and return circuits, across the load at furthest point or according to the lowest negative deviation from the differential set point.
 - **Differential set point:** Submit proposals.
- **Shared duty:** Operate pumps together at same speed. If one pump fails increase the speed of the other pump to meet the load and raise an alarm.

75-75-50/295 Data logging

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; and 75-75-50/155 Mechanical ventilation systems control.

- **Actuator:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Alarm:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Motorized valve:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Sensor:**

- **Input:** Submit proposals.
- **Output:** Submit proposals.
- **Thermostat:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.

75-75-50/296 Plant monitoring

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; and 75-75-50/155 Mechanical ventilation systems control.

- **Cooling plant:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Fan:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Heating plant:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Humidifiers:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Pressurization units:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Pumps:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Water treatment:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.

75-75-50/120 Heating systems control

System outline

75-75-50/120 Heating systems control

- **System performance:** 75-75-50/201 Design and 75-75-50/212 Time control.
- **Objectives:** To design, supply, test, install, commission and set to work an efficient and effective system as described above and in full compliance with Approved Document L and Non Domestic Building Services Compliance Guide.
- **Start and stop control:** 75-75-50/202 Boost fixed time;
75-75-50/203 Domestic hot water demand;
75-75-50/205 Hand off auto switch;
75-75-50/206 Low inside air temperature interlock for building fabric and contents protection;
75-75-50/207 Low temperature interlock signals for plant protection;
75-75-50/210 Optimum start and stop heating;
75-75-50/211 Pump overrun;
and 90-65-25/380 Time switches.
- **Heating plant control strategies:** 75-75-50/224 Sequencing boilers, with individual pump and bypass circuit, control strategy.
- **Pumps:**
 - **Equipment:** Duplicate primary pumps (run and standby) and Duplicate secondary circuit pumps (run and standby).
 - **Primary pumps control strategies:** 75-75-50/235 Constant speed pumps control strategy
 - **Secondary pumps control strategies:** 75-75-50/237 Variable speed pumps control strategy.
- **Pressurization system control strategies:** 75-75-50/228 Pump pressurization unit control strategy and 75-75-50/229 Sealed expansion vessel pressurization unit control strategy.
- **Water distribution control strategies:** Constant volume/variable temperature (compensated control) and Constant temperature/variable volume.
- **Outlet control strategies:** 75-75-50/231 Heating secondary circuits control strategy.
- **Additional functions:** 75-75-50/295 Data logging and 75-75-50/296 Plant monitoring.
- **Equipment:** 90-65-50/310 Valve actuators;
90-65-50/320 Alarms;
90-65-50/340 Control panels;
and 90-65-50/350 Motorized valves.
- **Sensors:** 90-65-50/380 Air temperature sensors;
90-65-50/400 Flow in pipe sensors;
90-65-50/420 Pressure sensors;
and 90-65-50/430 Water temperature sensors.
- **Execution:** 75-75-50/610 Removing mechanical engineering services control and management systems.
- **System completion:** 75-75-50/810 Inspection and testing;
75-75-50/820 Start up and commissioning;
75-75-50/830 Commissioning of automatic control systems;
75-75-50/840 Spares;
75-75-50/850 Keys;
75-75-50/860 Documentation;
and 75-75-50/870 Servicing and maintenance.

System performance

75-75-50/201 Design

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; 75-75-50/155 Mechanical ventilation systems control; and 75-75-50/190 Gas fired heating system control strategy.

- **Submit including the following information:** Operation statements, point schedules, control logic diagrams, network topology schematics, panel diagrams and fascia drawings, method statements for testing and commissioning, method statements for witness testing and graphics.

75-75-50/202 Boost fixed time

Shared by: 75-75-50/120 Heating systems control; and 75-75-50/155 Mechanical ventilation systems control.

- **Boost operation:**
 - **Signal:** Set from calendar in winter season and preset time on time clock.
 - **Boost period and time:** October and March, 1 h;
November, 1.5 h;
and December, January and February, 2 h.
 - **Termination:** When zone reaches heating set point temperature.

75-75-50/203 Domestic hot water demand

Shared by: 75-75-50/110 Water supply systems control; and 75-75-50/120 Heating systems control.

- **Demand for hot water:**
 - **Operation:** Start valves, pumps and heat generator plant when signal received.
 - **Demand signal:** Temperature below storage set point.

75-75-50/205 Hand off auto switch

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; and 75-75-50/155 Mechanical ventilation systems control.

- **Operation:**
 - **Hand:** Plant operates as normal regardless of sensors and controllers but satisfying safety features and interlocks.
 - **Off:** Plant prevented from operating regardless of sensors and controllers. Position plant for shut-down.
 - **Auto:** Plant dependent on sensors and controllers.

75-75-50/206 Low inside air temperature interlock for building fabric and contents protection

Shared by: 75-75-50/120 Heating systems control; and 75-75-50/155 Mechanical ventilation systems control.

- **Low inside air temperature signal:**
 - **Operation:** Start all heating plant serving zone registering condition.
 - **Activation set point:** 8°C.
 - **Termination set point:** 14°C.
- **Priority:** Independent of low outside temperature and low primary heating return water conditions.

75-75-50/207 Low temperature interlock signals for plant protection

Shared by: 75-75-50/120 Heating systems control; and 75-75-50/155 Mechanical ventilation systems control.

- **Low outside air temperature condition:**
 - **Operation:** When activated start duty primary and secondary circuit heating and cooling pumps. Open primary and secondary heating circuit valves to allow water to circulate through circuits unless plant is in operating mode.
 - **Activation set point:** Below 3°C.
 - **Termination set point:** Activation set point plus 2°C.
- **Low primary heating return water temperature condition:**
 - **Operation:** When activated start heat source and primary and secondary heating pumps if not already enabled.
 - **Activation set point:** Below 8°C.
 - **Termination set point:** 35 °C where condensing boilers are used and 55°C where non-condensing boilers are used.

75-75-50/210 Optimum start and stop heating

Shared by: 75-75-50/120 Heating systems control; and 75-75-50/155 Mechanical ventilation systems control.

- **Start:**
 - **Optimum start time:** Following learning period, achieve temperature set point within +/- 15 minutes of start of occupancy;
Take account of day of week and holidays;
and Use a self-adaptive control algorithm to calculate when to start plant outside of normal operation by measuring outside and internal zone air temperature and using thermal response of structure and plant.
 - **Zone heating set point:** 19°C or as stated elsewhere in specification
 - **Maximum preheat time:** 4 h.
 - **Air handling plant start:** Use separate control for each air handling plant. Start air handling plant and boiler heating system.
- **Stop:**
 - **Optimum stop time:** Disable normal plant operation signal;
Following learning period, achieve minimum temperature within +/- 15 minutes of end of occupancy;
Take account of day of week and holidays;
and Use a self-adaptive algorithm to calculate the earliest time prior to end of occupancy when plant can be shut-down.
 - **Minimum acceptable temperature during occupied period:** 18°C.
 - **Maximum period between stop and end of occupied period:** 2 h.

75-75-50/211 Pump overrun

Shared by: 75-75-50/110 Water supply systems control; and 75-75-50/120 Heating systems control.

- **Operation:** Activate when heating plant has been operating, distributing to primary and secondary circuits.
- **Period:** 5m.

75-75-50/212 Time control

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-

50/145 Natural ventilation control; 75-75-50/155 Mechanical ventilation systems control; and 75-75-50/190 Gas fired heating system control strategy.

- **Time clock:** Automatically change between GMT and British summer time and allow for leap years and Provide clock and calendar programmed with periods of normal operation.
- **Extension of plant operation:**
 - **Action:** Allow manual override, for normal operation, activated by push button switch.
 - **Period:** 1 hr.
- **Winter mode:**
 - **Time period:** Between 1 October and 30 April.
 - **Outside temperature:** Above 17°C for at least 30 minutes.

75-75-50/224 Sequencing boilers, with individual pump and bypass circuit, control strategy

- **Plant:**
 - **Boilers:** Gas fired condensing boilers.
 - **Number:** Refer to equipment schedules and detailed design requirements
 - **Directly linked plant:** Forced draught fan.
- **Boiler off condition:** Disable boiler and primary pumps provided overrun is finished. Set mixing valve to full recirculation on each boiler.
- **Primary flow:**
 - **Operation:** Prove before starting lead boiler. If not proved in start up period, disable boiler and use following boiler in sequence as lead boiler.
 - **Start up period:** 15 s.
- **Sequence control strategy:**
 - **On/off boiler firing:** Not applicable.
 - **High/low boiler firing:** Not applicable.
 - **Modulating boiler firing:** Disable boiler when primary return water reaches 3°C above the point at which they were enabled;
Enable lead boiler when primary return temperature is 3°C or more below primary return temperature set point;
Enable next boiler after the primary return water temperature is 6°C or more below return water set point;
Enable next boiler after the primary return water temperature is 9°C or more below return water set point;
and Enable next boiler after the primary return water temperature is 12°C or more below return water set point.
 - **Primary return temperature under full load:** 60°C.
 - **Nominal flow temperature:** 80°C.
 - **Primary return temperature set point:** 60°C.
 - **Start up delay:** Enable next boiler after 3 minutes of previous boiler firing.
 - **Shedding time delay:** Allow 5 minutes before disabling successive boilers.
 - **Boiler enabled set point deadband:** 4°C.
 - **Minimum boiler recirculation temperature:** Not Applicable
 - **Boiler sequence change:** Every 7 days when plant is off;
Every 50 operating hours when plant is off;
and When boiler fails.
 - **Boiler sequence override:** Provide a switch to inhibit the boiler sequence routine.
- **High limit temperature control thermostat:**
 - **Operation:** When flow temperature exceeds set point disable fuel supply and lock-out boiler. Keep isolating valves open for run on period.

- **Set point:** 93°C.
- **Boiler interlocks:** Following boiler lock-out, reset via a switch on.
Packaged boiler control panel.
Motor control panel.
- **Panic buttons:**
 - **Operation:** Disable fuel supplies to boilers when pressed and raise a fuel valve closed alarm.
 - **Position:** At exit from plant room.
- **Fuel detection:**
 - **Detectors:** Fusible link above boiler and Gas detector above boiler.
 - **Activation:** Hard wire interlocks. Disable fuel supply and shut down boiler via.
Packaged boiler control panel.
Central control panel.
- **Fire alarm:** When activated, disable fuel supply and stop all plant.
- **Alarm:** Boiler lock out and High limit temperature alarm.
- **Manual alarm reset:** At boiler.
- **Linked equipment:** Forced draught or induced draft fan, on failure disable the boiler and fuel valves.

75-75-50/228 Pump pressurization unit control strategy

Shared by: 75-75-50/110 Water supply systems control; and 75-75-50/120 Heating systems control.

- **Spill valve:**
 - **Operation:** The packaged pressurization unit controls operate a spill valve when the pressure sensor, positioned in the water pipeline, detects primary water pressure above pre-set level.
 - **Pre-set level:** Submit proposals.
- **Pressurization pumps:**
 - **Operation:** The packaged pressurization unit controls operate the pressurization pumps when the pressure sensor detects pressure drops below the set point until the pressure set point is achieved.
 - **Set point:** Submit proposals.
- **High pressure switch:** When activated disable boiler and close fuel valve. Allow primary and secondary pumps to continue for run on period.
- **Low pressure switch:**
 - **Operation:** When activated disable boiler and close fuel valve, disable primary and secondary pumps. Raise a low pressure alarm. Hard wire interlocks.
 - **Reset:** Manual.

75-75-50/229 Sealed expansion vessel pressurization unit control strategy

- **Pressure sensor:**
 - **Operation:** A pressure sensor positioned in the primary flow circuit downstream of the primary pump will operate a pressurization pump when the pressure drops below the set point until the pressure set point is achieved.
 - **Set point:** Submit proposals.
- **High pressure switch:**
 - **Operation:** When activated, disable boiler and close fuel valve. Allow primary and secondary pumps to continue for run on period.
 - **Run on period:** 5 minutes

- **Low pressure switch:**
 - **Operation:** When activated, disable boiler and close fuel valve, disable primary and secondary pumps. Raise a low pressure alarm. Hard wire interlocks.
 - **Reset:** Manual.
- **Water level:**
 - **Operation:** If water level falls below a predetermined level, disable the boiler and close the fuel valve. Raise alarm. Hard wire interlocks.
 - **Pre-determined level:** Submit proposals.
 - **Reset:** Manual.

75-75-50/231 Heating secondary circuits control strategy

- **Circuit:** Constant volume, variable temperature with mixing valve on flow to secondary circuit before secondary pump and Variable volume, constant temperature with diverting valve on return from secondary circuit and secondary pump on heat source side of bypass circuit.
- **Low limit:**
 - **Operation:** Hold valves in full bypass until primary return water temperature rises above low limit set point. When set point is reached start duty secondary pump and open valves to maintain primary return temperature at set point.
 - **Low limit set point:** 40°C.
 - **Set point:** 50°C.
 - **Alarm:** Display a warning if water temperature has not risen to set point after 10 minutes and Modulate secondary circuit mixing valve to maintain set point and display a warning if water temperature falls below set point.
- **Mixing valve control mode:**
 - **Operation:** Compensated temperature control.
 - **Set points:** High limit water temperature set point, 82°C;
Low limit water temperature set point, 40°C;
Water flow temperature set point 80°C when outside air is 0°C and 30°C when outside air is 18°C;
and Zone air temperature set point, 21°C, unless stated elsewhere.

75-75-50/235 Constant speed pumps control strategy

Shared by: 75-75-50/110 Water supply systems control; and 75-75-50/120 Heating systems control.

- **Arrangement:** Duty and standby.
- **Plant shut down:**
 - **Operation:** Turn pumps off and fully close valves serving loads.
 - **Long shutdown period:** Run pumps for 5 minutes on a daily basis when shut down is longer than 2 days.
- **Operation:** Run pumps on receipt of signal.
- **Duty and standby:**
 - **Change lead pump:** Weekly.
- **Prove flow:**
 - **Operation:** Use a flow measurement device to prove flow. Start standby pump and raise alarm if flow is not proved in specified time.
 - **Specified time:** 15 s.
 - **Failure:** If flow is not proved after standby pump start, raise alarm.
 - **Reset:** Manual.

75-75-50/237 Variable speed pumps control strategy

Shared by: 75-75-50/110 Water supply systems control; and 75-75-50/120 Heating systems control.

- **Arrangement:** Run and standby
- **Plant shut down:**
 - **Operation:** Turn pumps off and fully close valves serving loads closed.
 - **Long shutdown period:** Run pumps for 5 minutes on a daily basis when shut down is longer than 2 days.
- **Running of plant:**
 - **Operation:** Run pumps on receipt of signal. Modulate pumps to obtain design differential set point between flow and return circuits, across the load at furthest point or according to the lowest negative deviation from the differential set point.
 - **Differential set point:** Submit proposals.
- **Shared duty:** Operate pumps together at same speed. If one pump fails increase the speed of the other pump to meet the load and raise an alarm.

75-75-50/295 Data logging

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; and 75-75-50/155 Mechanical ventilation systems control.

- **Actuator:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Alarm:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Motorized valve:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Sensor:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Thermostat:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.

75-75-50/296 Plant monitoring

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; and 75-75-50/155 Mechanical ventilation systems control.

- **Cooling plant:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Fan:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Heating plant:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.

- **Humidifiers:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Pressurization units:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Pumps:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Water treatment:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.

Ω End of system

75-75-50/145 Natural ventilation control

System outline

75-75-50/145 Natural ventilation control

- **System performance:** [75-75-50/201 Design](#) and [75-75-50/212 Time control](#).
- **Objectives:** As described above and within this specification
- **Start and stop control:** [75-75-50/208 Night cooling](#) and [90-65-25/380 Time switches](#).
- **Natural ventilation system:** Ventilation inlets and outlets with automatic controls. Provide manual overrides locally.
- **Shutdown:** Disable natural ventilation system.
- **Night cooling signal:** Open natural ventilation vents.
- **Normal operation:**
 - **Operation:** Open natural ventilation vents when zone temperature is above the set point and if CO₂ concentration is above the set point.
 - **Zone temperature set point:** 21°C.
 - **CO2 concentration set point:** 1000 ppm.
- **Additional functions:** [75-75-50/295 Data logging](#) and [75-75-50/296 Plant monitoring](#).
- **Equipment:** [90-65-50/316 Damper actuators type B](#);
[90-65-50/340 Control panels](#);
and [90-65-50/320 Alarms](#).
- **Sensors:** [90-65-50/370 Air quality sensors](#);
[90-65-50/380 Air temperature sensors](#);
and [90-65-50/390 Flow in duct sensors](#).
- **System completion:** [75-75-50/850 Keys](#);
[75-75-50/810 Inspection and testing](#);
[75-75-50/840 Spares](#);
[75-75-50/860 Documentation](#);
[75-75-50/830 Commissioning of automatic control systems](#);
[75-75-50/820 Start up and commissioning](#);
and [75-75-50/870 Servicing and maintenance](#).

System performance

75-75-50/201 Design

Shared by: [75-75-50/110 Water supply systems control](#); [75-75-50/120 Heating systems control](#); [75-75-50/145 Natural ventilation control](#); [75-75-50/155 Mechanical ventilation systems control](#); and [75-75-50/190 Gas fired heating system control strategy](#).

- **Submit including the following information:** Operation statements, point schedules, control logic diagrams, network topology schematics, panel diagrams and fascia drawings, method statements for testing and commissioning, method statements for witness testing and graphics.

75-75-50/208 Night cooling

Shared by: [75-75-50/145 Natural ventilation control](#); and [75-75-50/155 Mechanical ventilation systems control](#).

- **Format:** Mechanical and Passive.

- **Activation:** Average afternoon temperature greater than 20°C;
Average daytime zone temperature exceeds 22°C;
and Temperature of exposed concrete ceiling slab exceeds 23°C.
- **Period of operation:** When the zone temperature remains above outside air temperature;
When zone temperature remains above outside air temperature plus 2°C when using mechanical ventilation;
When zone temperature is greater than heating set point of 19°C;
and When outside temperature is greater than 12°C.
- **Availability:** Throughout entire non-occupied period and Seven days a week.

75-75-50/212 Time control

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; 75-75-50/155 Mechanical ventilation systems control; and 75-75-50/190 Gas fired heating system control strategy.

- **Time clock:** Automatically change between GMT and British summer time and allow for leap years and Provide clock and calendar programmed with periods of normal operation.
- **Extension of plant operation:**
 - **Action:** Allow manual override, for normal operation, activated by push button switch.
 - **Period:** 1 hr.
- **Winter mode:**
 - **Time period:** Between 1 October and 30 April.
 - **Outside temperature:** Above 17°C for at least 30 minutes.

75-75-50/295 Data logging

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; and 75-75-50/155 Mechanical ventilation systems control.

- **Actuator:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Alarm:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Motorized valve:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Sensor:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Thermostat:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.

75-75-50/296 Plant monitoring

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; and 75-75-50/155 Mechanical ventilation systems control.

- **Cooling plant:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.

- **Fan:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Heating plant:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Humidifiers:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Pressurization units:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Pumps:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Water treatment:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.

Ω End of system

75-75-50/155 Mechanical ventilation systems control

System outline

75-75-50/155 Mechanical ventilation systems control

- **System performance:** 75-75-50/201 Design and 75-75-50/212 Time control.
- **Objectives:** As described above
- **Start and stop control:** 75-75-50/204 Fan overrun;
75-75-50/202 Boost fixed time;
75-75-50/206 Low inside air temperature interlock for building fabric and contents protection;
75-75-50/210 Optimum start and stop heating;
75-75-50/208 Night cooling;
90-65-25/380 Time switches;
75-75-50/205 Hand off auto switch;
and 75-75-50/207 Low temperature interlock signals for plant protection.
- **Damper control strategies:** 75-75-50/246 Full outside air damper control strategy;
75-75-50/247 Mixing damper control strategy;
and 75-75-50/248 Carbon dioxide demand damper override control strategy.
- **Heating coils control strategies:** 75-75-50/249 Electric heater battery, pre-heat coil and frost protection control strategy;
75-75-50/250 Low temperature hot water pre-heat coil and frost protection strategy;
and 75-75-50/252 Low temperature hot water heating coil control strategy.
- **Heat recovery devices control strategies:** 75-75-50/256 Thermal wheel, variable speed, control strategy.
- **Supply fan control strategies:** 75-75-50/265 Constant volume supply fan control strategy or 75-75-50/266 Two speed supply fan control strategy.
- **Extract fan control strategies:** 75-75-50/272 Constant volume extract fan control strategy or 75-75-50/273 Two speed extract fan control strategy.
- **Terminal units control strategies:** 75-75-50/276 Constant volume air terminal unit, with reheat, control strategy.
- **Filter control strategies:** 75-75-50/284 Air filter with pressure sensor control strategy.
- **Supply air temperature control strategies:** 75-75-50/289 Zone air temperature control.
- **Additional functions:** 75-75-50/295 Data logging and 75-75-50/296 Plant monitoring.
- **Equipment:** 90-65-50/320 Alarms;
90-65-50/316 Damper actuators type B;
and 90-65-50/340 Control panels.
- **Sensors:** 90-65-50/370 Air quality sensors;
90-65-50/380 Air temperature sensors;
90-65-50/390 Flow in duct sensors;
and 90-65-50/420 Pressure sensors.
- **System completion:** 75-75-50/850 Keys;
75-75-50/810 Inspection and testing;
75-75-50/840 Spares;
75-75-50/860 Documentation;
75-75-50/830 Commissioning of automatic control systems;
75-75-50/820 Start up and commissioning;
and 75-75-50/870 Servicing and maintenance.

System performance

75-75-50/201 Design

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; 75-75-50/155 Mechanical ventilation systems control; and 75-75-50/190 Gas fired heating system control strategy.

- **Submit including the following information:** Operation statements, point schedules, control logic diagrams, network topology schematics, panel diagrams and fascia drawings, method statements for testing and commissioning, method statements for witness testing and graphics.

75-75-50/202 Boost fixed time

Shared by: 75-75-50/120 Heating systems control; and 75-75-50/155 Mechanical ventilation systems control.

- **Boost operation:**
 - **Signal:** Set from calendar in winter season and preset time on time clock.
 - **Boost period and time:** October and March, 1 h;
November, 1.5 h;
and December, January and February, 2 h.
 - **Termination:** When zone reaches heating set point temperature.

75-75-50/204 Fan overrun

- **Operation:** Activate when mechanical ventilation plant has been operated with an electric heater battery.
- **Period:** 5m.

75-75-50/205 Hand off auto switch

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; and 75-75-50/155 Mechanical ventilation systems control.

- **Operation:**
 - **Hand:** Plant operates as normal regardless of sensors and controllers but satisfying safety features and interlocks.
 - **Off:** Plant prevented from operating regardless of sensors and controllers. Position plant for shut-down.
 - **Auto:** Plant dependent on sensors and controllers.

75-75-50/206 Low inside air temperature interlock for building fabric and contents protection

Shared by: 75-75-50/120 Heating systems control; and 75-75-50/155 Mechanical ventilation systems control.

- **Low inside air temperature signal:**
 - **Operation:** Start all heating plant serving zone registering condition.
 - **Activation set point:** 8°C.
 - **Termination set point:** 14°C.
- **Priority:** Independent of low outside temperature and low primary heating return water conditions.

75-75-50/207 Low temperature interlock signals for plant protection

Shared by: 75-75-50/120 Heating systems control; and 75-75-50/155 Mechanical ventilation systems control.

- **Low outside air temperature condition:**
 - **Operation:** When activated start duty primary and secondary circuit heating and cooling pumps. Open primary and secondary heating circuit valves to allow water to circulate through circuits unless plant is in operating mode.
 - **Activation set point:** Below 3°C.
 - **Termination set point:** Activation set point plus 2°C.
- **Low primary heating return water temperature condition:**
 - **Operation:** When activated start heat source and primary and secondary heating pumps if not already enabled.
 - **Activation set point:** Below 8°C.
 - **Termination set point:** 35 °C where condensing boilers are used and 55°C where non-condensing boilers are used.

75-75-50/208 Night cooling

Shared by: 75-75-50/145 Natural ventilation control; and 75-75-50/155 Mechanical ventilation systems control.

- **Format:** Mechanical and Passive.
- **Activation:** Average afternoon temperature greater than 20°C;
Average daytime zone temperature exceeds 22°C;
and Temperature of exposed concrete ceiling slab exceeds 23°C.
- **Period of operation:** When the zone temperature remains above outside air temperature;
When zone temperature remains above outside air temperature plus 2°C when using mechanical ventilation;
When zone temperature is greater than heating set point of 19°C;
and When outside temperature is greater than 12°C.
- **Availability:** Throughout entire non-occupied period and Seven days a week.

75-75-50/210 Optimum start and stop heating

Shared by: 75-75-50/120 Heating systems control; and 75-75-50/155 Mechanical ventilation systems control.

- **Start:**
 - **Optimum start time:** Following learning period, achieve temperature set point within +/- 15 minutes of start of occupancy;
Take account of day of week and holidays;
and Use a self-adaptive control algorithm to calculate when to start plant outside of normal operation by measuring outside and internal zone air temperature and using thermal response of structure and plant.
 - **Zone heating set point:** 19°C or as stated elsewhere in specification
 - **Maximum preheat time:** 4 h.
 - **Air handling plant start:** Use separate control for each air handling plant. Start air handling plant and boiler heating system.
- **Stop:**
 - **Optimum stop time:** Disable normal plant operation signal;
Following learning period, achieve minimum temperature within +/- 15 minutes of end of occupancy;
Take account of day of week and holidays;

and Use a self-adaptive algorithm to calculate the earliest time prior to end of occupancy when plant can be shut-down.

- **Minimum acceptable temperature during occupied period:** 18°C.
- **Maximum period between stop and end of occupied period:** 2 h.

75-75-50/212 Time control

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; 75-75-50/155 Mechanical ventilation systems control; and 75-75-50/190 Gas fired heating system control strategy.

- **Time clock:** Automatically change between GMT and British summer time and allow for leap years and Provide clock and calendar programmed with periods of normal operation.
- **Extension of plant operation:**
 - **Action:** Allow manual override, for normal operation, activated by push button switch.
 - **Period:** 1 hr.
- **Winter mode:**
 - **Time period:** Between 1 October and 30 April.
 - **Outside temperature:** Above 17°C for at least 30 minutes.

75-75-50/246 Full outside air damper control strategy

- **Dampers:** Inlet and exhaust air.
- **Control:** Open/closed.
- **Shutdown period:** Close dampers.
- **Operation:** Open dampers on a plant operation signal. When fully open make damper end switch.
- **Damper end switches:** Hardwire to respective fan starter.
- **Fan failure signal:** Close dampers.

75-75-50/247 Mixing damper control strategy

- **Dampers:** Outside air, exhaust air and recirculation. Recirculation opens when outside air and exhaust air close and vice versa.
- **Shutdown:** Position dampers in full recirculation position, recirculation fully open and outside and exhaust air fully closed.
- **Operation:**
 - **Full recirculation position:** On signal for fan overrun, boost, optimum start heating or low zone temperature condition.
 - **Full outside air position:** On signal for optimum cooling start, night cooling and when external temperature is 2°C below internal temperature.
- **Modulating control:**
 - **Operation:** Position dampers to obtain zone air temperature set point and maintain minimum fresh air supply.
 - **Zone air temperature set point:** As room temperature set point
 - **Minimum fresh air supply:** 10 l/s per person

75-75-50/248 Carbon dioxide demand damper override control strategy

- **Monitor:** Concentration of carbon dioxide in return air.
- **Damper control:**
 - **Operation:** Override temperature control strategy on mixing dampers during normal

operation when CO₂ in return air rises above set point. Open outside air damper. When limit is satisfied, resume temperature or dehumidification control.

- **Set point:** 1000 ppm.
- **Temperature and moisture content set points:** When carbon dioxide control is active, maintain with other plant.

75-75-50/249 Electric heater battery, pre-heat coil and frost protection control strategy

- **Equipment to be controlled:** Electric heater battery pre-heat coil and high limit thermostat.
- **Freeze protection thermostat:** Hard wired;
Manual reset;
and Operated through control panel.
- **Operation:**
 - **Normal:** Vary heating demand signal under proportional control to maintain off-coil temperature set point. Prove fan operation.
Off-coil temperature set point: 5°C.
 - **Boost and optimum start heating:** Maximum duty when fan operation proved.
 - **Shut down or overrun mode:** Heating battery disabled.
- **High limit thermostat:**
 - **Operation:** Trip when temperature rises above pre-set value. Disable heater battery and initiate alarm signal.
 - **Pre-set value:** 10°C.
 - **Reset:** Manual.
- **Frost protection:**
 - **Operation:** When thermostat detects temperature below set point, stop supply and extract fans and initiate alarm. Prevent restart until temperature has risen and the thermostat has been reset.
 - **Thermostat set point:** 2°C.

75-75-50/250 Low temperature hot water pre-heat coil and frost protection strategy

- **Equipment to be controlled:** Low temperature hot water (LTHW) pre-heat coil and three port valve.
- **Freeze protection thermostat:** Hard wired;
Manual reset;
and Operated through control panel.
- **Operation:**
 - **Normal:** Modulate three port valve under PI control to maintain off-coil temperature set point. Prove fan operation.
 - **Off-coil temperature set point:** 4°C.
 - **Boost, optimum start heating, low return temperature and low outside temperature:** Fully open three port valve.
 - **Shut down or fan failure:** Three port valve on full bypass.
- **Frost protection:**
 - **Operation:** When thermostat detects temperature below set point, stop supply and extract fans and initiate alarm. Prevent restart until temperature has risen and the thermostat has been reset.
 - **Thermostat set point:** 2°C.

75-75-50/252 Low temperature hot water heating coil control strategy

- **Equipment to be controlled:** Low temperature hot water (LTHW) heating coil and three port valve.
- **Normal operation:** Prove fan operation and, after heating from heat recovery has been utilised, modulate three port valve under PI control to maintain required condition.
- **Required condition:** Supply air temperature set point.
- **Low zone temperature condition:** Prove fan operation and modulate three port valve under PI control to maintain zone heating temperature set point.
- **Boost, optimum start heating, low return temperature and low outside temperature:** Prove fan operation and fully open three port valve.
- **Shut down, optimum cooling start or night cooling mode:** Three port valve on full bypass. or Two port valve closed

75-75-50/256 Thermal wheel, variable speed, control strategy

- **Equipment to be controlled:** Variable speed thermal wheel.
- **Operation:** Enable thermal wheel when the supply fan is operating except for night cooling and fan overrun operation. Disable thermal wheel on shut down or during night cooling.
- **Start condition:**
 - **Operation:** Operate the thermal wheel when the temperature differential between the outside air and return air is greater than set value.
 - **Set value:** $\pm 2^{\circ}\text{C}$.
- **Speed of rotation:**
 - **Operation:** Use a PI signal to control the speed of the wheel motor to provide the required condition.
 - **Required condition:** Supply air temperature set point.
 - **Maximum speed:** Do not rotate wheel faster than setting.
 - **Setting:** To AHU manufacturers recommendation
- **Sequence:** During plant operating periods sequence the thermal wheel first to provide supply temperature set point control. Use other plant for temperature control when the thermal wheel is not rotating or when it is at maximum speed.

75-75-50/265 Constant volume supply fan control strategy

- **Equipment to be controlled:** Constant volume supply fan, hand/off/auto switch hardwired to motor and to extract fan fail.
- **Additional start and stop control:** Associated extract fan failure;
Freeze thermostat trip from pre-heater;
High limit thermostat on electric heater battery;
and Smoke detection device in return air ductwork.
- **Normal operation:** Enable fan and start on receipt of damper open signal.
- **Fan:**
 - **Operation:** Proved when supply air pressure switch or air velocity switch is made. If condition is not met within failure time, generate a fan failure alarm and disable the fan.
 - **Activate switch:** When the differential pressure between the duct and atmosphere rises above 200 Pa.
 - **Failure time:** 30 s.
- **Shut down:** Disable fan.

75-75-50/266 Two speed supply fan control strategy

- **Equipment to be controlled:** Two speed supply fan, hand/off/auto switch hardwired to motor and to extract fan fail.
- **Additional start and stop control:** Associated extract fan failure;
Freeze thermostat trip from pre-heater;
High limit thermostat on electric heater battery;
and Smoke detection device in return air ductwork.
- **Operation:**
 - **Normal:** Enable fan and start on receipt of damper open signal. Operate on low speed unless condition for high speed is signalled.
 - **High speed operation signal:** On measurement of the CO₂ concentration in the return air duct rising above 1000 ppm.
 - **Fan:** Proved when supply air pressure switch or air velocity switch is made. If condition is not met within the failure time, generate a fan failure alarm and disable the fan.
 - **Activate switch:** When the differential pressure between the duct and atmosphere rises above 200 Pa.
 - **Failure time:** 30 s.
- **Shut down:** Disable fan.

75-75-50/272 Constant volume extract fan control strategy

- **Equipment to be controlled:** Constant volume extract fan interlocked with associated supply fan and hand/off/auto switch hardwired to motor.
- **Additional start and stop control:** Associated supply fan failure and Smoke detection device in return air ductwork.
- **Fan control:**
 - **Normal operation:** Enable fan and start on receipt of damper open signal.
 - **Fan operation:** Proved when extract air pressure switch or air velocity switch is made. If condition is not met within failure time, generate a fan failure alarm and disable the fan.
 - **Activate switch:** When the differential pressure between the duct and atmosphere rises above 100 Pa.
 - **Failure time:** 30 s.
- **Shut down:** Disable fan.

75-75-50/273 Two speed extract fan control strategy

- **Equipment to be controlled:** Two speed extract fan interlocked to associated supply fan. Hand/off/auto switch hardwired to motor.
- **Additional start and stop control:** Associated supply fan failure and Smoke detection device in return air ductwork.
- **Fan control:**
 - **Normal operation:** Enable fan and start on receipt of damper open signal. Operate on the same speed setting as supply fan.
 - **Fan operation:** Proved when supply air pressure switch or air velocity switch is made. If condition is not met within failure time, generate a fan failure alarm and disable the fan.
 - **Activate switch:** When the differential pressure between the duct and atmosphere rises above 100 Pa.
 - **Failure time:** 30 s.
- **Shut down:** Disable fan.

75-75-50/276 Constant volume air terminal unit, with reheat, control strategy

- **Equipment to be controlled:** VAV terminal unit with constant volume air flow damper with LTHW reheat coil with two/three port valve.
- **Unit and damper control:**
 - **Shut down, low outside temperature or low return water temperature:** Disable terminal unit and open damper.
 - **Optimum start heating, optimum start cooling, boost or night cooling:** Enable terminal unit and open damper to provide design air flow rate.
 - **Normal operation, low zone temperature or supply fan overrun:** Modulate damper opening using proportional control to provide the supply air flow rate set point.
 - **Supply air flow rate set point:** 0.6 m/s.
- **Fan failure signal:** Open damper.
- **End switches:** not applicable
- **Reheat control:**
 - **Shutdown:** Set reheat coil to bypass.
 - **Low outside temperature, low primary heating return water temperature or supply fan overrun:** Not applicable
 - **Boost or optimum start heating:** Fully open reheat coil valve.
 - **Optimum start cooling, night cooling or fan failure:** Set reheat coil to bypass.
 - **Normal operation and low zone temperature condition:** Prove supply fan is operating and modulate valve by PI control to obtain zone heating temperature set point .

75-75-50/284 Air filter with pressure sensor control strategy

- **Air filters:** Monitor cleanliness by measuring differential pressure across filters using sensors.
- **Dirty filter warning signal:** When pressure switch is made.

75-75-50/289 Zone air temperature control

- **Set point adjustment:**
 - **Operation:** Provide temperature setback during periods when zone is unoccupied.
 - **Zone air temperature heating set point reduction:** 2°C.
 - **Zone air temperature cooling set point increase:** 3°C.
- **Sensor:** Occupancy detector.
- **Time delay:**
 - **Time from detection that occupancy has ended to set point adjusting:** 10 minutes.
 - **Time from detection that occupancy has resumed to set point adjusting:** 2 minutes.
- **Start up set point adjustment:** Not operative.

75-75-50/295 Data logging

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; and 75-75-50/155 Mechanical ventilation systems control.

- **Actuator:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Alarm:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.

- **Motorized valve:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Sensor:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Thermostat:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.

75-75-50/296 Plant monitoring

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; and 75-75-50/155 Mechanical ventilation systems control.

- **Cooling plant:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Fan:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Heating plant:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Humidifiers:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Pressurization units:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Pumps:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.
- **Water treatment:**
 - **Input:** Submit proposals.
 - **Output:** Submit proposals.

75-75-50/190 Gas fired heating system control strategy

System outline

75-75-50/190 Gas fired heating system control strategy

- **System performance:** 75-75-50/201 Design and 75-75-50/212 Time control.
- **Equipment to be controlled:** Direct fired gas heater.
- **Start and stop control:** 90-65-25/380 Time switches.
- **Operation:**
 - **Normal:** Start fan when served zone air temperature is below heating set point and high temperature cut out has not tripped;
Start burner when air flow switch is made;
and Modulate burner to obtain zone air temperature set point.
 - **Zones:** Submit proposals.
 - **Zone air temperature set point:** 19°C unless otherwise stated in this specification, on drawings or within room data sheets.
 - **Burner settings:** High when zone temperature is below 17°C and Low when zone temperature is between 17°C and 19°C.
- **Air flow switch:**
 - **Operation:** Make when air velocity is above set point. Raise alarm if switch is not made within set time.
 - **Set time:** 15 s.
 - **Set point:** 1.5 m/s.
- **High temperature cut out:**
 - **Operation:** Trip when temperature rises above set point.
 - **Set point:** 80°C.
 - **Reset:** Manual.
 - **Warning signal:** Send to control panel.
- **Fan overrun operation:** When burner switches off, run fan for and 5 minutes.
- **De-stratification:**
 - **Operation:** Operate fan when there is a heating demand and the high level temperature sensor is above the lower temperature sensor by the temperature difference.
 - **Temperature difference:** 3°C.
- **Control points schedules:** General and Gas fired heating.
- **Execution:** .
- **System completion:** 75-75-50/850 Keys;
75-75-50/810 Inspection and testing;
75-75-50/840 Spares;
75-75-50/860 Documentation;
75-75-50/830 Commissioning of automatic control systems;
75-75-50/820 Start up and commissioning;
and 75-75-50/870 Servicing and maintenance.

System performance

75-75-50/201 Design

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; 75-75-50/155 Mechanical ventilation systems control; and 75-75-50/190 Gas fired heating system control strategy.

- **Submit including the following information:** Operation statements, point schedules, control logic diagrams, network topology schematics, panel diagrams and fascia drawings, method statements for testing and commissioning, method statements for witness testing and graphics.

75-75-50/212 Time control

Shared by: 75-75-50/110 Water supply systems control; 75-75-50/120 Heating systems control; 75-75-50/145 Natural ventilation control; 75-75-50/155 Mechanical ventilation systems control; and 75-75-50/190 Gas fired heating system control strategy.

- **Time clock:** Automatically change between GMT and British summer time and allow for leap years and Provide clock and calendar programmed with periods of normal operation.
- **Extension of plant operation:**
 - **Action:** Allow manual override, for normal operation, activated by push button switch.
 - **Period:** 1 hr.
- **Winter mode:**
 - **Time period:** Between 1 October and 30 April.
 - **Outside temperature:** Above 17°C for at least 30 minutes.

Ω End of system

75-85-45/110 Lightning protection system

System outline

75-85-45/110 Lightning protection system

- **System performance:** 75-85-45/210 Design of lightning protection systems and 75-85-45/220 Building construction for information.
- **System manufacturer:** A member of the Association of Technical Lightning and Access Specialists.
- **External LPS type:** Attached to the structure.
- **Internal LPS:** Required.
- **Protection against explosive or highly flammable contents:** Required.
- **Protection of electrical and electronic systems:** Required.
- **Air termination system:** 90-75-50/370 Air terminals;
90-75-50/400 Aluminium solid circular conductors;
and Use roof covering as indicated on the drawings where provided.
- **Down conductors:**
 - **Type:** 90-75-50/400 Aluminium solid circular conductors and Use superstructure as indicated on the drawings where provided.
 - **Lateral connections:** Contractor's design.
- **Earth termination system:** 75-85-45/640 Installing ring earth electrodes;
90-75-50/320 Earth plates;
and Use substructure as indicated on the drawings where provided.
- **Accessories:** 90-55-15/320 Anti vandal capping;
90-60-30/410 Transient overvoltage surge suppression devices for mains power supplies;
90-75-50/340 Earth rod inspection pits;
and 90-75-50/430 Lightning protection conductor clamps.
- **Electrical identification:** 90-90-55/390 Equipment labels and warning notices type A.
- **Execution:** 75-85-45/610 Removing lightning protection systems;
75-85-45/650 Installing test joints;
75-85-45/660 Bonding;
75-85-45/620 Existing installations;
75-85-45/670 Dissimilar metals;
75-85-45/630 Installing lightning protection systems;
and 75-85-45/680 Installing notices and labels.
- **System completion:** 75-85-45/820 Documentation;
75-85-45/810 Inspection and testing lightning protection systems;
and 75-85-45/840 Maintenance.

System performance

75-85-45/210 Design of lightning protection systems

- **Design:** Complete the design of the lightning protection system.
- **Standards:** To BS EN 62305-1, BS EN 62305-2, class I, BS EN 62305-3 and BS EN 62305-4;
To BS EN 62305-1, BS EN 62305-2, class II, BS EN 62305-3 and BS EN 62305-4;

To BS EN 62305-1, BS EN 62305-2, class III, BS EN 62305-3 and BS EN 62305-4;
and To BS EN 62305-1, BS EN 62305-2, class IV, BS EN 62305-3 and BS EN 62305-4.

- **Coverage of LPS:** External.
- **Internal equipment to be protected:** Submit proposals.
- **Requirement:** Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

75-85-45/220 Building construction for information

- **Substructure:** Concrete pad foundations;
In-situ concrete piles;
In-situ strip foundations;
In-situ trench fill;
Precast concrete piles;
and Steel piles.
- **Superstructure:** In-situ concrete frame;
Load bearing masonry;
Precast concrete frame;
Steel frame;
and Timber frame.
- **Roof structure:** In-situ concrete frame;
Precast concrete frame;
Steel frame;
and Timber frame.
- **Roof coverings:** Aluminium strip covering;
Built-up felt roof covering;
Copper strip covering;
Fibre cement slating;
Lead sheet covering;
Liquid applied waterproof coating;
Mastic asphalt roofing;
Metal profiled sheet decking;
Natural slating;
Plain roof tiling;
Plastics profiled sheet cladding;
Single lap roof tiling;
Single layer polymeric sheet roof covering;
Stainless steel strip covering;
and Zinc strip covering.

Ω End of system

80-45-90/140 Vertical lifting platform system

System outline

80-45-90/140 Vertical lifting platform system

- **System performance:** 80-45-90/210 Design of vertical lifting platform system
- **System manufacturer:**
- **Approval:** Full member of the Lift and Escalator Industry Association.
- **Vertical lifting platform:** 90-80-65/350 Platform lifts.
- **Landing controls:** Wired.
- **Cable containment:** 90-55-10/380 Rigid conduit type B.
- **Containment accessories:**
- **Execution:** 80-45-90/625 Installing vertical lifting platform systems
- **System completion:** 80-45-90/805 Testing and commissioning vertical lifting platform systems;
80-45-90/840 Spares and consumables;
80-45-90/845 Documentation for vertical lifting platform systems;
80-45-90/875 Training for building user;
and 80-45-90/880 Maintenance.

System performance

80-45-90/210 Design of vertical lifting platform system

- **Design:** Complete the design of the vertical lifting platform system.
- **Standard:** To BS 6440.
- **Environment:** Indoor.
- **Duty cycle (minimum):** 10 return journeys per hour at maximum rated load.
- **Maximum vertical travel distance (mm):** 3600
- **Number of levels served (including lowest):** 2
- **Rated speed (maximum):** 0.15 m/s.
- **Level access at lowest level:** Via pivoting ramp.
- **Proposals:**
 - **Submittals:** Dimensioned drawings, plans, elevations and sections, building loadings, builder's work requirements, controls and wiring diagrams, manufacturers' literature, mounting and fixing details and schedule of labels.
 - **Timing:**
 - **Format:**

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