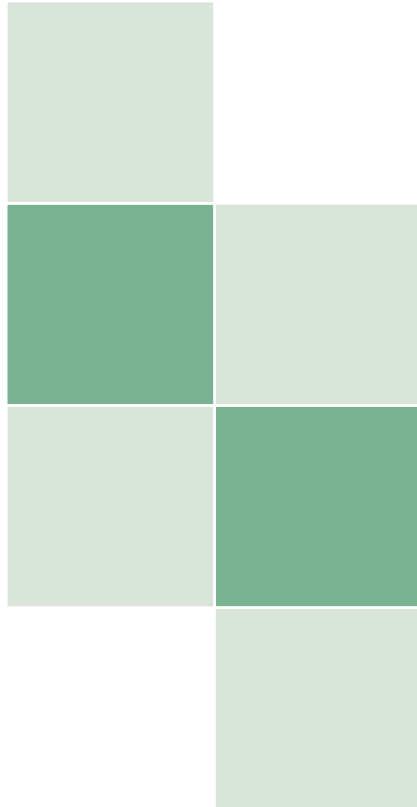




St Johns Place - Globe and Simpson

Mechanical & Electrical Services Stage 4a Performance Specification

**Conject Ref.
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Contents

Contents	3
1.0 Introduction	7
1.1 General	7
1.2 Building Overview	7
1.2.1 Shell & Core Areas	7
1.3 Responsibilities	8
1.4 Design Drawings	8
1.5 Additional Information	9
1.6 M&E Obsolescence	9
2.0 Mechanical, Electrical & Public Health Services Installation Parameters	10
2.1 Associated Documents	11
3.0 Utility Infrastructure	12
3.1 Mains Cold Water Services	12
3.2 Natural Gas	12
3.3 Electricity	12
3.4 Telecoms	13
4.0 Mechanical & Public Health Services	15
4.1 Design and Installation Parameters	15
4.1.1 Responsibilities	17
4.1.2 Additional Information	18
4.1.3 Access Requirements	18
4.2 Chilled Water Cooling System Installation	18
4.2.1 Chillers	18
4.2.2 Circulating Pumps	19
4.2.3 Inertia Pumps Bases	20
4.2.4 Pipework's and Fittings	20
4.2.5 Pipework Supports	20
4.2.6 Painting of Pipework	21
4.2.7 Pressure Testing	21
4.2.8 Sleeves	21
4.2.9 Air Vents	21
4.2.10 Drain Points	22
4.2.11 Valves	22
4.3 Low Temperature Hot Water (LTHW) Installations	22
4.3.1 Boilers	22
4.3.2 Boiler Flues	23
4.3.3 Boiler Room Ventilation	24

4.3.4	Circulating Pumps	24
4.3.5	Inertia Pumps Bases.....	25
4.3.6	Pipework's and Fittings	25
4.3.7	Pipework Supports	25
4.3.8	Painting of Pipework.....	25
4.3.9	Pressure Testing	26
4.3.10	Sleeves.....	26
4.3.11	Air Vents.....	26
4.3.12	Drain Points	26
4.3.13	Valves	26
4.3.14	Radiators	27
4.3.15	Air and Dirt Separators	27
4.3.16	Dosing Pot	27
4.3.17	Flexible Connections.....	27
4.3.18	Floor Plates	27
4.3.19	Flushing Out and Cleaning System	28
4.3.20	Location of LTHW Pipework Distribution	28
4.3.21	Water Treatment.....	28
4.3.22	Landlord's Heating	28
4.4	Boosted Hot and Cold Water Services Installation	29
4.4.1	Floor Plates	30
4.4.2	Flushing/Chlorination.....	30
4.4.3	Location of BCWS Pipework Distribution	31
4.4.4	Air Vents/Anti-Vac Valves.....	31
4.4.5	Drain Points	31
4.4.6	Valves	31
4.4.7	Pressure Testing	31
4.4.8	Sleeves.....	31
4.4.9	Inertia Pumps Bases.....	32
4.4.10	Pipework's and Fittings	32
4.4.11	Pipework Supports	33
4.4.12	Trace Heating	33
4.4.13	External Water Supply	33
4.5	Mechanical Ventilation Installations	33
4.5.1	Office Ventilation Installation	34
4.5.2	Primary Core Toilet Areas.....	34
4.5.3	Plantroom Ventilation	35
4.5.4	Refuse Store Ventilation.....	35
4.5.5	Car Park Ventilation.....	35

4.5.6	Flexible Ductwork & Flexible Joints	36
4.5.7	Access Openings	36
4.5.8	Volume Control Dampers	36
4.5.9	Smoke/Fire Dampers	36
4.5.10	Protective Finishes	36
4.5.11	Identification of Ductwork	36
4.6	Dry Riser	36
4.7	Firefighting Ventilation and Smoke Control	37
4.7.1	Smoke Control Firefighting Ventilation	37
4.7.2	Smoke Control (Car Park)	37
4.8	Above Ground Foul Drainage	40
4.8.1	Sump Pumps	41
4.9	Syphonic Drainage	41
4.10	Sprinkler Installation	41
4.11	Data Room Cooling	44
4.12	Automatic Controls Systems	44
4.13	Energy Monitoring System	51
5.0	Electrical.....	58
5.1	Electrical Design and Installation Parameters.....	58
5.2	Associated Documents.....	58
5.3	Design Criteria.....	59
5.4	EMC (Electromagnetic Compatibility)	60
5.5	Harmonic Analysis and Remediation	60
5.6	Segregation of Services	60
5.7	Design Documentation.....	60
5.8	Scope of Work	61
5.9	Main LV Switchboard	62
5.10	Standby Generator (Life-safety secondary power supply)	63
5.11	Metering Strategy	67
5.12	LV Distribution.....	68
5.13	Containment Systems Installation	71
5.14	System of Wiring (Final Circuits)	73
5.15	Small Power Installation	73
5.16	General Lighting Installation.....	74
5.17	Lighting Controls.....	76
5.18	Emergency Lighting Installation	77
5.19	External Lighting.....	78
	External 'Art Wall' Lighting	78
5.20	Luminaire Apertures	79

5.21	Telecoms and Structured Cabling	79
5.22	Fire Alarm Installation	81
5.23	Fire Telephone and Disabled Refuge Alarm System	83
5.24	Disabled Toilet Alarm System	84
5.25	Audio Intercom and Access Control Installation.....	84
5.26	CCTV Installation	85
5.27	Mechanical Wiring Installation	86
5.28	Earthing and Bonding Installation	87
5.29	Lightning Protection Installation.....	87
5.30	Surge Protection Installation	89
5.31	Lifts	89
5.32	PV System	90
17.0	Testing and Commissioning	92
18.0	Operation and Maintenance Manuals	93
19.0	Builders work	94
20.0	Materials and Workmanship	95
21.0	Co-ordination with Other Trades	96
22.0	Maintenance Strategy	97
23.0	Plant Replacement Strategy	98
24.0	Economical life expectancy.....	99
25.0	Spares	101
26.0	Schedule of Manufacturers	102
	Appendix 1 – CDM Risk Assessments	105
	Appendix 2 – Tender Summaries.....	106

1.0 Introduction

This document is a Stage 4a Performance Specification for the proposed Building Engineering Services to be provided at the St Johns Place - Building C (Globe and Simpson) development in Manchester. As such, it forms part of a suite of Employer's Requirements documents for the Design and Build contract.

The Contractor shall include for the design development, supply, delivery, installation, testing and commissioning and setting to work of all engineering services within the development as outlined on the Stage 4a drawings and specifications.

Crookes Walker Consulting (CWC) shall be retained to review the design development and monitor installation works for compliance with the Performance Specification.

The St Johns Place, Building C is located on the junction of Water Street and New Quay Street in Manchester.

1.1 General

The Building Engineering Services design will be carried out in accordance with the relevant British/European Standards, CIBSE Guidelines, current Building Regulations and the local Manchester Planning requirements for energy performance.

It is proposed to locate the building services primary plant and equipment within dedicated plant spaces at mezzanine and at roof level.

1.2 Building Overview

Building C is a nine-storey mixed use building, located within the St Johns Development, Manchester. The building will comprise of:

- Reception and workspace at ground floor levels
- 8 floors of office workspace
- Car Park at Basement level
- Workspace at Mezzanine level
- Plant Space at Roof Level

Reception entrances (Tenant Fit out) are to be provided for the main tenant. Every floor can be accessed via the main core in Building C which accommodates four passenger lifts, a disabled WC plus dedicated male and female toilets. Toilets are also to be provided as part of the Tenant fit-out.

A secondary core provides an alternative means of escape from each floorplate.

1.2.1 Shell & Core Areas

The Contractor shall be responsible for the landlord's services throughout the shell and core areas, in addition connection points to the tenant demised areas as more specifically defined in the following performance specification and drawings.

The Contractor shall note that the fit-out of the toilets in the central core shall be carried out by the incoming office Tenant, as part of their fit-out.

The fit out of the changing rooms in the basement shall form part of base build works.

The Contractor shall include for the additional works required to facilitate the office fit-out and for liaising with the office Tenant.

1.3 Responsibilities

The Contractor shall also be responsible for:

- Working with the remainder of the design team to ensure compliance with Part L2 of the Building Regulations 2013.
- Developing the design through RIBA Stages 4b, 4c and 5 including detailing in accordance with BSRIA BG6 2013.
- Achieving Building Regulations and Insurance Company approval.
- Procuring engineering services samples and achieving approval from the client and the remainder of the design team.
- Detailed design of the engineering services installation.
- Production of calculations and drawings as necessary to demonstrate the engineering services design to CWC.
- Design liability including warranties.
- Producing EPCs for all areas of the building (including individual commercial units and office areas).
- Manage the integration of utility services for water, gas, electricity, and telecommunications into the development.
- Applications for incoming utility supplies.

This performance specification shall be read in conjunction with all other contract documentation and the following Standard Specifications and Standards:

- CWC Stage 4a drawings
- CWC Preliminaries.
- Electrical Standard Specification
- Mechanical and Public Health Standard Specification
- All relevant British Standard Requirements, Building Regulations, CIBSE codes and guides and all relevant Codes of Practice.

The Contractor shall have full cognisance of the services distribution routes within the buildings and shall note the requirement for careful co-ordination of the services installation within the cores and corridors and risers.

Costs for maintaining the systems for a period of 12 months shall be submitted and identified separately.

As a condition of this Contract, the Contractor accepts that in the event of any ambiguity or omission in the combined suite of tender documents that the Contractor did not address with a query during the Tender stage shall be resolved with the solution deemed to be correct by the Client's consultant team at no additional cost to the client.

1.4 Design Drawings

The Contractor shall be responsible for the production of detailed design and working drawings, schedules, methodologies, detailed design calculations etc.

which accurately show the proposed services & shall include for updating these as necessary as the design is developed to ultimately turn working drawings into 'as fitted' drawings.

These drawings shall be submitted for comment to CWC prior to works commencing on site. The Contractor shall, on request by CWC, submit all design information to CWC for review prior to commencing on site.

The Contractor shall include for commercial unit setting out drawings for the incoming services and external louvre provision. These drawings shall include the coordination with the base build installations to ensure clashes are avoided.

The production of design drawings shall include for liaison with the future office Tenant representatives.

As part of the Stage 4 development the Contractor shall allow for the production of a typical fit floor out arrangement to facilitate co-ordination with the Stage 4 Structural and Architectural designs.

The Contractor shall develop the Stage 4 design in a BIM environment producing the information in Revit format in collaboration with the Architectural and Structural model production. Reference should be made to Lendlease BIM protocols and procedures for further details.

1.5 Additional Information

This performance specification shall be read in conjunction with architectural and structural plans which incorporate space allocation for plant and risers.

The Contractor shall be responsible for procuring any additional architectural or structural information required to undertake the design, installation and co-ordination of services.

The Contractor is advised that the fire strategy report prepared by the fire engineer shall be used to ensure the engineering services support the agreed fire strategy.

1.6 M&E Obsolescence

The Contractor shall ensure all M&E equipment supplied for this project shall continue to be supported by the supplier for a minimum of 10 years & shall be the most recent version of the equipment offered.

'Supported' shall mean that spare parts, consumables, software support, technical literature etc., shall be available for at least 10 years following completion of the project.

2.0 Mechanical, Electrical & Public Health Services Installation Parameters

This performance specification forms part of a set of documents listed below, which when taken together set out the requirements of the complete Mechanical & Electrical Services Installation, the required quality of workmanship and materials, and the contractual obligations of the Contractor: -

- Mechanical Services Performance Drawings
- Electrical Services Performance Drawings
- Combined Mechanical & Electrical Services RIBA Stage 4a Drawings
- MSS-01 Rev 6 – Mechanical Standard Specification
- ESS-01 Rev 6 – Electrical Standard Specification
- SPS-01 Rev 2 – Prelims Standard Specification
- Allied London Developers Specification for Building C (Globe and Simpson)

In addition, this specification shall be read in conjunction with all other Contract Documentation, some of which has been produced by Crookes Walker Consulting Ltd, and some of which has been produced by other members of the Client's Design Team:

- The Architect's Specification and Drawings
- The Quantity Surveyor's Contract Documentation
- The Main Contract Preliminaries
- The Structural Engineer's Specification and Drawings
- The CDM Plan
- The Fire Engineer's Specification and Drawings
- The Acoustic Consultant Reports and Specifications
- The Traffic Engineer/Consultants Reports, Specifications and Drawings
- Manchester City Council Planning Documentation

The Contractor shall be responsible for: -

- The detailed design RIBA Stages 4b and c.
- RIBA Stage 5 and installation of the complete Electrical, Mechanical and Public Health Services Installation.
- Coordination and Liaison with the Mechanical Services Contractor.
- Coordination and Liaison with the Electrical Services Contractor.
- Coordination and Liaison with the Main Contractor.
- Coordination and Liaison with Any Specialist Sub-Contractors.
- Liaison with the Architect and Structural Engineer.
- The detailed design and coordinated installation of the complete Mechanical, Electrical & Public Health Services Installation.
- Coordination and Liaison with the Client and/or his representatives regarding the final positioning of all Specialist Equipment and any associated electrical attendances.
- Coordination of and liaison with incoming services providers.
- Achieving the BREEAM requirements (Shell and Core – Excellent).
- Coordination and liaison with the Tenant(s) and/or their design teams.

2.1 Associated Documents

The complete Mechanical and Electrical Services installation shall be designed, supplied, installed, tested, commissioned and set to work by the Contractor.

The Contractor shall refer and adhere to Globe and Simpson Developer's specification, Revision 08.

The following associated documents shall be utilised, but shall not be limited to, when carrying out all aspects of the design and installation:

- Building Regulations
- 18th Edition of the IEE Regulations for Electrical Installations (BS 7671)
- Regulations under the Factories Act
- CIBSE Guides
- Energy Conservation Act
- British Gas Council Codes of Practice
- Regulations under the Electricity Acts
- Relevant HVCA Design Guidance Publications
- Memorandum of Guidance under the Electricity at Work Regulations 1989
- The Gas Safety Regulations
- The Clean Air Act
- The Control of Pollution Act
- Specific Requirements of the Local Electricity, Gas or Water Authority
- Requirements of the Local Fire Officer & Building Control
- Health & Safety at Work Act
- Construction (Design and Management) Regulations
- Relevant British Standards and Codes of Practice
- Relevant European Standards
- Electro-magnetic Interference Guidelines
- Building Services Research & Information Association Code of Practices
- All CIBSE Codes of Practice and Design Guidance Notes
- Asbestos Regulations.
- Control of Substances Hazardous to Health Regulations. (COSHH)
- Fire Prevention on Construction Sites
- The Department of Environment's Energy Efficiency Best Practice Programme (BRECSU).
- F-Gas Regulations 2018
- Building and Engineering Services Association Standards and Codes of Practice
- DS 439
- 2018 ErP Legislation
- BCO Guidelines

In all instances, the latest revision and/or amendments to the above publications/regulations/recommendations shall be utilised.

3.0 Utility Infrastructure

3.1 Mains Cold Water Services

Incoming utility mains cold water supplies will be provided to serve the building. The following metering provision is proposed to be provided:

- The Offices will be served by a bulk water meter.
- Individual water meter to serve the Café Area but taken from the main supply

The utility water meter location is to be confirmed and with agreement from United Utilities.

The incoming mains cold water application shall be made by the Contractor.

3.2 Natural Gas

Individual utility gas supply will be provided to serve the Globe and Simpson Building.

A gas supply will be installed to serve the gas-fired boilers located in the roof top plant area.

The incoming gas application shall be made by the Contractor following confirmation of gas demand from the Stage 4 design process.

3.3 Electricity

A new three phase, incoming electrical supply shall be provided to the building and shall be derived from the new local HV primary substation and network.

A new DNO substation shall be provided, dedicated to Globe and Simpson, within the building at ground floor level.

The Contractor shall oversee, programme and manage the entirety of the works carried out by the utility providers and shall include all costs and attendance in association. The order for the ENWL works shall be placed by the client.

The Substation shall be located at ground floor level, requiring 24/7 vehicular access.

The substation room design shall be approved by ENWL prior to construction, including all builders works, doors, trenching and earthing details.

A dedicated 70 kVA LV supply shall be derived from the DNO substation to serve the proposed retail unit at ground floor level.

A provisional electrical load estimate has been carried out which indicates that 840KVA supply capacity shall be required to the development.

Utility Provider: - ENWL

MPAN Number: - ENWL

Energy Supplier: - Tenant

Total Maximum Import Capacity (MIC): - To be confirmed as part of the contractor's duties. The Contractor shall be responsible for updating the load schedule for the building based on final plant and equipment selections. This load assessment shall be submitted to the Engineer for comment/approval on during stage 4b and verified again thereafter at the completion of the design stage and prior to the ordering of any plant and materials.

3.4 Telecoms

The development shall provide all containment and facilities to allow connection to the Telcom and BT infrastructure network. This shall comprise:

- Incoming service ducts terminating within the building. These shall be located in the diverse positions as indicated on the drawings and each consist of 4No. 100mm ducts connected back to the site wide ICT infrastructure duct network. The site wide duct network and inspection chambers are to be provided under separate contract.
- Within the building, a secure steel trunking containment system, sized 150x150mm, dedicated to the incoming diverse telecoms shall provide a segregated wiring route from the incoming duct locations to the main hub room and smaller secondary comms intake room (where the ducts do not terminate directly into hub rooms). A further secure trunking system, sized 100x100mm, shall link the two hub rooms.
- A further secure steel trunking containment system shall originate from each hub room and rise through the building via the primary and secondary risers. This shall be sized 50x50mm and contain 12way blown fibre tubing. Within the two risers, the trunking shall be mounted on 300mm steel wire basket and shall break at each floor to allow retrofit of a 350x100mm breakout box (by Node).
- Dedicated telecoms containment shall be provided from the comms intake positions to the proposed retail unit at ground floor level.
- The Telcom fibre optic infrastructure shall be installed to the building by Telcom.
- Telcom will also procure a BT fibre service to serve the FM, security and telematic telephone lines.
- Node will install building fibre optic and copper backbone cabling, telephone DP and final service points.
- Refer to the ICT schematic

The following comms/data connections are required for landlord facilities management:

- 4No. telephone lines for lifts
- 1No. telephone line for utility electricity meter to Globe and Simpson
- 1No. telephone line for utility electricity meter to retail unit / cafe

- 1No telephone line to the generator for remote interrogation by the generator maintainer.
- 1No. Redcare line for fire alarm
- Data connections providing:
 - IP connection to site wide landlord network for fire alarm monitoring at central control room
 - IP connection(s) to site wide landlord network for CCTV integration to central system
 - IP connection(s) to site wide landlord network for Access Control integration to central system
 - IP connection to site wide landlord network for BMS integration / remote monitoring
 - IP connection to site wide landlord network for Generator status remote monitoring
 - IP connection(s) to all landlord submeters.

Landlord comms passive equipment and structured cabling shall be provided by the contractor, with main cabinet located in the larger ISP hub room. Secondary cabinets will be provided as necessary and as indicated on the ICT schematic.

Tenants will procure their own services using the Telcom infrastructure located through the risers. Any tenant server room shall be provided within the fit out works and located within tenant spaces.

4.0 Mechanical & Public Health Services

The Mechanical and Electrical services within Building C will comprise:

4.1 Design and Installation Parameters

The Mechanical Services shall be designed and installed, tested, commissioned and set to work by the Contractor, in accordance with CIBSE guidelines, Best Practice and all relevant British Standards. The following design criteria shall be used when carrying out the design for the Mechanical Services:

External Design Criteria

Peak external design conditions

Summer:	Dry Bulb Temperature	28 °C
	Wet Bulb Temperature	20 °C
Winter:	Dry Bulb Temperature	-5 °C
	Wet Bulb Temperature	-5 °C

When the external ambient temperatures either exceed in summer or fall below in winter the defined external design conditions then the internal conditions shall drift away from those defined below.

Cooling plant selection shall be on 32 °C db (heat rejection operating up to 35°C at reduced capacity).

Internal Design Conditions

The design conditions for the areas shall be as listed below:

Office Areas:	24 ± 2* °C summer
	20 ± 2* °C winter
Toilets:	Minimum 18°C
Main Entrance and Reception Area:	23 ± 2* °C summer
	21 ± 2* °C winter
Core Circulation:	Minimum 18°C
Plantrooms:	Minimum 5°C frost protection

*Control Tolerance

No humidity control is to be provided as part of the shell and core installation.

Ventilation Design Rates

Office Areas:	12 l/s/person, Occupancy 1 person per 8m ²
Toilet Areas:	10 ACH – make up air shall be drawn from adjacent areas
Changing Rooms and Showers:	10 ACH
Plantrooms:	1 ACH
Cycle Store:	2 ACH
Refuse Rooms:	6 ACH

Winter Infiltration Design

Air permeability: 3 m³/hr/m² @ 50Pa

Noise Criteria

The building services shall be designed to provide the following acoustic levels:

<u>Area</u>	<u>Internal Noise Limits</u>
Office (open plan)	NR38
Core Areas	NR40
Plant rooms	NR65
Entrance/Reception	NR40
Landlord Toilets	NR40
Offices (cellular)	NR35
Refuse Room	NR40

The Contractor shall comply with the external noise criteria stated in the Acoustic Consultant's report. The Contractor shall note that the Acoustic Consultant's report shall take precedence.

Heat Gains – Office Areas

The comfort cooling to the offices shall be designed to meet the following criteria:

Occupancy:	1 person/8m ²	net floor area
People:	90 watts sensible	50 watts latent
Lighting:	10 W/m ² in the office areas	
Small Power:	25 W/m ² in the office areas	

Air Filtration Standards

Changing Rooms:	G5 Filers
Office AHUs:	F7 Filters pre filter G4

Cold Water Storage

Storage requirements:

15 litres per person per day, to provide 8 hours potable water storage in the event of a mains failure.

The cold water storage shall not be combined to serve the sprinkler storage requirements.

Above Ground Drainage

Design Standard - European standard 12056-2: Gravity Drainage Systems Inside Buildings; Sanitary Pipework, Layout and Calculation.

All pipework systems shall be installed to achieve a self-cleansing velocity.

Ductwork

All ductwork shall be installed to DW/144 and BS EN 15780 'medium' cleanliness.

4.1.1 Responsibilities

The Contractor shall also be responsible for:

- Design, Supply, Installation and Commissioning of the following:
 - New MCWS supplies for the development
 - New gas supplies for the development
 - Dry Riser system
 - Smoke ventilation systems (mechanical and natural)
 - Refuse Store ventilation systems
 - Boosted Cold Water Service
 - Above ground drainage systems
 - LTHW heating systems
 - Mechanical supply and extract ventilation systems
 - Sprinkler system
 - Automatic controls and BMS
- Complying with Part L of the Building Regulations.
- Detailing and undertaking all builders work in connection with mechanical services
- Co-ordination with the Architect, Structural Engineer and Electrical Sub-Contractor
- Production of all design drawings and calculations for the complete works for approval by the client, his representatives and Consulting Engineer
- Testing & Commissioning
- Providing warranties
- O&M Information including As Fitted Drawings
- Compiling an asset register of all plant and equipment
- Providing & setting out of services for retail unit
- Provision of information to support the BREEAM Excellent rating during design and post-construction assessments

4.1.2 Additional Information

This specification shall be read in conjunction with architectural plans which incorporate space allocation for plant and risers.

The Contractor shall be responsible for procuring any additional architectural or structural drawings required to undertake the detailed design, installation and co-ordination of services.

The Contractor is advised that the fire strategy report prepared by the fire engineer shall be used to ensure the engineering services support the agreed fire strategy.

This specification should be read in conjunction with the Crookes Walker Consulting drawings issued for Stage 4a Tender purposes and with the Developer's Specification for Building C.

4.1.3 Access Requirements

The Contractor shall include for all access requirements and working platforms in order to undertake and complete the works in a safe manner and in accordance with HSE and CDM Regulations.

The Contractor shall provide confirmation that all access requirements have been included within his tender.

4.2 Chilled Water Cooling System Installation

The chillers shall be installed on the level 9 rooftop plant space. The chillers shall be installed on new steel frames.

The Contractor shall install air cooled liquid chillers to serve the office areas (Levels Ground to 8) and the AHUs with chilled water. The distribution pipework serving each floor plate is to be installed by the Tenant's CAT fit-out.

The secondary circuits shall be variable flow.

The system shall be pressurised by as packaged pressurisation unit complete with expansion vessels.

External pipework shall be trace heated.

4.2.1 Chillers

The chillers shall provide chilled water at 7°C flow and 12°C return water temperatures.

The chillers shall utilise R1234ze and be suitable for external locations. The chillers shall be including a Turbocor Centrifugal Compressor arranged in 2 independent refrigerant circuits and designed, manufactured and tested in a facility with ISO9001 accreditation.

The chillers shall be complete with the following:

- Eco Directive 2016/2281 Ener (Lot 21) Compliant
- Inverter compressor drives
- Temperature and pressure display
- Chilled water in/out readout
- Electronic expansion valves
- Slide valve compressor unloaders
- Full refrigerant charge
- Single mains disconnection switch
- LP & HP pressure relief valves
- 10 bar operating pressure on waterside
- Chilled water flow protection
- Low noise fans
- Chilled water temperature reset
- Chiller alarm relays (per circuit)
- PED compliant
- Compressor acoustic enclosure
- BREEAM leak detection

The Contractor shall include for the chiller manufacturer to attend site and test and commission each chiller with a return visit after 6 months.

The chillers shall be installed complete with acoustic package to satisfy the acoustic constraints highlighted in the acoustic specialists' report.

The chillers shall be manufactured by Airedale, Leeds or equal and approved

4.2.2 Circulating Pumps

The chilled water pumps shall be of the mechanical seal direct drive in-line close coupled pump sets complete with flanges, counter flanges and pressure tappings.

The pump bodies shall be of cast iron having cast iron impellers, stainless steel shaft BS970, mechanical seal suitable for a temperature up to 120°C and shall be complete with one pair of Engineering Appliances flexible connections for each pump or pump set and also complete with isolating valves, non-return valve, strainer (with pressure gauges on the inlet and outlet) and pressure gauges on the suction side and discharge side of the pump set. Flexible connections shall have matching flanges.

The pumps shall be suitable for 230 Volts, 1 Phase, 50 Hz or 415 Volts, 3 Phase, 50 Hz electric supply.

The pumps shall be manufactured by Grundfos or equal and approved.

Each pump shall be mounted on a concrete inertia base unless otherwise detailed. Where on steels the Contractor shall include for inertia vibration pads to suit and omit the transmission of vibration through the steelwork.

Each pump or pump set shall be complete with pump line size EA53 matching flanged flexible connections fitted on suction and delivery flanges of each pump or pump set to BS4504 and as manufactured by Engineering Appliances Ltd.

The pumps shall be quiet in operation.

Isolating valves and gauge cocks are to be provided on the suction and delivery lines to each pump set and each strainer on the heating pumps.

150mm dial pressure gauges each graduated to suit application are to be provided complete with syphons, suitable for fixing into the gauge cocks either side of pump sets, strainers, etc.

The pumps shall be inverter driven these drives shall be complete with the pump and installed as part of the pump or adjacent same and supported and wired accordingly.

4.2.3 Inertia Pumps Bases

The Contractor shall allow for the supply and installation of pump inertia bases as manufactured by DST Group, or equal and approved.

Each base shall be of a size suitable for its location and the pump detailed and the Contractor shall include for each unit to be concrete filled after final positioning.

Each unit shall have paint finish applied complete with spring mounts as appropriate for the location and application.

Where pumps are pipeline mounted with primary steel members, the contractor shall install DST Group purpose made TICO type anti-vibration padding between pump and steel to avert transmission of vibration through the existing structure.

4.2.4 Pipework's and Fittings

The CHW pipework in plantrooms, risers and distribution routes shall be of heavy grade steel to BS 1387 Table 5 and in accordance with the Mechanical Standards Specification, Sections 2.0 and 3.0. Victaulic joints and couplings and press fit systems shall not be permitted on this part of the installation.

All valves to be supplied by Tour and Anderson / Hattersley, or equal and approved.

All pipework shall be provided with a 25 year warranty.

4.2.5 Pipework Supports

The whole of the pipework installation shall be adequately supported throughout and shall be as Mechanical Standard Specification Section 2.0.

4.2.6 Painting of Pipework

All new pipework shall be cleaned down to remove any surface corrosion and painted with red oxide primer. All exposed pipework shall receive 2 topcoats of gloss paint, final topcoat paint finish to be confirmed by the architect.

4.2.7 Pressure Testing

All water services pipework shall be pressure tested hydraulically at twice working pressure for a period of two hours or 345KN/m², whichever is the greater and carried out generally as the Mechanical Standard Specification, Section 22.0.

4.2.8 Sleeves

Where pipes span through walls, floors, ceilings, etc.... sleeves of the same material as the pipe or Tenmat Firefly products are to be inserted at a suitable length to finish flush with the respective finished faces.

Pipework passing through walls, slabs, etc. shall be insulated though their entire length including on their passage through the respective structures.

Sleeves should not touch the pipe under any circumstances. Where pipes pass through fire walls/barriers the contractor shall use fire sleeves utilising fire stopping materials to maintain the integrity of the fire barrier.

Particular attention is drawn to situations where multiple pipe arrangements pass through fire break walls. Consideration shall be given to providing a purpose-made mounting plate with sleeves welded in position at these situations to enable the hole to be adequately sealed. The Mechanical Contractor shall be responsible for ensuring that his services are installed in such a manner as to permit the fire stopping to be adequately installed around them and to fully liaise with other trades to ensure a fully fireproof barrier for all services is obtained.

Details showing the proposed pipework arrangement where four or more pipes pass through fire break walls shall be submitted to the Consulting Engineer and approved before erection.

4.2.9 Air Vents

Air vents shall be installed at all high points in the systems as necessary to enable the correct venting of the system to ensure the complete removal of air to maintain the operation of the system and shall be, generally as Mechanical Standard Specification, Section 3.0.

4.2.10 Drain Points

Drain points shall be fitted at all low points to facilitate draining of the installation and shall be as Mechanical Standard Specification, Section 3.0.

4.2.11 Valves

Valves shall be installed as necessary to ensure the correct isolation and control of the system. Main isolation valves shall be as manufactured by Tour and Anderson or Hattersley utilising gate valves, butterfly valves shall not be permitted.

Where indicated on the drawings, and where considered necessary in agreement with the Consulting Engineer, the contractor shall design, supply, install, commission and set to work Pressure Independent Control valves as manufactured by Danfoss, or from the Schedule of Manufacturers and equal and approved.

4.3 Low Temperature Hot Water (LTHW) Installations

This section of the works shall consist of the design, supply, installation, testing, commissioning and setting to work of the LTHW heating system.

It is proposed that the boiler room is arranged to facilitate either modular or fully packaged plant.

This LTHW installation shall comprise high efficiency condensing boilers, buffer calorifiers, circulating pumps, pressurisation units, expansion vessels, strainers, valves and ancillary equipment. All to form a complete installation in all respects.

The LTHW system shall distribute through a flow and return piped network (with temperatures; flow 60°C, maximum return 40°C) around the building to serve the AHUs, entrance heaters, stair core heating etc.

Each pipework branch connection shall terminate as the pipework exits the risers. The branch connection shall be complete with isolation valves, commissioning sets, reverse acting differential pressure relief valves, etc.

The system shall be pressurised by as packaged pressurisation unit complete with expansion vessels.

4.3.1 Boilers

The Contractor shall include for forming builder work plant bases to suit the equipment layout as generally indicated on the drawings.

Boiler plant shall be condensing boilers, fully modulating, gas fired modular type:

- Modular format, capable of being dismantled into sections for ease of delivery and future removal, via any restricted access routes.

- Fully modulating, suitable for flow and return conditions (60/40 °C), but capable of condensing operation.
- High efficiency, in accordance with Non-domestic building services compliance Guide minimum requirements.
- Low NOx emissions in conjunction with BREEAM Credits.
- Complete with pre-fabricated flow and return pipe kits and isolation valves.

The boilers shall be complete with all necessary flame failure safety controls and automatic temperature control and shall be suitable for firing natural gas. Manufactured to ISO 9001/CE approved.

Each boiler shall be complete with modulating control, hours run indication, high limit protection, BMS interfaces.

Each boiler control panel to incorporate: -

- i. Boiler on/off switch
- ii. Boiler control thermostat
- iii. High limit thermostat
- iv. Boiler on indication lamp
- v. Boiler "lock-out" indication lamp
- vi. Water temperature/altitude gauge
- vii. Hours run meter shall be controlled
- viii. Boiler fully modulating control

Boilers in multiple selection to be controlled in a cascade operation via the BMS system with individual control of each boilers modulating fire to fully interlaced operation.

Each boiler shall be enclosed in an insulated sheet steel boiler case finished in stove enamel and shall have the following mountings: -

- 1 - Flue connection
- 1 - Flow connection
- 1 - Return connection
- 1 - Gas connection
- 1 - Safety valves
- 1 - 150mm dial thermometer.
- 1 - 150mm dial altitude gauge.
- 1 - 28mm hose union draincock.

Each boiler shall operate under the control as described within this specification.

The Contractor shall include for a complete set of boiler cleaning tools to be supplied in the boiler room.

The Contractor shall include all off-loading, handling, cramage positioning and commissioning of the boilers by the manufacturers.

4.3.2 Boiler Flues

The Contractor shall include for the design, supply and installation of the boiler manufacturers approved boiler flue arrangement.

The flue shall discharge at roof level as indicated on the drawings and shall be in accordance with BS5440 with termination and weathering detail to the architect's approval.

The Contractor shall issue his proposed weathering detail to the architect for approval prior to procuring or undertaking any works and shall include for co-ordinating any builder's works with the main contractor.

4.3.3 Boiler Room Ventilation

The Contractor shall include for the design, supply and installation of a boiler room ventilation system in accordance with BS6644, and current Gas Regulations. This shall include the installation of high and low level natural ventilation louvres to meet the combustion requirements of the boilers.

4.3.4 Circulating Pumps

The LTHW pumps shall be of the mechanical seal direct drive in-line close coupled pump sets complete with flanges, counter flanges and pressure tapplings.

The pump bodies shall be of cast iron having cast iron impellers, stainless steel shaft BS970, mechanical seal suitable for a temperature up to 120°C and shall be complete with one pair of Engineering Appliances flexible connections for each pump or pump set and also complete with isolating valves, non-return valve, strainer (with pressure gauges on the inlet and outlet) and pressure gauges on the suction side and discharge side of the pump set. Flexible connections shall have matching flanges.

The pumps shall be suitable for 230 Volts, 1 Phase, 50 Hz or 415 Volts, 3 Phase, 50 Hz electric supply.

The pumps shall be manufactured by Grundfos or equal and approved.

Each pump shall be mounted on a concrete inertia base unless otherwise detailed. Where on steels the Contractor shall include for inertia vibration pads to suit and omit the transmission of vibration through the steelwork.

Each pump or pump set shall be complete with pump line size EA53 matching flanged flexible connections fitted on suction and delivery flanges of each pump or pump set to BS4504 and as manufactured by Engineering Appliances Ltd.

The pumps shall be quiet in operation.

Isolating valves and gauge cocks are to be provided on the suction and delivery lines to each pump set and each strainer on the heating pumps.

150mm dial pressure gauges each graduated to suit application are to be provided complete with syphons, suitable for fixing into the gauge cocks either side of pump sets, strainers, etc.

The pumps shall be inverter driven these drives shall be complete with the pump and installed as part of the pump or adjacent same and supported and wired accordingly.

4.3.5 Inertia Pumps Bases

The Contractor shall allow for the supply and installation of pump inertia bases as manufactured by DST Group, or equal and approved.

Each base shall be of a size suitable for its location and the pump detailed and the Contractor shall include for each unit to be concrete filled after final positioning.

Each unit shall have paint finish applied complete with spring mounts as appropriate for the location and application.

Where pumps are pipeline mounted with primary steel members, the contractor shall install DST Group purpose made TICO type anti-vibration padding between pump and steel to avert transmission of vibration through the existing structure.

4.3.6 Pipework's and Fittings

The LTHW pipework in plantrooms, risers and distribution routes shall be of heavy grade steel to BS 1387 Table 5 and in accordance with the Mechanical Standards Specification, Sections 2.0 and 3.0. Victaulic joints and couplings and press fit systems shall not be permitted on this part of the installation.

All valves to be supplied by Tour and Anderson / Hattersley, or equal and approved.

All pipework shall be provided with a 25 year warrantee.

4.3.7 Pipework Supports

The whole of the pipework installation shall be adequately supported throughout and shall be as Mechanical Standard Specification Section 2.0.

4.3.8 Painting of Pipework

All new pipework shall be cleaned down to remove any surface corrosion and painted with red oxide primer. All exposed pipework shall receive 2 topcoats of gloss paint, final topcoat paint finish to be confirmed by the architect.

4.3.9 Pressure Testing

All water services pipework shall be pressure tested hydraulically at twice working pressure for a period of two hours or 345KN/m², whichever is the greater and carried out generally as the Mechanical Standard Specification, Section 22.0.

4.3.10 Sleeves

Where pipes span through walls, floors, ceilings, etc.... sleeves of the same material as the pipe or Tenmat Firefly products are to be inserted at a suitable length to finish flush with the respective finished faces.

Pipework passing through walls, slabs, etc. shall be insulated though their entire length including on their passage through the respective structures.

Sleeves should not touch the pipe under any circumstances. Where pipes pass through fire walls/barriers the contractor shall use fire sleeves utilising fire stopping materials to maintain the integrity of the fire barrier.

Particular attention is drawn to situations where multiple pipe arrangements pass through fire break walls. Consideration shall be given to providing a purpose-made mounting plate with sleeves welded in position at these situations to enable the hole to be adequately sealed. The Mechanical Contractor shall be responsible for ensuring that his services are installed in such a manner as to permit the fire stopping to be adequately installed around them and to fully liaise with other trades to ensure a fully fireproof barrier for all services is obtained.

Details showing the proposed pipework arrangement where four or more pipes pass through fire break walls shall be submitted to the Consulting Engineer and approved before erection.

4.3.11 Air Vents

Air vents shall be installed at all high points in the systems as necessary to enable the correct venting of the system to ensure the complete removal of air to maintain the operation of the system and shall be, generally as Mechanical Standard Specification, Section 3.0.

4.3.12 Drain Points

Drain points shall be fitted at all low points to facilitate draining of the installation and shall be as Mechanical Standard Specification, Section 3.0.

4.3.13 Valves

Valves shall be installed as necessary to ensure the correct isolation and control of the system. Main isolation valves shall be as manufactured by Tour and Anderson or Hattersley utilising gate valves, butterfly valves shall not be permitted.

Where indicated on the drawings, and where considered necessary in agreement with the Consulting Engineer, the contractor shall design, supply, install, commission and set to work Pressure Independent Control valves as manufactured by Danfoss, or from the Schedule of Manufacturers and equal and approved.

4.3.14 Radiators

The Contractor shall allow for the installation of steel flat panel radiators to core areas and stairwells.

All radiator positions shall be co-ordinated with the Architect prior to installation of pipework and radiators.

The type of radiator proposed by the Contractor shall be agreed with the Client and the Architect prior to procurement.

Each radiator shall be provided with flush air cock Thermostatic Radiator Valves on the flow and combined Lock Shield Valves and drain cocks on the return to facilitate easy draining of the radiator. This radiator drain cock is in addition to drain cocks required at all low points on mains, etc. The Contractor shall include for an end of line bypass to maintain minimum pump flow rate.

The installation of the radiators shall be coordinated with the electrical installations.

4.3.15 Air and Dirt Separators

Where indicated on the drawings, pipeline combined de-aerators and dirt separator shall be supplied and installed.

4.3.16 Dosing Pot

Where indicated on the drawings supply and install a dosing pot assembly complete with all necessary isolation and non-return valves to form a complete installation in all respects.

4.3.17 Flexible Connections

Each pump set shall be provided with flexible connections on the suction and discharge connections as manufactured by Engineering Appliances Ltd, utilising their EA53 type, or DST Group, with pump size diameter complete with matching flanges to BS4504.

4.3.18 Floor Plates

Where pipes pass through floors, walls, ceilings and are visible they shall be complete with clip on type chromium plated floor plates. The floor plates shall be fitted after all the decoration of the building has been completed.

4.3.19 Flushing Out and Cleaning System

Immediately after the satisfactory completion of the whole system final fix in each phase and hydraulic pressure tests the Mechanical Contractor shall flush out, remove all foreign matter and clean all the systems. The system shall be flushed out with clean water, fed in at high points and flushed out at low points with a sufficient velocity to achieve the objective and shall be in accordance with the requirements of the Mechanical Standard Specification, Section 22.0.

The plate heat exchanger shall be provided with a removable flushing bypass, which shall be removed after flushing.

4.3.20 Location of LTHW Pipework Distribution

The routing of the LTHW pipework distribution within risers and corridors shall be positioned as far as reasonably possible from the BCWS pipework distribution to mitigate as far as reasonably possible any risks of elevating the boosted cold water temperature and legionella growth.

4.3.21 Water Treatment

The Contractor shall include for the LTHW pipework systems to be treated with corrosion inhibitor and biocide to prevent bacterial growth. The water treatment shall ensure compatibility between the various system component materials and prevent fouling and corrosion cells.

Allow for the design, supply, installation and testing of a new water treatment regime.

The water treatment design for the LTHW heating installation shall be carried out by a Specialist Water Treatment Contractor.

The Specialist Water Treatment Contractor shall include for reviewing the list of materials for the LTHW system, confirming a water treatment regime including the type of chemicals required and the dosing frequency. The Specialist Water Treatment Contractor shall confirm any potential material reactions with the LTHW installations prior to procurement (to enable changes to be made, if required).

All flushing works shall be carried out in accordance with BSRIA guidance document BG 29/2012.

The Specialist Water Treatment Contractor shall include for dosing the entire system on completion of the works.

4.3.22 Landlord's Heating

The Contractor shall install heat emitters to achieve the design conditions stated above in all Landlord areas. The heating shall be served by the LTHW heating installation.

The Contractor shall install all pipework, valves, emitters, controls for a complete installation.

4.4 Boosted Hot and Cold Water Services Installation

The Contractor shall design, supply, install, test, commission and set to work all the tanks, pumps, expansion and relief equipment, piped networks, valves, switches, items of plant and equipment, etc. to provide a fully functioning combined boosted cold water and domestic hot water systems throughout the building in line with the following requirements.

A new incoming mains cold water supply shall be provided to serve the basement level BCWS cold potable water storage tank and shall be provided with a utility AMR water meter with a pulsed output for connection to an automatic controls system and to monitor the building's water usage.

The basement level BCWS cold water storage tank shall provide potable domestic cold and services to the whole of the building.

The BCWS supplies shall distribute from the cold water storage tank via the booster set, around the building via risers and lateral pipework within the basement and ceiling voids and shall terminate at each outlet/appliance/office floor connection location with an appropriate isolation valve.

The toilets will be served with domestic hot water from local electric water heaters installed by the Tenant.

All connections off the BCWS riser shall have a PRV installed to protect appliances from excessive pressures.

The packaged cold water and booster set shall include an integrated control panel and software to protecting against hydraulic shock such as the RE-PRESS power restoration electronic safety system by Aquatech, offering the end user a controlled system refill following electrical supply failure. The control panel shall provide an audible alarm upon failure of the set.

The Contractor shall supply and install Aquavent pipework protection valve to all Hot and cold water services risers within the building.

The BCWS shall distribute to all cold water outlets and appliances and incorporate an accessible isolation valve immediately prior to the connection to the outlet or appliance.

The cold water pipework distribution system shall be installed in a suitable WRC approved material.

The storage tank shall be externally flanged, GRP, pre-insulated sectional 2 compartment tank, complete with delayed action ball valve in each compartment sealed lid, access ladders, manholes, screened vents, overflows and warning pipes, self-draining base and drain points, all fully compliant with Water Supply (Water Fittings) Regulations 1999.

The tank shall be split to provide 50% water storage whilst the remaining 50% is drained for routine maintenance/cleaning.

BCWS storage tank shall be provided with the following:

- High level alarm
- Low level alarm (well above the low level mark)
- High temperature alarm

From the BCWS tank a multi pump inverter driven booster sets (typically duty/assist/standby) shall be provided to serve the BCWS and hot water requirements of the building.

The booster set shall incorporate a fault signal, and maintenance of each pump should be achievable without affecting the operation of the remaining pumps.

The booster set shall cut out automatically if the low level float switches in either tank are activated. In addition, each warning pipe from the water tanks shall be provided with a leak detection sensor to identify if the tanks are in a state of 'overfill'.

All hot water outlets serving showers and disabled toilet areas shall incorporate fail to cold TMV 3 type thermostatic mixing valves to maintain a water temperature of less than 43°C at the outlet.

The booster set shall be the Aquatech Pressmain AMV FE-Enhanced Series or equal and approved.

4.4.1 Floor Plates

Where pipes pass through floors, walls, ceilings and are visible they shall be with clip on type chromium plated floor plates. The floor plates shall be fitted after all the decoration of the building has been completed.

4.4.2 Flushing/Chlorination

Immediately after the satisfactory completion of the BCWS & domestic hot water installations, the Contractor shall flush out, remove all foreign matter and clean all the systems. The system shall be flushed out with clean water, fed in at high points and flushed out at low points with a sufficient velocity to achieve the objective and shall be in accordance with the requirements of the Mechanical Standard Specification, Section 22.0.

The Contractor shall employ a Specialist Company to undertake chlorination of all water systems in accordance with BS 6700. The contractor shall allow for disposal of chlorinated water and agree place of discharge with local water authority.

The Contractor shall provide chlorination certificate/test results to demonstrate that the water is suitable for consumption and include appropriate sets in Operating and Maintenance Manuals.

4.4.3 Location of BCWS Pipework Distribution

The routing of the BCWS pipework distribution within risers and corridors shall be positioned as far as reasonably possible from the LTHW pipework distribution to mitigate as far as reasonably practicable the risks of elevating the boosted cold water temperature and legionella growth.

4.4.4 Air Vents/Anti-Vac Valves

Air vents shall be installed at all high points in the systems as necessary to enable the correct venting of the system to ensure the complete removal of air to maintain the operation of the system and shall be, generally as Mechanical Standard Specification, Section 3.0.

In addition, Automatic Combined Air Release, Anti Vacuum & Surge Protection valves shall be installed at the top of all the hot & cold water risers to protect the pipework from abnormal pressure fluctuations.

4.4.5 Drain Points

Drain points shall be fitted at all low points to facilitate draining of the installation and shall be as Mechanical Standard Specification, Section 3.0.

4.4.6 Valves

Valves shall be installed as necessary to ensure the correct isolation of the system. Main isolation valves shall be as manufactured by Tour and Anderson or Hattersley utilising gate valves, butterfly valves shall not be permitted.

4.4.7 Pressure Testing

All water services pipework shall be pressure tested hydraulically at twice working pressure for a period of two hours or 345KN/m², whichever is the greater and carried out generally as the Mechanical Standard Specification, Section 22.0.

4.4.8 Sleeves

Where pipes run through walls, floors and ceilings sleeves of the same material as the pipe or Tenmat Firefly products are to be inserted at a suitable length to finish flush with the respective finished faces.

Pipework passing through walls, slabs, etc. shall be insulated through their entire length including on their passage through the respective structures.

Sleeves should not touch the pipe under any circumstances. Where pipes pass through fire walls/barriers the contractor shall use fire sleeves utilising fire stopping materials to maintain the integrity of the fire barrier.

Particular attention is drawn to situations where multiple pipe arrangements pass through fire break walls. Consideration shall be given to providing a purpose-made mounting plate with sleeves welded in position at these situations to enable the hole to be adequately sealed. The Mechanical Contractor shall be responsible for ensuring that his services are installed in such a manner as to permit the fire stopping to be adequately installed around them and to fully liaise with other trades to ensure a fully fireproof barrier for all services is obtained.

Details showing the proposed pipework arrangement where four or more pipes pass through fire break walls shall be submitted to the Consulting Engineer and approved before erection.

4.4.9 Inertia Pumps Bases

The Contractor shall allow for the supply and installation of pump inertia bases as manufactured by DST Group, or equal and approved.

Each base shall be of a size suitable for its location and the pump detailed and the Contractor shall include for each unit to be concrete filled after final sitting.

Each unit shall have paint finish applied complete with spring mounts as appropriate for the location and application.

Where pumps are pipeline mounted with primary steel members, DST Group shall supply purpose made TICO type anti-vibration padding between pump and steel to avert transmission of vibration through the existing structure.

4.4.10 Pipework's and Fittings

The BCWS and hot water pipework shall be Copper Table X, non-arsenical and de-oxidised to BS EN 1057:2006+A1:2010, half hard having a 25 year guarantee in accordance with the Mechanical Standards Specification, Sections 2.0 and 3.0.

The BCWS and hot water shall distribute to all water outlets and appliances and incorporate an accessible isolation valve immediately prior to the connection to the outlet or appliance.

Victaulic joints and couplings shall not be permitted on any part of the installation.

All valves to be supplied by Tour and Anderson / Hattersley, or equal and approved.

Where pipework is exposed to view, copper pipework and fittings shall be chromium plated, and as the Mechanical Standard Specification, Sections 2.0 and 3.0.

Push fit and crimped plastic pipework shall not be permitted.

4.4.11 Pipework Supports

The whole of the pipework installation shall be adequately supported throughout and shall be as Mechanical Standard Specification Section 2.0.

4.4.12 Trace Heating

Where pipework passes through unheated spaces i.e. plantroom, external areas, basement and refuse areas, the Contractor shall trace heat all pipework to protect the cold water service and sprinkler pipework from freezing.

Any faults on the system shall be indicated on the remote alarm panel in The Building Management/FM Manager office via the BMS system

The design and construction of heating tapes, and the design of system employing them shall generally be in accordance with BS EN 62395 and BS EN 60079.

The heating tapes shall be of the self-limiting type, which can be cut to length on site and suitably sealed to prevent ingress of moisture. Sealing methods shall be approved in writing by the tape manufacturer; a copy shall be handed to the Engineer.

4.4.13 External Water Supply

A separate metered supply shall be provided from the boosted supply to facilitate connection to external pop-up water points as identified on the sitewide external landscaping scheme.

4.5 Mechanical Ventilation Installations

This section of the works shall consist of the design, supply, installation, testing, commissioning and setting to work of the mechanical ventilation systems.

All supply and extract AHUs and fans shall meet the specific efficiency values required to comply with ErP legislation (Energy Related Products).

The supply and extract ductwork shall be low pressure Class A ductwork supplied and installed in accordance with DW/144.

Acoustic attenuators shall be provided on the system side of AHUs/fans. Atmospheric side attenuation shall be provided on the intake air and exhaust air connection to meet external noise criteria defined by the planning conditions or acoustic requirements of the project.

All bends shall be full radius or include turning vanes.

Fire dampers, c/w access doors shall be provided at all points where fire compartments are breached.

Fire and smoke dampers shall be installed where ductwork passes through escape routes or as dictated by the building fire strategy.

Generally, the Contractor shall connect the intake and exhaust ductwork to the louvres provided through the Architectural facades package.

The ductwork shall be configured to ensure all volume control dampers, fire dampers and cleaning access hatches are located above appropriately sized access hatches.

4.5.1 Office Ventilation Installation

The office areas on all levels shall be served by central Air Handling Units (AHU) providing tempered supply air to achieve the stated occupancy.

The AHUs shall incorporate heat recovery and summer bypass.

The AHUs shall include the following components:

- Motorised Inlet Damper
- Panel and bag filters
- Heat Recovery Thermal Wheel (inc. filter protection)
- Heater battery (LTHW coil)
- Supply Fan (inc. VSD)
- Extract Fan (inc. VSD)

Filters shall be selected to operate at temperatures at -10deg C without impacting on the performance of the air handling system.

The Contractor shall issue a complete design for the ventilation system for review by the Client and Consulting Engineer for comment prior to procurement of equipment.

The supply and extract serving the office areas shall distribute to the primary core and both secondary cores. A separate AHU shall be provided to serve each core.

The Contractor shall install condensate drainage from the AHU to the nearest appropriate drain.

4.5.2 Primary Core Toilet Areas

A twin fan extract arrangement shall be installed to serve the toilet areas and basement changing room area (Tenant fit out).

The Contractor shall install the discharge ductwork from the fan to the discharge point and the system side ductwork shall be installed as follows:

- Levels Ground and Levels 1 to 8 – ductwork installed in the riser only. A branch duct shall be installed at each office level that terminates 1.0m from the riser. A VCD, Constant Volume Unit and fire damper only shall be installed.
- Mezzanine – ductwork installed in the riser only.

The ductwork shall be configured within the toilet area to ensure all volume control dampers, fire dampers and cleaning access hatches are located above appropriately sized access hatches.

Make-up air shall be drawn into the toilets from the adjacent areas using transfer ducts with cross talk attenuators or via undercut doors.

4.5.3 Plantroom Ventilation

The plantrooms shall be provided with mechanical extract ventilation to operate during periods of elevated temperatures above 20°C. Humidity sensors shall be included in tank rooms to operate upon elevated humidity.

The systems shall comprise of supply and extract fans, interconnecting ductwork, volume control dampers, fire dampers, attenuators, etc. as required to provide fully functioning plant room ventilation installations.

Inline extract fans shall be located at high level within the ductwork in the plantroom and shall operate via a wall mounted temperature and humidity sensor positioned within the plantroom complete with a manual override.

The fans shall be ducted to exhaust louvres on the façade of the building/roof level.

4.5.4 Refuse Store Ventilation

The refuse store(s) shall be ventilated to reduce odours and prevent the build-up of toxic and explosive gasses within the rooms.

If there is a lobby between the refuse store and the amenity area(s) then this will be positively pressurised via a supply air system to prevent odours passing from the refuse store into the amenity space(s).

Air shall be extracted from the space via inline extract fans ducted to the louvres on the façade. Make-up air shall be drawn through the louvres at high level on the façade.

Acoustic attenuators shall be provided on the system side of the fans. Atmospheric side attenuation shall be provided on the exhaust air connection only if deemed necessary to meet external noise criteria defined by the planning conditions.

4.5.5 Car Park Ventilation

The Basement car park will be provided with day to day extract ventilation to comply with Building Regulations, supplied and installed as part of the Smoke Ventilation system. In Line with these documents 3 air changes will be provided at all times, with CO detectors located around the basement. If the CO concentration becomes too high the system will increase to 6 air changes. 10 air changes shall be achieved on fire condition.

Refer also to the smoke control section later in this Specification and the requirements of the Fire Engineering Strategy for this project.

4.5.6 Flexible Ductwork & Flexible Joints

The Contractor shall include for the final connections to diffusers, louvres and equipment to be made using flexible ductwork max 0.5 metre length.

All ductwork must be supported from the building structure.

4.5.7 Access Openings

Access openings shall be provided in accordance with DW144, Appendix M 'Guide to Good Practice Cleanliness and Ventilation Systems', Level 3 – and as detailed in the Mechanical Standard Specification, Section 7.0.

4.5.8 Volume Control Dampers

The Contractor shall include for opposed blade type volume control dampers where necessary as detailed in Mechanical Standard Specification, Section 7.0.

4.5.9 Smoke/Fire Dampers

The Contractor shall include for the supply and installation of smoke/fire dampers where ductwork passes through fire walls, ceilings or floors to the appropriate rating and integrity of the structure. All fire dampers should be easily accessible for resetting/testing.

Smoke dampers shall be installed in line with the requirements of the Fire Strategy for the project.

Fire dampers shall be installed in accordance with DW145.

4.5.10 Protective Finishes

Refer to Mechanical Standard Specification, Section 6.0.

4.5.11 Identification of Ductwork

Refer to Mechanical Standard Specification, Section 6.0.

4.6 Dry Riser

Dry riser installations shall be provided to the main core firefighting stair and the secondary core.

A dry riser inlet pipe connection, complete with valve and cap on a chain, in a proprietary breaching box will be provided at a suitable location at ground floor of

all firefighting staircases, with a pipe feeding above to a landing valve at all levels in all fire-fighting cores.

Dry risers shall be designed and installed in compliance with BS9990: 2015 and be complete with landing valves and inlet breeching boxes, in accordance with BS 5306 Part 1.

Refer to the fire strategy document for the locations and quantity of firefighting staircases.

4.7 Firefighting Ventilation and Smoke Control

4.7.1 Smoke Control Firefighting Ventilation

The firefighting lobby in the core shall be ventilated by providing:

- A proprietary mechanical system that achieves an equivalent performance

The vent opening in the smoke shaft should be provided with a fire and smoke damper system to allow the common shaft to serve the fire floor at any one time.

At the head of stair cores a 1m² AOV shall be installed.

4.7.2 Smoke Control (Car Park)

Mechanical ventilation system shall be provided in the basement car parks due to the lack of access to external walls. The system shall include for the ventilation of the complete single storey basement area of St John's Place.

The ventilation system should be designed in accordance with section 11 of Approved Document B, Approved Document F, BS 12101-3 and BS 7346-7. The following applies;

- The system shall achieve 10 air changes per hour as a minimum under fire conditions.
- The system shall achieve 6 air changes per hour minimum under day to day conditions and include CO control.
- Fans (shaft and impulse) shall be rated at 300°C for a minimum of 60 minutes.
- All materials used in the systems must have a melting point greater than 800°C.
- Suitable emergency power supplies shall be provided.

Smoke extract ventilation will be provided to serve the basement car park. This will require a ventilation shaft to discharge in a suitable external location and impulse fans to channel smoke in the event of a fire in the basement. The discharge location is identified indicatively and will required design development with the Landscape Architect for the Podium.

Intake air for the system shall be taken from the ramp on Manchester Goods Yard and distributed to the St John's Place basement via the connecting tunnel.

The system should be designed to push smoke away from escape routes.

It is proposed that an impulse fan system is adopted to serve the basement. The system should be carefully designed to ensure coverage throughout the full volume of each basement levels. Central smoke extract plant areas shall be provided to extract via a shaft to an outlet at high level and away from exit doors. This shall be coordinated with the means of escape strategy.

The smoke extract system installed shall be capable of including additional impulse fans as required by a possible future extension of the system.

The smoke control strategy shall be developed in conjunction with the Fire Strategy.

The smoke extract ventilation system shall be provided by the following (or equal and approved):

Manufacturer Colt International Limited
 Colt House
 Ridgeway Office Park
 Bedford Road
 Petersfield
 GU32 3QF

Tel. - 023 9245 1111

Contact Name Lee Metcalfe – 07515 197954

The system shall comprise:

- Inlet ventilation shall be provided via the entrance ramps and any additional natural ventilation opening which connects directly to external air.
- Extract by a central extract system with dual fans discharging to atmosphere
- Air distribution and mixing within the car park by a network of induction fans.

The extract plant shall include for inlet and exhaust side attenuators to achieve a maximum noise level of NR55 within the car park at 3 m away from any item of Colt equipment and 55 dBA externally at 3m from the extract fan discharge grills. These levels apply when the system is operating in general ventilation mode.

The Colt Cyclone induction fans shall be located to ensure good mixing of air with no stagnant areas in normal mode and effective clearance of smoke in fire mode.

The laminar airflow fan will incorporate a backward curved centrifugal impeller within a low profile slim-line casing.

The unit shall be powder coated as standard to RAL 7035 light grey.

The motor is to be totally enclosed, air stream cooled, metric frame to IP55 standard. It shall have Class F or Class H insulation for normal continuous duty or smoke conditions, once only at 300°C for 1 hour, Class F300 to EN 12101-3 (2002). The motor shall be single speed. The motor shall have flying leads connected to an external lockable isolator switch to IP65 Standard.

The unit shall be designed and manufactured with procedures as defined in BS EN ISO 9001: 2000. The unit shall be tested at elevated temperatures in accordance with the requirements of the European standard EN 12101-3: 2002 and achieve a F300 rating.

Power to the car park ventilation system shall be provided from a maintained supply and cables shall be fire resistant. The maintained supply (by others) shall terminate close to the control panel. Automatic change over from these incoming supplies will be an integral part of the car park ventilation system control panel.

All electrical wiring from this point shall be the responsibility of the system supplier.

Under automatic control the system shall operate in normal mode at slow speed during operating hours. In fire mode the system shall operate at high speed. Fire mode shall be activated by a signal from the building's fire detection system. The operating sequence in fire mode shall be that initially the system is switched off to avoid smoke mixing during the escape period. After an agreed escape period (typically 5 minutes) the system is switched back on to high speed.

The CO monitoring and control is to run the system at a lower flow rate, providing 3 ACH under normal circumstances, with the system only going to 6 ACH if the CO detection system detects higher CO levels typically above 35 ppm (parts per million).

A mimic switch for fire service use shall be mounted in a position accessible to and agreed with the fire service and shall incorporate manual override for fire service use.

A full design report including all calculations and CFD analyses (if required) shall be provided for submission to Building Control prior to installation.

One Specialist Company and their approved sub-contractors shall carry out the design, manufacture, installation, wiring and commissioning of the complete system. The Specialist Company shall be responsible for demonstrating and gaining Building Control approval for the ventilation system.

The Specialist Company shall be a BSI registered firm for the design, manufacture, installation and commissioning of smoke control systems in accordance with ISO 9000. Proof of certification shall be provided with tender submission.

The system will require annual maintenance and testing. The supplier shall include in the tender for a service visit and system functional test (not a smoke test) to be carried out within a year after the system hand over. This shall be identified as a separate item.

4.8 Above Ground Foul Drainage

The sanitary plumbing installation shall be designed and installed in accordance with BS EN 12056, BS 8000 Part 13, and shall be fully in compliance with the requirements of the Local Authority.

All new drainage installations shall fall to self-cleansing velocities.

All new soil, waste and ventilation pipework shall be installed in solvent welded PVC-U pipework and all horizontal waste pipework in PVC-U or MUPVC, conforming to BS 4514 or BS 5255. All above ground drainage passing through and/or in the commercial units and car park areas shall be installed in lightweight stainless steel or cast iron to afford mechanical protection.

Adequate allowance for pipework expansion shall be included as recommended by the manufacturer. Each branch shall be water tested and witnessed prior to concealment.

A blow off pipe to accommodate any discharge from the un-vented water heaters safety devices shall be provided. The safety devices shall discharge to the blow off pipe via water-less trap.

Expansion joints shall be provided in accordance with the manufacturer's recommendations to all sections of horizontal and vertical pipework.

Where pipes penetrate through fire compartments, built in fire sleeves shall be provided in accordance with BS 476 and the Building Regulations.

Suitable sleeves shall be provided around all services where they pass through walls and floors.

Systems shall be insulated in order to achieve the required sound attenuation of Building Regulations Part E, and to avoid condensation in accordance with Building Regulations Part F. Generally, the insulation shall comprise rigid fibre glass sections (80-110kg/m³), split for fixing, attached using galvanised steel wire, or similar.

All sanitary ware is to be as specified by the Architect and fixed to soil and waste connections provided by the Contractor.

Overflows from WC cisterns shall discharge internally through the WC flushing valve assembly.

A final test shall be made upon completion of the drainage systems for soundness and performance in accordance with BS EN 12056 Part 2 Code of Practice for Sanitary Pipework.

The Contractor shall complete test certificates for each section of work.

4.8.1 Sump Pumps

The Contractor shall provide duty/standby sump pumps to serve the changing rooms and showers at basement.

4.9 Syphonic Drainage

The solution for surface water drainage from roof level is to be a syphonic solution. The system shall collect surface water from roof level and distribute to basement level down two rising positions in locations developed in the co-ordinated Revit model.

The system shall be designed and installed by a registered a specialist who is a full member of the Siphonic Roof Drainage Association.

The outfall shall be through the basement wall to the surface water outfall connecting to the wider masterplanning surface water strategy. The installation shall be complete with syphonic break prior to it leaving the basement.

The system shall be designed for a 50 year event with a two hour duration and the requirements of BS8490:2007.

The Contractor shall allow for co-ordination of the roof outlets with the detailing of the roof developed by the Architect.

The Contractor shall allow for insulation to the drainage system to limit the noise transmission in the spaces and to eliminate the risk of condensation.

4.10 Sprinkler Installation

The extent of work covered by this section of the specification covers the full design, supply, delivery to site, erection, testing and commissioning of an automatic sprinkler installation, to achieve the protection requirements of the fire strategy.

The level of sprinkler protection identified is Ordinary Hazard III; subject to approval by the Fire Officer, Insurance Company, Building Control and all other Authorities having Jurisdiction.

The automatic sprinkler installation shall be provided in accordance LPC Rules for Automatic Sprinkler Installation 2015 Incorporating BS EN 12845 and the project Fire Strategy Documents requirements for active protection systems.

The sprinklers installation comprises of the distribution pipework serving the building core areas only. The sprinkler installation shall be extended from the sprinkler infrastructure and plant serving the basement area. A branch connection shall be installed to serve all office areas.

The shell and core installation shall include coverage for:

- Core Landlord areas (Full installation)
- Car Park Area (Full installation)
- Risers and branches to serve office floorplates for extension as part of Cat A and Cat B Tenant fit out. (capped connections)
- Basement changing areas (Full Installation)

The system shall be designed and installed by:

Hall and Kay
Oak Court First Floor,
Clifton Business Park,
Wynne Avenue,
Clifton
M27 8FF

Tel: +44 (0)161 872 7316

Or equal and approved

Scope of Works

The automatic sprinkler water supply shall be taken from the water storage tanks and pump sets in the MGY basement.

Design Parameters

The automatic sprinkler system shall be designed in accordance with the following:

LPC Rules for Automatic Sprinkler Installation 2015 Incorporating BS EN 12845

Approved Document B

Health & Safety Executive

Electrical Regulations

Installation Control Valves

The installation control valves shall be of an approved type, listed by the LPCB.

Testing Facilities

Testing facilities incorporating a direct reading flow meter shall be of a type approved by the LPCB.

Alarm Panel

An alarm panel shall be provided and shall incorporate the following alarms: -

1. Drop in mains pressure
2. Status of zone valves

3. Water flow switches

The alarm panel shall be powered by an independent battery supply and charger, capable of providing sufficient power to the alarm panel and sounder for duration of 72 hours.

Sprinkler Heads

Sprinkler heads are of a type and temperature rating suitable for the area in which they are to be located. All sprinkler heads shall be of a type which has been tested and approved by the LPCB.

All sprinkler heads which are exposed to view in the basement shall be a bright brass finish. Samples, prior to ordering shall be submitted for approval.

Sprinkler heads shall be either of the pendants, upright or open drencher pattern and shall be as approved by the Insurance Company.

The pendent and upright heads shall be of the 'Wet' or 'Dry' quartzoid type to suit the type of installation and be of 15mm nominal size with the colour of glass bulb and temperature rating suitable for the application.

The drencher system heads shall be of the open pattern and shall be of 15mm nominal size.

The Contractor shall allow for the installation of high-quality finished heads to be mounted in the false ceiling panels within occupied areas and depending on the manufacturer, allow for either adjustable rosettes or adjustable flush mounted sprinkler heads to suit the ceiling tile and Engineer's requirements.

The entire installation shall be designed where practicable to fully drain back to the main isolation valve or accessible drain valves. No section of the installation shall allow for water entrapment at low points; as such any trapped sections must be provided with a means for local draining.

Pressure Alarm Switch

An approved water flow alarm switch shall be incorporated into the system above the alarm valves, for transmitting an alarm signal.

Control Valve Set

The sprinkler control valve set shall be installed strictly in accordance with the requirements of the LPC Rules for Automatic Sprinkler Installation 2015 Incorporating BS EN 12845, and the Local Water Authority and must, where required, be submitted to the Local Water Authority for testing and stamping prior to installation.

The sprinkler valve set shall comprise: -

Automatic alarm valve with inspection cover for easy access.

Sluice valve to BS 5163 fitted with "Open and Shut" indicator, strap and padlock.

Hydraulic alarm motor and gong sounding an alarm on discharge.

Pressure operated alarm switch to provide a remote alarm facility.

Drain/test valve complete with direct reading flow meter and associated pipework.

Test valve

Two pressure gauges with pet cocks.

All necessary pipework and fittings to complete the valve set.

Zone Isolation Valves

The main sprinkler distribution shall be zoned, with a gate valve to BS 5163 fitted with a micro-switch to enable the valve to be remotely monitored. The micro-switch shall be fitted so that it will indicate immediately the hand wheel is operated away from the normally open position.

Zone valves shall be installed on all office levels.

Pump Set

Located in the MGY plantroom.

Sprinkler Storage Tanks

Water storage tanks shall be installed as part of the MGY contract.

Frost Protection

Where 'wet' sprinkler pipework, fittings and valves are located in unheated areas where they are likely to be vulnerable to frost, the design and installation shall include measures to ensure that the pipework and equipment concerned are not exposed to temperatures below 4°C, or alternatively the pipework shall be trace heated and lagged.

4.11 Data Room Cooling

A cooling unit shall be provided to the basement Telcom Data Room. For Tender purposes this shall be a wall mounted cassette unit to provide a sensible cooling capacity of 5kW. The condensing unit shall be located at high level within the basement car park. Condensate shall be pumped to the waste pipework at high level in the Basement.

The cooling unit shall link to the IBMS system and the room shall be provided with a temperature sensor to detect out of limit conditions.

4.12 Automatic Controls Systems

General

An intelligent building management system (IBMS) shall be provided to comply with the site wide requirements for the overall development of St John's Manchester to provide an integrated platform across the buildings so that a consistent system is provided for the FM provider. The buildings on the site shall

be capable of being monitored from the Central Control Room within Bonded Warehouse.

This section details the requirements needed for the control of the building management system and also explains how other systems will integrate into it.

A DISTECH or SIEMENS open protocol system shall be used. The Contractor shall employ the following building integration specialist:

Eco-I Limited
823 Birchwood Boulevard
Birchwood
Warrington
WA3 7QZ

Contact: David Hodges, 07532188800
Email: david.hodges@eco-igroup.com

Eco-I shall be employed as an integration specialist supplier to the Contractor, hereinafter referred to as the Automatic Controls Specialist. All BMS equipment shall be manufactured by the Automatic Controls Specialist utilising their latest range of 'freely programmable (DDC) outstation micro-processor controllers

The Automatic Controls Specialist shall ensure that a fully operational and integrated working control system is implemented throughout and all equipment installed is fit for the purpose and application.

The Automatic Controls Specialist shall be responsible for the equipment design requirements, supply, supervision, software programs, commissioning and setting to work of all the Automatic Controls and (BMS) equipment, including the supply of the (HVAC) Outstation Control Panels (ELV), to ensure that the systems are completely acceptable to the Engineer and for instructions to the client's staff prior to handover of the plant.

Operation and Maintenance Instruction Manuals for the BMS system shall be undertaken by the Automatic Controls Specialist. This shall include providing documentation and details in accordance with the general conditions of contract, presented for incorporation into the O&M Manual.

System Architecture

The BMS design must include for the provision of the following "open systems": BACnet, MPBUS, MODBUS, KNX

The BMS hardware must communicate the protocol(s) without the requirement of any 3rd party communication conversion tool(s). The BMS must also incorporate within ALL design the 'compatibility' with other third-party devices such as lighting control, electrical distribution, intruder detection, access control, CCTV and fire alarm panels using the open protocols listed above. If proprietary protocols are to be used, they must be approved by the design consultant in writing.

The system structure shall communicate at the highest level possible but will operate over three primary layers.

Controls Panel

A purpose built ELV form 1 control panel shall be provided within the roof top plant room. A dedicated 18-way 3 phase 250 Amp Schneider Acti9 Isobar B type distribution board will be installed adjacent to the ELV panel to power the mechanical plant. The distribution board will be provided and installed as part of the eco-i works. The main incoming supply to the distribution board will be provided by the main electrical contractor.

The equipment powered from the distribution board shall include the following:

- Boiler 1
- Boiler 2
- Boiler 3
- Boiler 4
- Boiler 5
- Gas solenoid valve
- CHW AHU Pump1
- CHW AHU Pump 2
- CHW FCU Pump 1
- CHW FCU Pump 2
- LTHW AHU Pump1
- LTHW AHU Pump 2
- LTHW FCU Pump 1
- LTHW FCU Pump 2
- CHW Pressurisation Unit
- LTHW Pressurisation Unit
- Toilet Extract Fans (2 No)
- General Supply and Extract AHU 1 (wiring by main electrical contractor)
- General Supply and Extract AHU 2 (wiring by main electrical contractor)

Power wiring to the mechanical plant shall be provided by eco-i other than the packaged plant such as the AHU units. The main electrical contractor shall power each of the packaged units through to final connection.

Once the mechanical board is live access will be controlled by the main electrical contractor.

Note any component (sensor, isolator or actuator) that is installed outside will be rated to IP65 or protected accordingly. Cables installed will be UV rated.

Controls Philosophy

Gas fired Boilers

Five gas fired boilers shall provide LTHW to the building. The boilers will include internal stats for protection and will receive enable and monitoring signals from the BMS. Power to the boilers will derived from the mechanical distribution board and will be installed by eco-i. Each boiler will be provided with a dedicated circulation pump. This pump shall be powered from the boilers internal control system. The connection of the boiler pump and any associated loose controls will be provided by the electrical contractor or boiler installer.

A thermal link above each boiler shall be provided and wired in series via an emergency know off button. Activation will shut the plant room gas solenoid valve

The automatic control specialist shall provide and wire immersion sensors in the flow and return pipework to monitor the temperatures. This will be wired back to the ELV control panel. In addition, an outside detector temperature sensor will be located on a north facing wall to feedback the ambient temperature to the building management system.

Pressurisation unit

A pressurisation unit will monitor the individual LTHW system pressure. A power supply will be installed to each unit from the local distribution board by the eco-i. A control cable will provide indication of a fault to the building management system.

AHU CT (Secondary) Pumps

Two primary CT pumps shall circulate water around the AHU heating coils. Each pump will include an integral inverter to alter the pump speed. The pump will be powered from the mechanical distribution board by the eco-i.

A BACnet MSTP cable will be installed at each pump and communicate operational data to the BMS system. A differential flow switch will monitor the pump for positive flow. In the event of loss of flow, and alarm will be raised at the BMS. The DP switch will be provided and wired by the automatic control specialist.

A hard-wired interlock will disable the pump in the event of an alarm from the pressurisation unit

The automatic control specialist shall provide and wire immersion sensors in the flow and return pipework to each CT circuit to monitor the temperatures. This will be wired back to the ELV control panel.

FCU (Secondary) Pumps

Two sets of CT LTHW pumps shall circulate water around their respective circuit. Each pump will include an integral inverter to alter the pump speed. Each pump will be powered from the mechanical distribution board by the eco-i.

A BACnet MSTP cable will be installed at each pump and communicate operational data to the BMS system. A differential flow switch will monitor the pumpset for positive flow. In the event of loss of flow, and alarm will be raised at the BMS. The DP switch will be provided and wired by the automatic control specialist.

A hard-wired interlock will disable the pump in the event of an alarm from the pressurisation unit.

The automatic control specialist shall provide and wire immersion sensors in the flow and return pipework to each FCU circuit to monitor the temperatures. This will be wired back to the ELV control panel.

General Supply and Extract AHUs

Two air handling units shall provide fresh air to the office fan coil unit system. The AHU will be a packaged unit complete with control panel and power section. The preferred method of communication is BACnet over IP, although the automatic control specialist will assist with the selection of the interface.

The AHU shall be powered from the power distribution, with the mains power being installed and connected into the AHU control panel by the main electrical contractor.

A CAT 5 cable shall be installed and plugged into the IP switch within the ELV control panel. The AHU IP address shall be provided to the AHU specialist to change to a range that is compatible with the rest of the BMS network.

The following information shall be communicated to the BMS from the packaged AHU as a minimum. If additional sensors are provided, they must also transmit this to the BMS.

- Supply air temperature
- Extract air temperature
- Filter DP status
- Valve positions
- Frost alarms
- Fan operational status
- Air flow proven status
- Motor kWh
- Damper position / end switch
- Common alarm
- Time Schedules
- Enable signal

The automatic control specialist shall assist the mechanical contractor with the setting up of the AHU upon site by fitting any loose sensors or fittings that are provided loose.

A hard-wired fire alarm contact shall be provided adjacent to each AHU by the fire alarm specialist to provide fire shut down and smoke clearance duties. The link from the fire alarm addressable relay box and the AHU shall be installed by the automatic control specialist in fire rated cable.

Toilet Extract Fans

A Nuair type extract fans shall serve the toilet areas to remove the stale air within the male and female toilet blocks. The extract fans shall be provided with an internal control starter panel. Eco-i will install the starter system adjacent to the extract fan. Power to the motor shall be provided from the plant room distribution board and connected into the extract fan motor by the automatic control specialist.

The starter unit shall provide volt free contacts to the building management system. The control wiring will be installed by the automatic control specialist. An alarm shall be raised in the event flow failure is detected by the BMS.

Roof Top Chilled Water Plant Room

A purpose built ELV form 1 control panel shall be provided within the roof top plant room at Level 10. A dedicated 18-way 3 phase 250 Amp Schneider Acti9 Isobar B type distribution board will be installed adjacent to the ELV panel to power the mechanical plant. The distribution board shall be provided and installed by eco-i. The main incoming supply to the distribution board shall be provided by the main electrical contractor.

The following equipment shall be powered from the mechanical distribution board:

- CHW AHU Pump1
- CHW AHU Pump 2
- CHW FCU Pump 1
- CHW FCU Pump 2
- LTHW AHU Pump1
- LTHW AHU Pump 2
- LTHW FCU Pump 1
- LTHW FCU Pump 2
- CHW Pressurisation Unit
- LTHW Pressurisation Unit

Chiller Units

Two Air Cooled chiller units will provide chilled water. The units shall be provided fully packaged with integral controls to sequence the compressors to maintain the chilled water flow temperature. Power will derive from a LV board provided by the main electrical contractor.

The mains power shall be installed by the main electrical contractor with termination into the chiller incoming isolator.

A CAT 5 cable shall be installed and plugged into the IP switch within the ELV control panel. The Chiller IP address shall be provided to the Chiller specialist to change to a range that is compatible with the rest of the BMS network.

The automatic control specialist shall provide and wire immersion sensors in the flow and return pipework to monitor the temperatures. This will be wired back to the ELV control panel.

A pressurisation unit will monitor the chilled water system pressure. A power supply will be installed for the local distribution board by the automatic control specialist. A control cable will provide indication of a fault to the building management system.

Chiller Water Primary Pumps

Two chilled water primary pumps shall circulate water around the low loss header. Each pump will include an integral inverter to alter the pump speed. The pump will be powered from the mechanical distribution board by eco-i.

A BACnet MSTP cable shall be installed at each pump and communicate operational data to the BMS system. A differential flow switch will monitor the pump for positive flow. In the event of loss of flow, an alarm will be raised at the BMS. The DP switch will be provided and wired by the automatic control specialist.

A hard-wired interlock shall disable the pump in the event of an alarm from the pressurisation unit.

Chilled Water Secondary Pumps

Two chilled water secondary pumps shall circulate water around the AHU coils and a second circuit to serve the building. Each pump will include an integral inverter to alter the pump speed. The pump will be powered from the mechanical distribution board by eco-i.

A BACnet MSTP cable will be installed at each pump and communicate operational data to the BMS system. A differential flow switch will monitor the pump for positive flow. In the event of loss of flow, and alarm will be raised at the BMS. The DP switch will be provided and wired by the automatic control specialist. A hard-wired interlock will disable the pump in the event of an alarm from the pressurisation unit.

The automatic control specialist shall provide and wire immersion sensors in the flow and return pipework to each AHU circuit to monitor the temperatures. This will be wired back to the ELV control panel.

CHW Pressurisation units

A pressurisation unit will monitor the individual LTHW system pressure. A power supply will be installed to each unit from the local distribution board by the eco-i. A control cable will provide indication of a fault to the building management system

Boosted Cold Water

A packaged cold-water booster will maintain water pressure within the building. The water booster will be provided with an internal control and monitoring system. Each booster will receive a mains power supply from the mechanical distribution board. A control cable will monitor each booster for a fault signal that provides an alarm at the BMS when activated.

The power and control wiring will be installed as part of the main electrical contractor.

Cold Water Storage Tank

A split cold-water storage tank will provide water to the building. The tank will receive water from the incoming mains supply, which the temperature will be monitored by the building management system.

Each section of the tank will have high- and low-level water monitoring with an immersion sensor to measure tank temperature.

All sensors and level switches will be provided free issue for fitting by the tank manufacturer. The automatic control specialist will be responsible for the wiring of the items back to the ELV panel.

Sprinkler Manifold Set

A manifold set is provided at basement level for the sprinkler provision to the building. The BMS shall interface with the flow switches to each zone to provide an alarm signal to the BMS.

Refuse Extract System

A dedicated extract fan shall serve the refuse storage area to remove the stale create from the waste. The extract fans shall be provided with an internal control starter panel. Eco-i will install the starter system adjacent to the extract fan. Power to the motor will be provided from the plant room distribution board and connected into the extract fan motor by the automatic control specialist.

Car Park Extract System

The IBMS system shall integrate with the car park extract panel to enable a run and status to be provided.

Building Smoke Control System

The IBMS system shall integrate with the building smoke control panel to enable a run and status to be provided.

Basement Telcom Data Room

The IBMS system shall receive a fault signal from the cooling unit provided in the Telcom Data Room and monitor temperature within the Data Room for out of limit conditions.

4.13 Energy Monitoring System

The automatic control specialist shall make provision to collate energy data for satisfying Part L requirements, for use in energy management.

To ensure the best strategy is determined the automatic control specialist shall adopt CIBSE TM39. The TM39 guidelines offer a cost-effective and practical approach to procuring and developing energy metering systems. It is used to optimise the metering strategy against cost, practicality, the value of the information gained and future energy savings.

The automatic control specialist must provide the necessary EMS hardware and tools to ensure 30 minute periodic reading of each meter.

The building shall monitor energy consumption of the electrical, gas and water systems. The use of Heat meters shall be installed to monitor certain primary and secondary systems. All gas, water and heat meters shall be sized and provided by the automatic control specialist. Electric meters shall be provided by the main electrical contractor.

Wherever gas, water and heat meters are provided, the EMS specialist shall accommodate a Mbus or Modbus as the primary communication method. If a pulsed input is to be used, it will be collected by the use of a Mbus or Modbus collector. The controls specialist shall be responsible to ensure the pulse duration is compatible with the pulse collector. i.e the system will not duplicate or miss any counts from the meters.

The control specialist shall also ensure the pulse ration is in accordance with the meter, so an accurate consumption is calculated.

Where heat meters are deployed, the meters must be ultrasonic and provided with a Modbus or Mbus integrator. The automatic control specialist will be responsible for the installation of a mains power supply. Under no circumstances

will a battery-operated heat meter be acceptable due to the frequency of transmission and the amount of data being recorded.

The pulsed metering shall be monitored using a Modbus or Mbus collector communicating over the MSTP-RS485. The meters shall be monitored as part of the BREEAM and Part L requirements. UNDER NO CIRCUMSTANCES shall pulsed inputs be incorporated into the BMS kWh data collected from inverter drives shall also be transmitted across the BACnet network into the EMS for secondary monitoring and analysis. The kWh readings shall be logged at a period of 30 minute increments for a minimum of thirty days before being archived with the EMS historical database.

To assist with energy analysis, the EMS shall also have the capability to transmit logged data from temperature sensors within the rooms and mechanical plant. The EMS shall be compatible with the EMS to allow the overlaying of consumption data with temperature readings for diagnostic purposes.

To allow full visibility of the energy consumption, the automatic control specialist shall provide software to display the energy in an easy to view format. The software shall collect the data from the dedicated EMS hardware

The EMS system shall have the ability to automatically export its energy consumption to 3rd party data bases, this shall be via email and the data shall be compiled into a CSV format.

Leak detection shall be implemented by the EMS system comparing the external and internal incoming meter readings. If a discrepancy between the readings are noticed, the EMS shall relay an alarm

Under new GDPR legislation in 2018 it is now mandatory to protect the integrity of data and the consumption readings must be transferred directly to the wholesaler or billing agent without 3rd party handling.

It is mandatory that dedicated EMS hardware be used to collect consumption data and export the readings to the correct stakeholder.

Integrating meter readings into the BMS shall not be permitted under any circumstances.

Electric Meters

For Electrical Meter Quantities please refer to the HV / LV schematics. The electrical meters shall communicate across a TCP/IP – RS485 Modbus network. The network controllers shall not exceed 25 meters per device to ensure good communication and polling times.

Electric metering shall be monitored using a Modbus interface as indicated on the electrical distribution schematic. The electric meters shall be monitored as part of the BREEAM and Part L requirements. The meters shall provide live data to the EMS for logging. The following information shall be recovered per electric meter:

- kWh consumption
- kWh Maximum demand (if available)
- Phase 1 amps
- Phase 2 amps

- Phase 3 amps
- Phase 1 voltage
- Phase 2 voltage
- Phase 3 voltage
- 3 phase amps
- 3 phase voltage

All data shall be logged at 30-minute increments for a minimum period of thirty days upon the remote EMS loggers to capture and store the data in the event of a network or transmission failure. This will allow the data to be recovered once the connection has been restored.

All meters will need testing by the electrical contractor before the automatic control specialist can commence any commissioning works. The electrical contractor will provide a visual inspection including the following:

- Shorting lings are removed from the current transformers
- The orientation of the current transformers is correct
- The polarity of the current transformers is correct
- Serial number of the meter

The automatic control specialist shall ensure the meter serial number is connected to the address of the meter in a check sum exercise. The EMS system shall null the data in the event a mismatch between the meter and its designated address exist. This is to prevent re-addressing of meters and potential fraud.

The electric meter shall be tested under a load condition and certify the meter and the EMS system are reading identical values. This shall be witnessed independently and signed off before being accepted by the client team.

Water Meters

The automatic control specialist shall make provision to monitor the water meter as located upon the schematic drawings. The meter shall be provided with a MBUS or Modbus signal as the primary source of communication. If a pulsed input is to be used, this must be agreed in writing by the CWC. In the event it is deemed acceptable, the automatic control specialist shall advise the mechanical contractor to select a meter that offers (1) pulse to one (1) l/s into the EMS system and also ensure the frequency of the pulse is within the hardware tolerances.

The water meter pulsed output shall be collected into a local MBUS or Modbus collector; this will allow the data to be transmitted across a single network. The data shall be stored upon the collector for a minimum period of a week to protect from losing data from network or power failures.

The automatic control specialist shall inspect the meter for its installation and orientation to confirm the work has been carried out to the manufacturer's guidelines. This is to ensure the accuracy of the meter, for example a meter that is installed in a vertical pipe work against the guidelines, will provide pulses to the EMS, however this will be inaccurate.

The automatic control specialist shall ensure the meter reading on the meter is calibrated to the EMS reading as the meter may have begun reading prior to the installation onto the EMS system. The meter shall also be calibrated under a load

condition by the mechanical contractor. This shall be witnessed independently and signed off before being accepted by the client team.

All data shall be logged at 30-minute increments for a minimum period of thirty days upon the remote data loggers to capture and store the data in the event of a network or transmission failure. This will allow the data to be recovered once the connection has been restored.

Energy Heat Meter (EMS)

To calculate the consumption of the LTHW and DHWS circuits, heat meters shall be deployed as detailed within the schematics. The heat meter shall be KAMPSTRUP or ITRON ultrasonic meter provided with a calculator integrator which shall communicate using a Modbus, MBus or BACnet RS485 protocol. The heat meter shall reside upon the same network as the electricity and water meters, forming part of the dedicated EMS sub-network.

The heat meter shall be a mains power unit that shall have the power supply derived from a mechanical distribution board, using a dedicated un-switched supply so to prevent mains power during maintenance work. The meter main supply shall be installed by the electrical contractor. Battery powered integrators shall not be acceptable.

The heat meter shall provide the following information:

- Flow temperature
- Return temperature
- Flow rate
- Kwh

The automatic control specialist shall ensure the meters are tested by the mechanical contractor before they commence any commissioning works. A visual inspection commissioning sheet shall include the following:

- The orientation of the heat meter is correct
- The flow and return sensors have not been cut
- Serial number of the meter

The automatic control specialist shall ensure the heat meter serial number is assigned to the address of the meter in a check sum exercise. The EMS system shall null the data in the event a mismatch between the meter serial number and its designated address exist. This is to prevent re-addressing of meters and potential fraud.

The electric meter shall be tested under a load condition and certify the meter and the EMS system are reading identical values. This shall be witnessed independently and signed off before being accepted by the client team. All data shall be logged at 30 minute increments for a minimum period of thirty days upon the remote data loggers to capture and store the data in the event of a network or transmission failure. This will allow the data to be recovered once the connection has been restored.

Gas Meter

The automatic control specialist shall make provision to monitor the gas meter as located upon the schematic drawings. The meter shall be provided with a pulsed output signal. The automatic control specialist shall advise the mechanical contractor to select a meter that offers 1one (1) pulse to one (1) l/s into the EMS system and also ensure the frequency of the pulse is within the hardware tolerances.

The Gas meter shall have the necessary chatter box and / or intrinsically safety measures supplied by the provider of the meter.

The Gas meter pulsed output shall be collected into a local MBUS or Modbus collector; this will allow the data to be transmitted across a single network. The data shall be stored upon the collector for a minimum period of a week to protect from losing data from network or power failures.

The mechanical contractor shall inspect the meter for its installation and orientation to confirm the work has been carried out to the manufacturer's guidelines. This is to ensure the accuracy of the meter, for example a meter that is installed in a vertical pipe work against the guidelines, will provide pulses to the EMS, however this will be inaccurate.

The automatic control specialist shall ensure the meter reading on the meter is calibrated to the EMS reading as the meter may have begun reading prior to the installation onto the EMS system. The meter shall also be calibrated under a load condition by the mechanical contractor. This shall be witnessed independently and signed off before being accepted by the client team.

All data shall be logged at 30 minute increments for a minimum period of thirty days upon the remote data loggers to capture and store the data in the event of a network or transmission failure. This will allow the data to be recovered once the connection has been restored.

Meter Collector

Data will be collected from each meter and recorded within the EMS system. The collection methods will be either a hard-wired dedicated system or by using WiFi technology. Where WiFi technology is to be used, the automatic control specialist will provide evidence of the data collection points with a survey report, to ensure all extremities of the building operate robustly.

SIP+ EMT shall be used to collect and store the data received from the meters, The SIP+ EMT with Vision software will be provided with local and public dashboards, so the solution can also be configured and managed by end users, with the following

Fire Alarm Interlocks

The controls system shall include fire alarm interlocks to shut off the following equipment:

- Ventilation Plant
- LPHW Gas Boilers
- Chillers

All equipment without gas connections shall be capable of automatic restart and all gas equipment shall be manually reset (at control panels), once the fire alarm signal has been cleared.

A fire alarm test key switch shall be installed adjacent to the fire alarm panel to facilitate the isolation of the automatic control system from the fire alarm system during a fire alarm test, to prevent the mechanical services plant from shutting down. The switch shall incorporate a 2 position key switch, denoted 'Normal' and 'Test', which shall only allow removal of the key when in the 'Normal' Position.

The remote indicator shall relay a common alarm.

The automatic controls panel/infrastructure shall allow for an additional 50% input/outputs and additional space available within the cabinet to incorporate future installations onto the system.

Power and Control Wiring

The whole of the interconnecting power and control wiring, trunking, tray, conduits, etc, emanating from the control panels shall be by the Automatic Controls Specialist to serve all items of mechanical services plant and equipment. This shall include all wiring to form a complete installation in all respects.

The Automatic Controls Specialist shall also include for all co-ordination with the Mechanical and Electrical installation works, testing and commissioning.

Cat A Installation

The system and control panel design shall be capable of being extended to facilitate the installation of fan coils to the floor plate as part of the Tenants fit out works by way of networking in additional outstations.

User Interface and Access

The BMS system shall provide a genuine Web solution that can be viewed using PC or hand-held device by access using an internet browser over local WiFi or GSM network. The system shall have the ability to host and display HTML5 graphical images that will render depending upon the device that is accessing the system. i.e. if a mobile phone is being used, the BMS system shall understand this and display the image or APP in the correct size and ratio.

The system shall have the capability to offer remote access via a handheld tablet device or smart-phone using the local wireless network or / and 3G – 4G mobile access. The user shall have the capabilities to switch and adjust items upon the BMS system and view graphical pages and dedicated APP's in a similar manner as described within the WEB Access above.

The Automatic Controls Specialist shall include for all equipment and software proposed, proving software and final operational acceptance test of the complete (BMS).

If requested by the client the automatic control specialist shall prior to shipment of equipment to site, shall set up a representative sample of the (BMS) and demonstrate that the performance of the system satisfies the requirements of the Specification. The sample shall include the following.

The Automatic Controls Specialist shall allow for the provision of a PC 'front end' to the system which for Tender purposes shall be assumed to be located within the rooftop internal plant space. Final location to be agreed during Stage 5.

Integration into the sitewide IBMS shall be developed in conjunction with sitewide IBMS strategy to ensure compatibility and in particular with respect to security, data protection and graphical displays.

5.0 Electrical

5.1 Electrical Design and Installation Parameters

This specification defines the Employer's Requirements and forms part of a set of documents listed below, which when taken together detail the extent of the complete Electrical Services Installation, the required quality of workmanship and materials, and the contractual obligations of the Contractor: -

- Mechanical and Electrical Services Drawings commensurate with Stage 4a
- ESS-01 Rev 6 Electrical Standard Specification
- MSS-01 Rev 6 Mechanical Standard Specification
- SPS-01 Rev 2 Standard Prelims Specification
- Infrastructure 3D Revit Model

In addition, this specification shall be read in conjunction with all other Contract Documentation, some of which has been by Crookes Walker Consulting Ltd, and some of which has been produced by other members of the Client's Design Team:

-

- The Main Contract Preliminaries
- The Architect's Specification and Drawings
- The Quantity Surveyor's Contract Documentation
- The Structural Engineer's Specification and Drawings
- Fire Engineers Report
- Developer's Specification
- Acoustic Engineer Report
- Local Planning Requirements
- Building Control Requirements
- The CDM Plan

The Contractor shall be responsible for: -

- The detailed design and installation of the complete Electrical Services Installation
- Coordination and Liaison with the Mechanical Services Contractor
- Coordination and Liaison with the Main Contractor
- Coordination and Liaison with Any Specialist Sub-Contractors
- Liaison with the Architect and Structural Engineer
- Demonstrating and achieving Building Regulation compliance

The Contractor shall be responsible for procuring any additional Architectural or Structural information required to undertake the design, installation and co-ordination of services generally.

5.2 Associated Documents

The complete Electrical Services installation shall be designed, supplied, installed, tested and commissioned by the Contractor.

The following associated documents shall be utilised, but shall not be limited to, when carrying out all aspects of the design and installation:

- British Council for Offices Best Practice Guide 2014
- All relevant British and European standards
- Non-Domestic Building Services Compliance Guild CLG 2010
- All CIBSE Codes of Practice and Design Guidance Notes
- 18th Edition of the IEE Regulations for Electrical Installations (BS 7671)
- Health and Safety at Work Act 1974.
- Electricity at Work Act 1989.
- Electricity Authority local and general regulations.
- Construction, Design and Management Regulations (CDM).
- Asbestos Regulations.
- Control of Substances Hazardous to Health Regulations. (COSHH)
- The Building Regulations.
- Fire Prevention on Construction Sites, 4th Edition, June 1997.
- The Department of Environment's Energy Efficiency Best Practice Programme (BRECSU).
- BSRIA Design Guidance
- IET Guidance Notes
- Current Legislation
- Statutory Obligations
- Local Authority Regulations
- Home Office Guidelines
- Planning Authorities
- Building Control Officer

In all instances, the latest revision and/or amendments to the above publications/regulations/recommendations shall be utilised.

5.3 Design Criteria

The following particular design criteria and parameters shall be used when carrying out the design for the Electrical Services.

- BS 7671 Regulations for Electrical Installations 18th Edition
- BS 5266-1:2016 Emergency Lighting – Code of Practice for the Emergency Escape Lighting in Premises
- IET Code of Practice for Electric Vehicle Charging Equipment Installation
- CIBSE Code for Lighting 2012

- Lighting Levels; as recommended below in this document and as per BS 12464

- Utilising Reflectance Values;

Ceilings	0.7
Walls	0.5
Floors	0.2

- BS 5839-1:2017 Fire Detection and Fire Alarm Systems for Buildings – Code of Practice for System Design, Installation, Commissioning and Maintenance
- BS EN 62305-1 Protection Against Lightning
- BS EN 81 – Safety Rules for The Construction and Installation Of Lifts
- BS 7430 – Code of Practice For Protective Earthing Installations
- BS5839-9 - Fire Detection and Fire Alarm Systems for Buildings – Code of Practice for Design, Installation, Commissioning and Maintenance of Emergency Voice Communication Systems
- Building Occupancy – 1 person per 6m²

Final circuit loading limitations

- Lighting; 16No luminaires (max)
- Sockets; 8No DSS Outlets (max)
- Underfloor Busbar; 12m (max)

5.4 EMC (Electromagnetic Compatibility)

The electrical installation shall be designed and installed in accordance with the EMC Directive 2004/108/EC, UK Statutory Instruments SI 3418 relating to EMC, relevant British standards.

All equipment vendors shall provide evidence of compliance with the EMC directive by providing a current 'Declaration of Conformity' certificate.

5.5 Harmonic Analysis and Remediation

The Sub-Contractor shall allow for a return to site within six weeks of occupation by the building user to conduct a full harmonic analysis study to Engineering Recommendation G5/4 when the building is in use in 'normal' conditions. The Contractor shall prepare a written report and submit this to The Contractor Administrator (CA) for comment. Upon the completion of this survey and approval from the engineer a full implementation of current injection active harmonic filtration solution shall be affected.

5.6 Segregation of Services

Segregation of services shall be in accordance with BS 7671 and designed to satisfy the EMC requirements of BS EN 50174 & BS EN 61000.

It is a requirement of BS 7671 that fire alarm and emergency lighting circuits are segregated from all other cables and from each other in accordance with their respective British Standards, BS 5839 and BS 5266.

5.7 Design Documentation

The Contractor shall be responsible for the provision of all design documentation necessary to enable the Engineer/Client to carry out a comprehensive appraisal of their design.

This documentation shall include, but shall not be limited to, the following: -

- Services in accordance with RIBA Stage 4b onwards
- Fully detailed and dimensioned Installation Drawings
- Total electrical load assessment summary for the building
- Comprehensive schedule of all plant and equipment
- Confirmation of all specialist suppliers and sub-contractors
- Final circuit cable sizing calculations using Amtech ProDesign software
- Lighting calculations for all internal and external spaces, based on final, coordinated installation locations. These shall include lux levels, uniformity, glare (where sensitive to usage / area), and maintenance factor calculation.
- Emergency lighting calculations, based on final, coordinated installation locations.
- Coordinated M&E reflected ceiling plan layouts
- Full protective device discrimination check
- Fire Alarm - Cause & Effect Schedule – updated by specialist for construction
- IT cabinet layouts and IT labelling notation
- Lightning protection risk analysis & validation of design
- Mains and generator earthing design and layout

All drawings shall be submitted in PDF and AutoCAD electronic format and all calculations shall be carried out using appropriate and recognised computer software packages; e.g. Amtech, Dialux, etc.

The Contractor shall issue a file containing all documentation to the Engineer in accordance with the overall programme, allowing sufficient time for review and comment prior to the commencement of any installations on site.

5.8 Scope of Work

The Electrical Services Installation shall include the design, supply, delivery, off-loading, erection, connection, testing and commissioning and setting to work of all plant and materials as described in this Specification, as necessary for a complete, safe and satisfactory Electrical Installation within the Building C, St Johns Place II (Globe & Simpson) development.

The various services to be provided under this specification are as follows: -

- Incoming Utility Services Installations
- LV Distribution
- Containment Systems Installation
- General Power Installation
- General Lighting Installation
- Lighting Control Systems
- Emergency Lighting Installation
- Telecoms
- Fire Alarm Installation
- Disabled Alarm Installations
- Audio/Video Intercom and Access Control Installation
- CCTV Installation
- Mechanical Wiring Installation
- Earthing & Bonding Installation

- Lightning Protection Installation

5.9 Main LV Switchboard

The main low-voltage switchboard(s) shall be located within the electrical switchroom(s) located in the basement.

The switchboards shall be of the cubicle floor mounted type, constructed to the requirements of Form 4b, Type 6 and comprising incoming ACB'S, metering section and outgoing MCCB's etc. as necessary. The switchboards shall generally be arranged as shown on the LV schematic.

The switchboard ratings shall be suitable for the calculated fault current.

The main switchboard installation shall be bonded to the ENWL / IDNO earth and consumer's earth matrix, with facility provided for disconnection of this earth for test purposes.

All items of equipment on the switchgear shall be clearly labelled to denote their function. Labels shall be laminated Traffolyte engraved black on white background to denote function and red on a white background to indicate danger. Adhesive fixing of labels will not be acceptable.

The Contractor shall be responsible for obtaining approval from the Engineer, the Utility Provider and the Energy Supplier prior to the commencement of the manufacture of the main switchboard.

Power Factor Correction

The contractor shall supply and install Power Factor Correction (PFC) equipment to ensure a power factor of 0.95 minimum is achieved.

The design and sizing of the PFC equipment is indicated on the LV schematic, final sizing and arrangement to be confirmed by the contractor after engagement of their specialist.

The PFC unit shall be wall mounted/floor standing, remote but adjacent to the main switchboard.

The power factor correction (PFC) shall automatically be switched in stages.

Digital indication shall be provided on the front fascia of the cubicle to indicate number of stages energised and resultant instantaneous power factor.

The PFC shall automatically disconnect all stages on loss of supply. Upon supply restoration, stages shall be switched back in sequentially with adequate time delay between stages.

The entire system shall be detuned to allow for compatibility with future installation of active harmonic filtering.

Space allowance shall be allowed for future harmonic filtering and power factor correction equipment.

Safety Mat

A closed cell rubber safety mat 800mm wide (to B.S. 921) shall be installed along the length of each accessible section of the main switchboard(s).

Switchroom Notices

A first aid chart, comprising a 340mm x 438mm wall chart for "Instructions for Dealing with Electric Shock" printed in red and black mounted in clear plastic shall be installed in each Electrical Switchroom.

An approved laminated schematic drawing of the Mains Wiring Diagram for the complete electrical installation shall be provided. The drawing shall be provided by the Contractor and shall measure 600mm x 450mm. The schematic shall be permanently fixed to the switchroom wall.

5.10 Standby Generator (Life-safety secondary power supply)

In accordance with the fire strategy, an alternative back-up supply is required to support the building life safety systems.

The Contractor shall design, supply, test and commission a secondary supply/source for life safety systems taken from the Landlord's Generator panel.

The life safety distribution board shall be segregated from other services, in a separate space, with a minimum 120 min fire-resisting construction. An area has been identified on the roof level adjacent to the secondary core riser.

The switchboard shall be of the cubicle floor mounted type, constructed to the requirements of Form 4b, Type 2 and comprising incoming switch and outgoing MCCB's etc. as necessary. The switchboard shall generally be arranged as shown on the LV schematic.

The switchboard rating shall be suitable for the calculated fault current.

All items of equipment on the switchgear shall be clearly labelled to denote their function. Labels shall be laminated Traffolyte engraved black on white background to denote function and red on a white background to indicate danger. Adhesive fixing of labels will not be acceptable.

The life safety distribution board shall be clearly marked at the point of isolation with a warning explaining that isolation would switch off the life safety system.

Secondary sub-main cables to items of life safety equipment shall run on dedicated containment systems along diverse routes with suitable separation from the primary sub mains supplies.

The specification for life safety cabling and cable management support systems shall be designed and installed in accordance with BS 8519:2010 Selection and installation of fire-resistant power and control cable systems for life safety and fire-fighting applications. Code of practice.

The Contractor shall provide all electrical supplies, including all cable, containment, sensing equipment and changeover switchgear, to enable

continuous electrical supplies to the development's critical life-safety supplies in compliance with BS9999. These include, but are not limited to:

- Fire Fighting Lifts
- Fire Fighting Stair Core / Shafts - Lighting & Power DB's
- AOV & mechanical smoke ventilation system.
- Car park smoke ventilation
- ISP Comms hub distribution board

The Standby Generator will be a three phase, 50 Hz 400 Volt diesel generator which will provide standby power for the life-safety systems in the event of failure of the Utilities power supply.

The generator has been sized at 150kVA (stand-by) allowing for the anticipated load diversity conditions at change-over and this instantaneous load being 60% of generator capacity. This shall be reviewed and verified by the contractor as part of the contractor's developed design, upon final plant selections and their motor characteristics. It shall be suitably sized to accommodate all life safety plant and equipment as detailed within this specification, with any load step delay incorporated in the ATS control as required. Ultimately, all life safety equipment is to be available under secondary power within 15s in compliance with BS9999.

Include acoustic housings, attenuators to the ventilation system and exhaust silencers to the flue for the standby generator capable of limiting the noise external from the generator in accordance with the requirements of the acoustic report (to be provided by the acoustic consultant) and planning conditions.

The generator installation shall be acoustically treated to achieve a maximum 70dB at 1metre and the generator shall be mounted on efficient anti-vibration mounts.

The contractor shall employ a generator specialist to undertake the following; design, supply, test at works, install, test and commissioning on site a complete diesel generator installation comprising but not limited to:

- Engine-alternator sets - **all** components will be enclosed in a dedicated room or acoustically enclosed enclosure
- Alternator mains cabling gland boxes to accept the cabling required
- Engine cooling systems
- Exhaust systems, including flues and silencers
- Fire Dampers on Intake and Exhaust
- Fuel delivery/storage systems 8 Hours full load
- Starting systems
- Individual generator set control panels capable of "slave" or "autonomous" operation
- Acoustic treatment
- Mechanical ventilation systems
- Control system associated with the Generator cooling and Fuel systems
- Neutral Earthing Contactor Assemblies, panels, cabling, control, etc.
- Temporary Load bank connection box systems (to ease future load bank connections without intrusive switchboard cabling/connectivity issues)
- Full load tests at manufacturers works and on site of individual and collective engine sets

- Full load tests at manufacturers works and on site of the 400 Volt switchgear
- Commissioning of Cooling and Fuel systems
- Co-ordination protection grading study
- Design, supply, installation and testing of all 400 Volt power and control wiring, supports, containment, accessories and any works not described above necessary to form a complete installation. (**Contractor to supply info with Tender return**)
- Any works not described above necessary to form a complete generator system installation.

Generator shall include:

- IEC and BS Reference number
- Serial Number (Including Diagram of Connection)
- Year of Manufacture
- Connection symbol
- Rated Voltage
- Rated Insulation Levels
- Rated Frequency and number of phases
- Rated normal current
- Rated impedance
- RPM
- Oil type, volume and operating temperature
- Coolant type and volume
- DC Starting Voltage
- Battery type

Each incomer from the generator on the generator switchboard will be provided with a generator protection relay or relays. This relay will be selected in conjunction with the generator specialist but will include the following features as a minimum:

- Balanced differential protection of each generator alternator (including feeder cable).
- Restricted earth fault protection of each generator alternator (including feeder cable)
- Over/Under Voltage and Frequency
- Reverse power protection
- Negative phase sequence
- Overcurrent, earth fault and high set

The Contractor will include full maintenance schedules of remedial actions required during extended running of the sets. For example, after 12 hours running check the fuel oil level, temperatures etc. After "x" hours running top up lube oil, etc. This schedule should be included within the tender return.

The Contractor will confirm the parasitic/cooling fan load requirements for the new generator solution being offered, and the way this load is to be fed. These loads typically include the radiator fans, cooling systems required for each generator set, etc. These loads must be fed direct from the individual generator set. This means that these parasitic loads require no external power connections.

There is no allowance within the electrical supply installations outside the generator package for any LV installations to support these parasitic generator unit services. The Generator Contractor will make allowance for all equipment necessary for serving these generator systems, avoiding external power supplies and hence avoid reliability issues with power supply.

External power supplies will be provided to the generator installations to support services such as water jacket heaters, alternator anti condensation heaters, instrumentations, etc. The loads of these will be limited as the parasitic load for each generator set will be fed from each generator set.

A generator auxiliary distribution board will be provided near the generator for these external supplies within this design – the generator specialist shall provide all circuits to the generator as necessary.

On completion of the generator installation and following the completion of testing and commissioning, the Contractor shall ensure that generator oil storage is 'replenished and tank is full' prior to handover. The fuel fill will be 'free-of-charge' to the Client.

Codes of Practice and Regulations

The following codes of practice and Regulations will be adhered to in the design and assembly of the generator, fuel oil storage and distribution systems.

- BS5514 – Reciprocating internal combustion engines
- BS 799-5 – Oil Burning Equipment – Part 5: Specification for oil storage tanks
- IEC 34 – Rotating electrical machines
- BS7430 – Earthing
- The Electricity at Work Act 1989
- The Health and Safety at Work Act 1984
- The current Building and Fire Regulations
- Current Construction Design and Management Regulations
- Supply Authority local and general regulations
- COSHH Codes of Practice
- BS 7671: Current Edition of the IEE Wiring Regulations
- Clean Air Act and other European and British Standards for Exhaust systems
- BS7698, BS7354, BS 4999, BS 5514, BS EN60439, BS EN 60034
- Distribution Code of the Public Electricity Suppliers of England and Wales
- Electricity Association Engineering Recommendation G5/4

Generator Earthing

The generator system will be earthed to a system that utilises earth electrodes as the means of earthing. These dedicated generator earth electrodes are to be designed to achieve an overall system earthing resistance of less than 1Ω and be for the sole use of the generator system.

This earth network is to be designed and installed in accordance with BS 7430.

The earth network shall be connected to a terminal bar located at the generator position.

Generator earthing system detailed design, installation and testing from the main earth terminal bars and any generator equipment/switchgear shall be the responsibility of the contractor.

The Contractor will be responsible for the design, supply and installation of ALL earthing systems to the generator position including the generator earth terminal bar. These will include bonds to the generator chassis, generator alternator, and control panels, mechanical and electrical services local to the generator.

5.11 Metering Strategy

The utility meter shall be located in the main switch room located on the mezzanine level. The Contractor shall provide and install fixing boards, cable containment and management as required by the meter supplier.

The contractor shall provide a meter and sub-meter installation following the process as set out in CIBSE TM39, and as indicated on the LV Schematic. In summary, metering shall be provided by:

- Tenancy – individual sub-let areas shall metered by area at the busbar tap-off. The tenant fit-out shall be responsible for subsequent sub-metering of end uses within the sub-let area.
- Shell and Core areas – This area shall be sub metered by end use, including the following as a minimum:
 - Lighting and power by floor and area
 - Lighting and power separately in larger areas (e.g. basement).
 - Heating
 - Hot Water
 - Cooling
 - Ventilation
 - Car Park

All meters within the facility shall comply with the Measuring Instruments Directive - 2004/22/CE (MID)

The following will be monitored for each electric meter:

Item	Monitored Condition	Engineering Units
1	Individual L1 L2 & L3 Instantaneous Current	Amps
2	Individual L1 L2 & L3 Instantaneous VA Volt	Volt Amps
3	Individual L1 L2 & L3 Instantaneous Voltage	Volts
4	Instantaneous Energy Consumption	KWh / MWh
5	Power Factor	Unit
6	Frequency	Hertz
7	½ Hourly Consumption	KWh/30 mins

Approved meters shall be as Schneider's METSEPM5331 or equal and approved.

All meters shall operate on the Modbus protocol and be provided by a landlord network IP connection.

All meters shall be synchronised to read at the same intervals in order for accurate comparison of data and readings.

A harmonics meter shall be provided on the incomer to be capable of monitoring harmonics up to the 25th order. This shall be reviewed when the building is in full operation with retrofit of harmonic filter as required.

The Harmonic metering will need to include the facility to record measurements over an agreed period of time in addition to instantaneous measurement to determine the level of correction required.

The contractor shall make all due allowance in costs and programme to fully commission and prove (by demonstration and witnessing process) the metering installation and reporting to the complete satisfaction of the client, client's energy agent and services engineer.

5.12 LV Distribution

Submains

The sub-main distribution system shall comprise new SP&N and TP&N supplies, derived from the main LV Switchgear to serve the proposed distribution boards, busbar and control panels.

Submains cabling shall be provided using suitably rated multicore XLPE/SWA/LSF cabling. All sub mains cabling shall be suitably supported on proprietary, galvanised containment along the entire length to the point of termination.

All vertically-run cables within riser that are greater than or equal to 25mm overall diameter shall be 'individually' fixed to cable trays using proprietary fire-resistant fixing. The use of plastic tie-wraps will not be accepted.

The Contractor shall provide power supplies to each lift served from a dedicated protective device from the Landlord's switchboard.

Firefighting lifts shall be provided with a secondary supply in accordance with BS 9999 and BS 8519.

The secondary supply shall follow an entirely diverse route to that of the primary firefighting lift supply.

The two supplies shall terminate to an automatic change over switch adjacent to the lift control gear within the firefighting core.

Rising Busbar

Vertical rising busbars shall be installed within the risers with separate busbars provided for landlord's and tenant's services as detailed on the CWC drawings.

Rising mains busbar shall be fed via suitably rated end feed units located at the base of each rising main.

The busbar trunking system shall not exceed 1000V.

All busbar trunking shall be of approved manufacturer and the enclosure shall be made of galvanised sheet steel.

The busbar shall be designed and manufactured to comply with BSEN 61439 parts 1 and 6 for use on a 400V, 3 phase and capable of withstanding prospective fault levels as defined by the design.

The busbar trunking shall have solid conductors with copper connection points at all tap-off outlets and joint positions.

Each rising busbar main shall be fully rated (including the neutral conductor) and complete with proprietary accessories including but not limited to:

- Fixing kits
- Shrouds and covers
- Tap of units
- End feeds
- MCCB's
- Expansion joints as appropriate

Busbar shall be plug in arrangement, complete with safety latches and covers.

Tap of units shall be provided as:

- Manufacturer: As Schneider Canalis (or equal and approved).
- Standard: To BS EN 61439-6.
- Arrangement: Plug-in.
- Rating: to match final load characteristics
- Phase: TP&N.
- Assembly: Fully type-tested.
- Circuits: To match busbar trunking.
- Accessories: Manufacturer's standard.

Bus-bar trunking shall conform to IEC61439 1&6.

All busbars and circuit breakers to be Association of Short Circuit Testing Authorities (ASTA) certified.

The design of busbar systems shall address:

- Temperature rise due to energy losses
- Energy efficiency and lifetime cost
- Short-circuit current stresses and protection
- Jointing methods and performance
- Maintenance.

The contractor shall be responsible for all final sizing of containment and cabling, cable routes and full coordination with the structure and other services throughout the building.

Sufficient spare capacity shall be provided on the rising busbars to facilitate future tenant installations.

Distribution Boards

The contractor shall supply and install a number of new distribution boards throughout the building as indicated on the CWC stage 4a drawings and LV schematic.

The electrical services within the landlord areas will be served via dedicated landlord's boards as indicated on the LV schematic and layout drawings.

Circuit protection devices in all distribution boards shall be MCB's and combined MCB/RCD's and any unused ways shall be fitted with blanking modules. All distribution boards shall be fitted with a proprietary lock and key.

The Contractor shall select the rating/type of all protection devices to ensure that there is full discrimination.

In each distribution board an earth and neutral terminal block shall be provided having sufficient capacity to take all circuit conductors and circuit protective conductors emanating from the distribution board and in any case at least the same number as there are ways on the distribution board.

Distribution boards shall be fitted with digital sub-meters, to afford separate sub-metering of the building loads in accordance with the requirements of the Building Regulations and CISBE TM39. All sub-meters shall incorporate the facility for connection to the BMS. These meters shall be dual channel where it is desirable to separately meter the lighting installation (generally tenant boards and the basement). Refer to section 5.11.

Final distribution boards shall be provided at each level to serve the tenant spaces. These shall be 24way TP&N, generally unpopulated apart from temporary lighting provided as part of the shell and core works.

Landlord distribution boards shall be suitably sized to accommodate the required number of outgoing ways with a minimum of 25% spare capacity left for future use. Where TP&N boards are used, this shall include at least 4 complete TP&N ways.

Generally, distribution boards shall be wall mounted within risers and 'back of house' spaces, however due to space restrictions in the firefighting core riser it will be necessary to mount boards in front of containment using Unistrut frame and brackets.

The boards shall be of metallic construction and shall be provided with a lockable door. The locks shall be common to all boards and the contractor shall ensure that a minimum of 25 keys are provided to the client at handover.

Traffolyte identification/warning labels, typed circuit charts and transparent envelopes etc. shall be provided at each of the distribution boards. Labelling shall comply with the 18th Edition of the IEE Regulations and approval shall be required from the Engineer as to the wording of all labels before their manufacture.

Typewritten circuit schedules shall be prepared for each board and updated with any changes made before Practical Completion. The printed sheets should be at least A4 in size and presented in a durable, protective holder securely fixed inside the hinged board cover. The sheets may be prepared using appropriate software but shall be exported and presented electronically in plain text CSV (Comma

Separated Value) format on a compact disc. This shall be included within the Operation and Maintenance Manual.

The circuit schedule shall contain the following information as a minimum:

- Board Reference
- Board Description
- Board Source(s) of Supply
- Board Incomer Type & Size
- Circuit Reference
- Circuit Type
- Circuit Description
- Circuit Current (Design)
- Circuit Protection Device (Size, Type & Class)
- Circuit Conductor Type & Size
- Circuit Protective Conductor Type & Size
- In addition, the electronic file shall contain the following:
 - Board Prospective fault current (measured)
 - Board Source Impedance (measured)
 - Circuit Earth Loop Impedance
 - RCD Tripping Time

The Contractor shall note that RCBO's are to be provided on all circuits serving socket outlets. MCBs shall generally be Type C except where a different type is specifically required due to equipment or wiring characteristics. Internal lighting circuits shall generally use a 10A device. Common RCD's shall not be used in order to avoid unnecessary disruption and nuisance to other circuits.

Where contactors, time clocks, sensors etc. are specified or identified in the Contract documents, these shall be mounted in a separate enclosure. This enclosure shall also be clearly identified as to its purpose.

Boards shall be positioned and installed so that all doors and hinged covers operate freely and without undue pressure. In particular, take care to ensure that trunking mounted beside or below the board does not interfere with the operation of the door.

A consumer unit shall be installed within the substation.

Suitable shrouding shall be provided within distribution boards to prevent contact with live metal and to enable ways to be wired whilst the board is live.

5.13 Containment Systems Installation

Primary / Secondary Cable Trays

The contractor shall supply and install a complete primary and secondary containment system throughout the building to facilitate the electrical services installation. Primary containment is indicated on the electrical layout drawings, any additional secondary containment shall be provided by the contractor.

The contractor shall include for all necessary fixings, supports, expansion joints, brackets, earthing, fire-stopping and builder's works required to ensure a suitable, continuous system of containment is provided.

All cable trays shall be constructed of galvanised steel (minimum medium grade) and shall be installed supported directly off the underside of the floor slab above.

All cable trays shall be installed neatly parallel and perpendicular to the building lines, and in a logical arrangement.

Systems shall be suitably segregated in accordance with electrical class, IT standards and EMC segregation.

Dedicated Extra Low Voltage (ELV) cable containment shall be installed with separate compartments provided for individual systems. One compartment shall be for telephone and the other compartment for all other ELV cabling (e.g. IT, security, intercom etc.).

Fire alarm cabling shall be run in a dedicated cable basket or trunking, or within in a dedicated compartment of a multi-compartment basket or multi-compartment trunking.

Dedicated containment to be provided from incoming comms position to telecoms room, from comms room position to the risers and from there to each demise (see section 3.4)

Dedicated cable trays over diverse routes shall be provided for life safety systems.

Life safety and building alarm system, support systems should have a fire survival time equal to that of system installation.

All power and comms cables must (mandatory) be Construction Products Regulation (CPR) Compliant and have a CE mark and a Declaration of Performance (DoP) provided by the manufacturer in accordance with: BS EN 50575:2014+A1:2016 Power, control and communication cables. Cables for general applications in construction works subject to reaction to fire requirements.

Vertical and external cables shall be secured using metallic fire-resistant cable fixings.

The contractor shall ensure that a minimum of 25% spare capacity is provided to facilitate future installations.

Where containment passes through fire compartments/barriers, the contractor shall ensure that proprietary fire stopping, and internal fire barriers are provided to ensure the fire rating is maintained.

Distribution Trunking

Generally, plant area and basement power containment systems shall comprise hot-dipped galvanised steel trunking, with single return edge, shall be supplied where necessary and installed to carry final distribution circuits. Lids shall be of similar material, with turnbuckle retaining clips.

All trunking shall be effectively cross-bonded to each and every distribution board throughout its route. Copper saddles to be used at junctions, visible from beneath.

Proprietary internal fire barriers shall be used where the trunking passes through fire-rated compartments to ensure that the fire rating of the compartment is maintained.

5.14 System of Wiring (Final Circuits)

Final circuit wiring shall generally be carried out using FP200 type cabling to shell and core areas. All cables shall be laid and secured onto a dedicated LV cable basket. Sheath colour should clearly differentiate mains cables from fire alarm circuits.

The installation within shell and core areas, including lift lobbies and staircases, shall be entirely of a recessed or concealed nature, concealed above suspended/plasterboard ceilings as appropriate and with high impact PVC conduits recessed in walls.

The installations within plant rooms and car park areas shall generally be of a surface mounted nature, with Class 4 HGSW galvanised steel conduits emanating from a system of exposed trunking installed at high level. All visible wiring systems shall be installed neatly and parallel to the building lines.

5.15 Small Power Installation

The contractor shall supply, install and commission a fully functional small power installation as described within this specification and as indicated on the CWC performance drawings.

A complete small power installation shall be provided throughout the landlord's / communal areas.

The installation will generally comprise 13A switched socket outlets for cleaning (lockable) and ancillary purposes, together with supplies to dedicated items of mechanical plant and equipment.

The Contractor shall supply and install dedicated radial circuits for the entire mechanical services installation, in accordance with the Employers requirements, including any specialist Contractor elements. This shall include all supplies to extract fans, booster pumps, sprinkler pumps etc. and any other items of mechanical plant served directly from the Landlord switchboard.

Means of local isolation and connection to fixed plant and equipment shall be provided by one of the following methodologies, as suitable to rating, number of phases and location:

- Fused connection unit for supplies 3-13A single phase
- Rotary isolator / switch disconnecter for equipment rated 16A+ or three phases
- IP65 rated rotary isolator for all external / exposed equipment

FP200 / SWA cables shall terminate directly into the ingoing side of the isolation device, with flexible conduits from the outgoing side to the equipment terminal boxes.

The Contractor shall provide all necessary power to ancillary and security systems to form complete and functional installations including the following items of ancillary equipment, but not limited to:

- Access control power supply units.
- CCTV camera power supply units (unless POE).
- Fire detection and alarm system panel and power supply units.
- Information and Communication technology (ICT) systems
- Disabled alarm systems
- Mechanical Equipment

Fused connection units serving security equipment shall be unswitched and installed within a secure area.

A minimum of 1no. switched double socket outlet shall be provided on each floor within the lift lobby.

The Contractor shall develop and allow for a general array of general cleaner socket outlets (SSSO) throughout the landlords' circulation areas and welfare facilities.

RCD/RCBO protection shall be applied in accordance with the requirements of BS 7671.

Fused connection units shall be to BS 5733, complete with neon indicator, and conduit connection to a separate flex outlet position, allowing the fused connection unit to be located in an accessible position.

Wiring accessories shall be fitted flush to the finished build fabric in all areas, with the exception of plant areas where the installation shall be surface mounted with Metal clad outlets.

The finish of all accessories shall be agreed with the architect and engineer prior to procurement. For the purpose of tender, MK (or equal and approved) brushed stainless steel accessories shall be provided.

All small power cabling shall be as per the relevant British and European standards regarding current capacities, fixing, spacing, capacity of the containment etc.

Mounting heights of equipment will be in accordance with Part M of the building regulations and agreed with the architect and engineer prior to installation.

5.16 General Lighting Installation

The contractor shall design, supply, install and commission a fully functional lighting system throughout the building as detailed within this specification.

The lighting installation shall be provided to all landlord's and communal areas.

The tenant's office areas and the main building reception shall be installed as part of the tenants fit out works.

The lighting installation shall comprise a variety of different luminaires selected to satisfy the technical and/or aesthetic requirements of each room and its intended purpose.

All luminaires shall be chosen to be compatible with the installed environment. IP 20 rated luminaires shall be provided within clean, dry, internal areas, and IP 54/65 protected luminaires installed in exposed plant areas.

The lighting installation shall generally consist of LED luminaires controlled by automatic lighting controls and complete with 3-hour integral, emergency battery packs where required.

Samples shall be provided for all luminaire types. These shall be agreed with the Client/Sponsor, Electrical Engineer and Architect prior to final Specification and the commencement of first fix works.

All lighting fittings shall be carefully installed in a manner appropriate to their nature and method of fixing. The metal work of luminaires shall be efficiently earth bonded.

Where luminaires are suspended from the structural slab, they shall be supported by drop rods and channel bracketry. Surface mounted luminaires shall have BESA conduit fittings and 20mm conduit holes at fixing centres as specified in BS 4533.

Lighting within the electrical substation shall be IP65 LED, prismatic diffusers. All lamps shall have minimum colour temperature of 3500K. The lighting control shall be via surface mounted light switches, mounted at 1400mm above finished floor level.

All lighting levels shall be in accordance with BS EN 12464 and CIBSE Code of Interior Lighting. The table below provides indicative minimum lighting levels for typical areas throughout the building.

Area	Lux Level (lux)
Toilets / Bathrooms	200
Stair core	100
Cleaner's cupboards / storerooms	100
Circulation Areas / Corridors	100
Plant Rooms	200
Car Park Generally	50
Car Park Ramp	100

5.17 Lighting Controls

The contractor shall design, supply, install and commission a complete, fully functional lighting control system throughout the building comprising presence/absence detection with manual overrides as appropriate.

The lighting control installation shall be designed with the following key attributes:

- Simple, intuitive and unobtrusive operation for end users
- Open protocol
- Straightforward maintenance and management of the system(s) without an excessive amount of specialist training
- Effective control of energy use by using daylight dimming and / or absence detection as appropriate.
- 5 year supported software warranty.

The Contractor shall ensure that all areas covered by automatic detection provide complete coverage without leaving any blind spots. In particular, a detector shall be positioned near to each entrance door to detect a person immediately upon entering.

Daylight sensing shall be incorporated adjacent to the building perimeter where appropriate.

Presence detectors shall be set to provide adequate time delay before switching off. Within toilet areas the time delay shall be set to 20 minutes, all other PIR's to be 10 minutes with the facility to extend to 45 minutes if required.

Lighting in corridors and communal areas shall be controlled via occupancy sensors throughout the common parts. The Contractor shall be responsible for the installation of sensors to provide 100% detection coverage with spacings recommended by the manufacturer. The system shall be so arranged that the luminaires are timed on for 10 minutes minimum from activation of the occupancy sensors.

Presence detectors, photocells and dimming control equipment shall be of the same manufacturer and type.

The Contractor shall employ the lighting control suppliers approved agent as a Specialist to test, commission and certify the complete lighting control installation, ensuring that the control gear within all luminaires is compatible with the automatic lighting control equipment.

Where a special tool, software, software license or apparatus is required in order to commission the lighting controls, the Contractor shall provide at least one unit of each type required so that the Client's Building Manager can make their own changes to the following parameters without having to employ or contact a specialist:

- Maintained illuminance set-point
- Time delay to off

5.18 Emergency Lighting Installation

A complete emergency lighting installation shall be provided as detailed in this Specification, and to afford compliance with the Building Regulations.

The system shall fully comply with the requirements of BS 5266 Part 1: The emergency Lighting of Premises and BS EN 50172. The written approval of Building Control and the Fire Officer or Fire Officer Specialist Consultant together with authorised signed off drawings shall be provided for the system to be installed.

Emergency lighting shall be provided throughout the communal areas of the building in accordance with the building fire strategy. A system of self-test, self-contained emergency luminaires shall be installed together with illuminated maintained Emergency Exit signs and external emergency bulkhead luminaires located above exit doors.

Emergency luminaires shall be provided with 3-hour, integral battery packs and shall be complete with LED indicators to show the charging state of the battery packs.

Illuminated "EXIT" signage shall be complete with appropriate European style legends.

Switching of the luminaires shall be automatic upon detection of mains failure. The emergency power supply shall be from self-contained maintenance free nickel-cadmium batteries. The minimum battery life shall be five years and the recharging cycle, which shall be automatic on restoration of mains supply, shall be less than 24 hours.

The supply of the luminaires shall be taken via a key switch from the unswitched live side of an adjacent lighting circuit. Key switches shall be installed at distribution board positions to facilitate manual testing of the emergency luminaires, in addition to the self-test facility.

Emergency luminaires shall also be located externally, adjacent to each final exit.

Emergency luminaires shall be located to specifically highlight hazards, firefighting equipment (extinguishers, fire alarm break glass units, etc.), indicate changes of direction/level and draw attention to intersections.

All emergency lighting fittings shall be ICEL certified.

The entire emergency lighting installation shall be installed, commissioned and tested in accordance with BS 5266-1, and copies of the appropriate Test Certificate shall be handed over to the Engineer upon Practical Completion of the work.

Each emergency fitting shall be fitted with a typed address label and corresponding test sheets shall be included in the Operation & Maintenance Manual, in the form of an 'Emergency Test Log.

5.19 External Lighting

The design of the external lighting scheme is being developed site wide, separately to the design of the Globe and Simpson project.

The external lighting strategy is predominantly based on building mounted lighting as shown on the drawings with some additional public realm lighting within the landscaped areas. To this end, dedicated distribution boards and KNX lighting control modules have been allowed in the design in the basement and in the mezzanine riser as the source for these circuits.

The contractor shall allow for the preliminary design as shown on the drawings and luminaire schedule for building mounted lighting, complete with containment, circuits and controls.

In addition, the contractor shall allow for a further 10 circuits from the basement distribution boards to serve public realm lighting. For tender purposes, these shall be 4.0mm² 3C XLPE/SWA/LSF cables on tray internally and ducts externally, 100m length each. Allow for connections to be made to 20No. ground mounted luminaires / columns / bollards.

External 'Art Wall' Lighting

The building will include an 'Art Wall' located on the North East elevation. The final details are currently unknown, however the contractor shall include for the following within their tender submission:

- Allow 1No. metered 63A TP&N TM-D MCCB tap-off from busbar BB02/03 (floor TBC)
- Cable to, and provide 1No. 4-way TP&N type B distribution board as Schneider Isobar, located within the riser near the tap off. Include for contactor incomer, controlled by the KNX controller detailed below.
- Allow 6No. 10A SP&N circuits wired in 2.5mm 3C XLPE/SWA/LSF and terminated in a 16A socket outlet positioned in the riser, behind the North Elevation, 3No. at L01 and 3No. at L08
- Allow for 1No KNX controller and data point as per the other external lighting supply distribution boards, to allow integration onto the site wide Allied London control strategy.
- Allow for supply, fixing and connection of 32No surface mounting high power LED linear façade wall wash luminaire, as per ERCO Focal Flood, 16No. at L01 and 16No. at L08.

Final detail design of all external and art wall lighting shall be included by the contractor, compliant to a performance design and strategy by others. This strategy is currently in the client approval phase and will be issued when complete. The contractor shall advise the latest date for receipt of the strategy / performance design information in good time, with one month notice.

5.20 Luminaire Apertures

All apertures created within building fabrics for luminaires and lighting controls shall be left suitably fire stopped where necessary to ensure the rating of the fire compartment is maintained.

5.21 Telecoms and Structured Cabling

Refer to section 3.3 for requirements and description of the incoming services provision.

Design and install the structured cabling system as shown on the structured cabling schematic, layout drawings and provide the below:

- Landlord cabinets and hubs as shown on the ICT schematic and layout drawings.
- CAT6A cabling and RJ45 outlets serving all outlets as identified on the layout drawings and indicated on the schematic.
- CAT6A cabling and RJ45 outlets serving all outlets as required for specialist, control and security systems.
- CAT6A cable patch panels in the main rack, and all terminations.

The installation shall be designed, installed and tested in accordance with:

- BS EN 50173 (series) Information technology. Generic cabling systems
- BS EN 50174 (series) Installation technology. Cabling installation
- BS 6701 Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance.
- BS EN 50346 BS EN 50346:2002+A2:2009 Information technology. Cabling installation. Testing of installed cabling
- BS 7671 IEE Wiring Regulations
- EMC Standards

The Contractor shall design, supply and install dedicated containment installations for the data and telecoms installations throughout the development, to include vertical cable trays for rising services and horizontal distribution to each area of use, generally as follows:

- Telcom / Node fibre optic infrastructure – Steel trunking with secure lids as described in section 3.3.
- Landlord structured cabling – Steel wire basket

The Contractor shall ensure all containment systems are installed to Node specification prior to attendance of the utility installation team on site.

All cable containment systems for data and telecoms to be fully coordinated with all other services present within any given area.

Ensure segregation is maintained between data and power cabling minimum 200mm.

The contractor shall provide all necessary power supplies for equipment and cabinets as required.

- 4No. 32A single phase industrial 'Commando' sockets with isolators shall be provided in the main hub room for cabinet connections
- A dual 13A socket outlet shall be provided in the smaller comms intake room at high level
- A dual 13A socket outlet shall be provided to each landlord secondary hub at high level

Provide a floor mounted cabinet within the main hub room as the origin of the landlord ICT installation and to house landlord active equipment and any security system servers, NVR's and the like:

- Minimum 800mm deep, 800mm wide
- 42U
- Lockable vented front door
- Removable/lockable vented rear doors
- Removable/lockable side panels
- Vented top covers
- Universal 19" mounting profiles front and rear
- A 10 way vertical sequential start PDU strip shall be mounted to the rear of the cabinet, connected into the commando socket.
- Full cable management for data and power cable s
- Full complement of airflow blanking strips
- Cable brushes at bottom of racks
- Plinth / feet / castors for floor mounting

The cabinet shall be located in the main basement hub room to provide the following clearances:

- 1m to the front
- 1m to the rear
- Banked with the Node cabinets

Provide wall mounted cabinets within the main riser as secondary hubs to the landlord ICT network:

- Minimum 800mm deep, 800mm wide
- 42U basement /12U roof level
- Lockable vented front door
- Vented top covers
- Universal 19" mounting profiles front and rear
- PDU
- Full cable management for data and power cable s
- Full complement of airflow blanking strips

Communication Cabinets shall be equipped with adjustable vertical mounting rails, both front and back. The front vertical mounting rails shall be recessed at least 100mm to provide sufficient clearance for cable management.

Within the Communications Cabinets, cables shall be supported to provide strain relief and prevent kinking, and in such a way that mechanical damage is avoided during later access to the patch panels or electronics.

Horizontal cable management shall be installed; one 1U management strip per 2U patch panels.

General Requirements

Provide printed cable unique identification at each end of each cable.

Ensure all cables are supported on / within a proprietary containment system, throughout their entire length, as described earlier in this specification.

The installation quality of cabling has a significant effect on the final performance level of the network; therefore, it is essential to ensure that the performance of the entire network is not diminished through improper installation. In particular:

- Care must be taken not to stretch or abrade cables during installation; i.e. the pulling tension for cables must not be exceeded.
- Cables that pass through the infrastructure of the building shall be suitably protected against damage.
- To ensure cable management and also strain relief, cables shall be properly dressed using Velcro cable ties. However, cables ties should never be over tightened.
- On vertical runs, the cables shall be dressed and tied from the bottom up, thus putting minimum strain on the cables.
- Sharp bends in the cable will damage the insulating material thus causing unacceptable losses in the transmission medium. Therefore, the internal radius of every bend in a cable shall be such as not to cause damage to the cable nor impair the characteristics of the cable and shall be in accordance with manufacturers guidelines.
- Contractors shall install the system such that sufficient slack remains to enable re-termination of the outlets a minimum of twice and a limited scope for movement of the cabinets. Excess coils of cables underneath the cabinets are unacceptable.

Cable shall not be routed over pipes, conduits, other cabling, ceiling tiles, etc., but shall rest directly on the supporting containment so as to minimize the potential for sharp bends, kinks etc. Every cable used shall be supported in such a way that it is not exposed to undue mechanical strain.

For cables which are not continuously supported, the maximum distance between supports shall not exceed 50cm (horizontal or vertical).

All terminations shall be made using an IDC punch tool fit for purpose. The incoming cables shall have all 4-Pairs terminated at both patch panel and TO, as follows:

- Pair 1: WHITE/blue - Pin 5; BLUE/white - Pin 4
- Pair 2: WHITE/orange - Pin 1; ORANGE/white - Pin 2
- Pair 3: WHITE/green - Pin 3; GREEN/white - Pin 6
- Pair 4: WHITE/brown - Pin 7; BROWN/white - Pin 8

The system shall be tested in line with current British Standards with results and test equipment calibration certificate being submitted within the O&M information.

5.22 Fire Alarm Installation

The Contractor shall employ a fire alarm specialist to design, supply, install and commission a complete, fully functional, networked, addressable fire alarm

system throughout the building as detailed in this performance specification and as indicated on the schematic and layout drawings

The system be supplied, installed and commissioned to comply fully with the requirements of BS 5839-1:2017 category L1, intended for the protection of life, in accordance with the fire strategy and associated documents.

The main fire alarm panel shall be located within the firefighting lobby at ground floor with a repeater panel provided in the ground floor tenant space.

Further loop nodes shall be provided at upper floor level and basement as indicated on the schematic.

The fire alarm installation serving Building C (Globe & Simpson) shall be networked back to the site control centre located within Bonded Warehouse to enable the system to be monitored out of hours.

The panel shall incorporate charger and battery units and shall be constructed from mild steel and be finished in the manufacturers standard finish. The integral battery back-up shall be capable of minimum twenty-four hours standby operation, with a subsequent 30 minutes of full alarm.

The panel shall be an open protocol, microprocessor based complete with fail safe features incorporated and of the analogue addressable type. The panel shall be modular in design to enable system expansion and provide simple operation to end user.

The panel shall incorporate an integral event printer this shall consist of a 24 character per time event printer which can be enabled via a menu selectable option.

It shall be possible to view or print the event memory in the following format.

- All events
- Range by date
- Priority alarm only events.

Automatic smoke and heat detectors shall be of the plug-in type. They shall have a visible indication of a fire condition via a red LED.

Sounders shall generally be of the loop powered addressable type; either incorporated into detector bases (emitting max 85 dB @ 1m) or wall mounted (emitting max 105 dB @ 1m).

Visual Alarm Devices (VADs) shall be installed to all WC's and public areas as required for compliance with the Equality Act 2010 and Approved Document M.

Wiring shall be carried out utilising 2 core and earth enhanced fire-resistant cable (red). Final cable sizing to be confirmed by the specialist.

Detection shall be provided to all voids throughout the building, as required to achieve the designated fire alarm category.

The electrical supply to the main fire alarm panel shall be provided from the dedicated life safety systems distribution board, via the generator backed landlord

busbar. A key switched and fused 20A double pole isolator shall be installed adjacent to the panel.

Fire alarm interface units shall be provided where required throughout the building. The contractor shall liaise with the mechanical services contractor and all specialist contractors/suppliers to determine the quantity and position of the required interfaces.

The retail unit at ground floor level shall be interfaced with the building wide fire alarm system to provide suitable in/out signals with the main fire alarm system.

All detectors shall be provided with manufacturers covers once installed. These covers shall remain in place until the building has been cleaned prior to handover and is deemed to be free from dust.

All covers shall be removed prior to handover.

The system shall be designed with a minimum 25% future capacity on all loops, cable trays and addresses.

The entire system shall be commissioned in accordance with the requirements of BS 5839-1 Code of Practice for Installation and Servicing of Fire Detection and Alarm Systems in Buildings, and shall include the following: -

- Electrical Tests
- Operation of each Device
- Audibility Tests
- Checks on all Control Panel Facilities
- Checks on all labels and Equipment

At completion of the tests and before handover, the Contractor shall provide the Engineer with a signed (4-Part) certificate indicating that the system has been designed, installed and commissioned and that test results have been satisfactory. All tests shall be carried out in the presence of the Engineer.

The Contractor shall, prior to handover, provide 1No. glazed framed fire alarm mimic indicating the exact zoning of the fire alarm system; the mimic shall be mounted adjacent to the main control panel.

The Contractor shall arrange for the Specialist Supplier to provide a demonstration and instruction to the Client's Representative regarding the operation of the installation.

The contractor shall also hand over to the Engineer an Inspection and Test Logbook in compliance with BS 5839-7, and shall include for an initial 12 Month Maintenance Agreement upon completion of the works.

5.23 Fire Telephone and Disabled Refuge Alarm System

The Contractor shall design, supply, install and commission a complete fire telephone and disabled refuge alarm system which covers all fire-fighting protected lobbies and disabled refuge points throughout the building, as detailed in this performance specification and indicated on the stage 4 drawings.

The system shall be provided in full compliance with BS 5839-9:2011.

A type A outstation shall be provided for each fire-fighting shaft.

A Type B outstation shall be provided at each designated disabled refuge position, to provide 2-way audio communication for Fire Officers/Building Management with disabled people who have been relocated to a disabled refuge point in the event of an emergency situation.

All outstations shall be flush mounted and shall incorporate a call push button, reassurance LED, speaker, microphone, cancel key and engraved instructions.

The main indicator panel shall be located in the main reception area and shall have an LCD display with microphone speaker and keypad to allow hands free communication to each remote call point, and a lamp indicator, reset push button (one per refuge), engraved with the dial out number for the station. The panel shall be complete with engraved instructions logically arranged in the form of a building plan or section.

All cabling shall be carried out using suitable, multi-core enhanced fire rated cable.

The Contractor shall include for the supply/ installation of all necessary containment and mains power supplies, and for testing and commissioning the system on completion.

5.24 Disabled Toilet Alarm System

The contractor shall design, supply, install and commission a disabled toilet alarm system to each accessible WC throughout the building.

As a minimum, each accessible WC shall be provided with pull cords (quantity to comply with ADM and BS8300), overdoor indicator and a reset button.

Local sounders shall be provided to each accessible WC, with indication and alarm at a central panel located at the reception position. The central panel shall be provided with integral batteries to facilitate 72 hours of operation of the system in the event of mains failure.

The Contractor shall include for the supply/ installation of all necessary containment and all interconnecting control cabling and mains power supplies, and for testing and commissioning the system on completion.

5.25 Audio Intercom and Access Control Installation

The Contractor shall be responsible for employing an NSI Approved Security Specialist Sub-Contractor to design, supply, install, test and commission a complete Access Control installation throughout the building as detailed in this Performance Specification.

The system shall restrict unauthorised access into and around the building in conjunction with the overall security and operational strategy for the premises.

The system shall utilise IP technology, with the facility to integrate fully into a centrally managed (off site) system over an IP connection.

The system head-end shall be located in the main hub room at basement level.

Restricted access shall be provided to the following: -

- External perimeter doors at ground level, within landlord and tenant demise.
- Basement level doors which access the Globe and Simpson building
- Lifts
- Refuse stores
- Cycle stores & associated facilities

Each external door will be fitted with a proximity release card/fob reader, push to release button and 'green' emergency break-glass unit. Depending on the door type, the access control system will be interfaced to either a powered door mechanism for automatic doors or a maglock for internal and external manual doors.

The emergency break-glass unit shall be provided on the secure side of every access-controlled door, and they shall each be alarmed to prevent misuse. Each access-controlled door shall be provided with a fire alarm interface to release the door in the event of a fire.

Note: In addition, containment shall be provided to each entrance door to the Tenant space on each level, to facilitate the installation of additional access control readers at a future date. The containment shall terminate in the ceiling void above the door and be blanked off at a conduit box adjacent to the door keep.

Video and Audio intercom shall be incorporated on the access controls to the rear goods entrance and communicating to the reception areas (allow for 2No. reception area receiving stations).

The intercom and access control system shall comply with Secure by Design and PAS 24-2016 Enhanced security performance requirements for door-sets and windows in the UK.

5.26 CCTV Installation

The Contractor shall be responsible for employing an NSI Approved Security Specialist Sub-Contractor to design, supply, install, test and commission a complete CCTV installation throughout the premises as detailed in this Performance Specification.

The system shall be integrated into the wider site-wide CCTV network and shall therefore be open protocol.

The system shall afford the monitoring and recording of all internal / external images using IP technology, with the facility for remote viewing.

The exact location of the CCTV cameras shall be determined by the Specialist Sub-Contractor, to include coverage of all critical areas including:

- External perimeter of the building
- Ground Floor Main Entrance

- Basement and car park area
- Refuse & cycle stores
- Within each lift car

The System shall deliver:

- A range of HD Cameras, with lens selection matched to each specific required view on site
- The ability to manage bandwidth and storage without compromise
- Indisputable image detail of recorded events and actions, sufficient for prosecution.
- An open System Network Video Management Software (NVMS) designed specifically for millions of pixels of information
- A platform that is "Purpose built" for HD performance with the broadest range of HD IP Cameras
- Lossless Video

The System shall provide High Definition Stream Management (HDSM) image transmission which delivers the highest image quality and frame rates and low bandwidths.

Software shall be provided and installed on the client IT network to provide an integrated alarm management and search function; scheduled System back up features, including web page integration and access to camera views by a site overview map allowing operators to immediately view a specific Camera by clicking on its position icon on the map.

The location of the Controls for the CCTV system shall be agreed with the engineer prior to installation. The pictures shall be fed to a dedicated RAID Server that will enable authorised viewing client networked PC's to monitor and review images.

The CCTV system shall be provided to meet the minimum recommended performance for identification by the Home Office in the UK for use as evidence in court.

The Contractor shall include for all power supplies, containment, underground ducts and draw wires required by the Specialist. All power supplies shall be wired on dedicated circuits from the local distribution board.

The CCTV system shall comply with Secure by Design requirements.

5.27 Mechanical Wiring Installation

Included in this section of the works shall be the provision of power supplies and control cabling to, but not limited to fans, pumps, boilers, air conditioning systems, smoke fans, controls etc. associated with the Mechanical Services Installation.

Final connections to all equipment shall be made by the Mechanical Services Contractor.

The Contractor shall liaise with the mechanical contractor and all Specialist Sub-Contractors, regarding exact locations and wiring details of Mechanical Services Equipment and associated controls.

The Contractor shall include for all necessary containment associated with the Mechanical Wiring installation, to meet their requirements.

All power supplies shall be wired on dedicated circuits, using LSF insulated stranded copper conductors.

A means of local isolation shall be provided for each item of equipment using electrical power. All isolators and switches shall be suitably rated for the equipment they are serving.

Isolating switches shall be rotary action, metal clad switch disconnectors with lockable handles.

5.28 Earthing and Bonding Installation

A complete earthing and bonding system shall be provided as required by BS 7671 and BS 7430 Code of Practice for Earthing, and as indicated on the earthing schematic.

All earth bars shall be copper bar installed on insulated supports.

The contractor shall provide a consumer's earth matrix to achieve a resistance reading of less than 1 Ohm at the main earth bar located adjacent to the main switchgear. The earth matrix shall be formed by forming bonds to the building substructure and any further electrodes / earth nests as necessary to achieve a satisfactory reading.

Care shall be taken to ensure that all joints are properly made and bonded to ensure continuity. The main equipotential bonding conductors shall be connected to the earth bar mounted adjacent to the main switchboard.

All electrodes and connections to the earth bar shall have test links and cables.

The earthing installation shall comprise all conductors, conduits, trunkings, cross bonds and separate individual circuit protective conductors to form the complete system.

Main equipotential bonding conductors shall be taken to all incoming gas, water service pipework, structural steelwork, metal cabinets, metal work surfaces, lightning protection network, satellite dishes and TV aerial systems.

A 'Clean' Earth shall be provided within each IT / Data / Telecoms room.

5.29 Lightning Protection Installation

A lightning protection system shall be fitted to the building to protect the structure, contents and occupants from the effects of a lightning strike by discharging dangerous potentials to the general mass of earth.

The lightning protection installation to be installed in compliance with BS EN 62305– Protection against Lightning.

The Contractor to provide a complete and fully functioning lightning protection system for the building based on the lightning protection specialists design risk assessment.

The Contractor shall be responsible for the detailed design, supply, installation, connection, testing, commissioning and setting to work of the complete and fully operational lightning protection system installation.

The system shall provide protection of the building, structure, exposed metal work and any protrusion above the general roof level from lightning. This shall be achieved by providing a low impedance continuous and inter-connected path to earth for lightning strikes to the building.

A risk assessment shall be carried out by the contractor.

Co-ordinated surge protection shall be fitted to the main LV panel, and all roof mounted panels and circuits to limit damage, disruption losses and downtime to sensitive electronic systems, communications equipment and any cables leading outside the building for roof plant caused by a lightning strike or other transient over voltage.

The Specialist shall provide detailed drawings of his proposals upon request. Any exposed conductor routes and termination details must be agreed with the Architect/Engineer prior to the commencement of the works.

The lightning protection system comprising an air termination network, down conductors, test joints, earth terminations and earth electrodes shall be in accordance with the requirements of BS EN 62305.

The lightning protection system shall comprise of:

- An air termination network consisting of a matrix of aluminium or copper tapes on the roof structure. Note: The air termination network shall account for bonding to all roof mounted plant.
- Down conductors consisting of the structural steelwork, metal reinforcement bars within the concrete structural columns or if this is not possible, separate aluminium or copper tapes hidden behind the cladding system;
- An earth termination network consisting of mats, rods or the structural foundations;
- Bonding to the Building Services and roof-mounted apparatus;
- Protection of roof-mounted plant using either catenary wires or strike rods.
- Co-ordinated surge protection to the incoming services including TV / radio / satellite antennae, power lines and telecoms services.
- Co-ordinated surge protection to power and data cables which penetrate the building envelope to serve roof-mounted plant.

Concrete inspection pits (plastic pits will not be accepted) shall be finished flush with ground level and the covers permanently labelled "Lightning Protection System Earth".

Upon completion the Specialist Sub-Contractor shall test the complete system for electrical continuity, overall earth resistance of each earth point and shall issue

the Engineer with a detailed Completion and Test Certificate in accordance with BS EN 62305.

"As Installed" drawings of the complete installation shall also be required at the time of Handover.

5.30 Surge Protection Installation

The Contractor shall supply and install surge protection devices to the electrical installation where required, as detailed in this Performance Specification.

Electronic Surge Protection shall be provided within the main switchboard and be protected by an outgoing protective device within the switchboard. The surge protection device shall be provided with status indicators which are to be placed in a position visible without removing covers.

The installation shall include the provision of 3phase 'all mode' transient voltage surge suppression to each of following: -

- Mains incoming supply
- External Lighting distribution board(s)
- Each distribution board which serves external plant

The transient over-voltage protection must:

- Have a let through voltage not exceeding 600v (tested to BS6651 Appendix C, Category C High 6kV 1.2/50 microsecond open circuit voltage, 3kV 8/20 microsecond short circuit current).
- Protect all modes (i.e. phase(s) to neutral, phases(s) to phase and neutral to earth)
- Have a full status indication with lights to show full protection, pre-failure and failure.

The unit shall be modular and withdrawable for ease of replacement should the need arise. The Contractor shall provide a complete and functioning system, complete with full documentation, full warranty and client training/instruction upon completion of the project.

In addition, suitable electronic surge protection shall be afforded to electrical distribution panels supplying sensitive electronic equipment such as IT cabinets, television and security systems.

Each suppressor shall be commissioned and tested by the manufacturers' local appointed agent upon completion.

5.31 Lifts

For details of lifts, refer to separate CWC Lift Traffic Analysis and Performance Specification.

The Electrical Contractor shall provide and install all power supplies to the lifts, inclusive of the local point of isolation. This shall be determined by the lift manufacturer and may consist of a suitably rated isolator and multi-pin BS4343 socket outlet.

The Contractor shall provide all required alternative supplies to support firefighting lifts and/or evacuation lifts.

The Contractor shall co-ordinate and install all lift interfaces.

The lift shaft lighting and power installation shall be installed by the lift supplier in its entirety, including any required distribution board. The afore mentioned isolator and BS4343 socket outlet shall be used as the source of supply for the entire lift and lift shaft installation.

The lifts shall be designed to operate in accordance with the building fire strategy and cause and effect.

5.32 PV System

The MEP contractor will design, supply, install, test, commission and validate the complete photovoltaic system connected to the building.

The contractor's role will include the management and agreement of all statutory certification in line with DNO requirements and Electricity Regulations.

Design and provide a complete PV system; referring to LV schematic, and coordinate and agree positions of all equipment.

Carry out the complete works to meet the requirements of:

- BS 7671
- BS EN 62124
- ENA 59/2-1.

Prior to construction and for client team agreement, submit detailed design drawings, manufacturers' literature and technical information, and calculations showing estimated annual energy yield using the Photovoltaic Geographical Information System (PVGIS) calculator.

Photovoltaic arrays

- All panels should be "Tier 1" panels with at least 10-year product warranty and 25 year linear power warranty.
- Panels to be from a Worldwide supplier and for approval by the client, e.g. **Sunpower Maxeon 3 400Wp unit.**
- Inverters to be provided with a minimum of 10-year warranty.
- Inverters to be from a Worldwide supplier and for approval by the client, e.g. **Sunpower**, Huawei, SMA, Fronius.

BRUKL Compliant Yield	28,401kWh/annum
Angle of Inclination	40°
Orientation	120° from North
Panel Efficiency	18% minimum
Inverter Efficiency	95% minimum

Provide a technical submittal of the proposed PV installation prior to procurement.

Engage MCS accredited specialist to carry out all works associated with the PV. Provide a stand-alone photovoltaic system in the area as represented on the PV Area drawing:

iGen Energy Ltd
3rd Floor Broadstone House
Broadstone Rd
Reddish
Gtr Manchester
SK5 7DL

Peter Hewart
07960348438
01615071593

phewart@igen-energy.com

Mount the photo-voltaic panels in the requested orientation, aesthetically pleasing and fixed to a suitable metal frame securely fixed & anchored to a proposed gantry structure over the roof plant area, **and additionally on the roof of the core areas as necessary**. The contractor shall design and provide all mounting frames and liaise with the architect, structural engineer **and roof specialist** to determine suitable fixing details.

Arrange the panels in suitable parallel arrays at the requested inclination. Connect to a series of inverters to be located on the roof top. **Inverters to be suitably IP rated if installed in exposed conditions.**

Provide submain, MCCB, and isolator to the PV system as shown on the LV schematic.

The inverters should incorporate suitable anti-islanding relays to G99. Otherwise, a G99 approved relay shall be provided separately between PV isolator and distribution panel, including a series of isolators to allow full isolation for maintenance.

The contractor shall ascertain the requirements of the G99 notification to the DNO. Complete all application forms and obtain approval prior to connecting the PV system to the LV supply. The contractor shall arrange and include costs for any witness test with the DNO. Both of these activities shall be planned and organized with all due consideration of the programme and DNO lead time.

Provide a generation meter (with Modbus connection to the BMS) for the PV. Ensure the meter will display and record the current energy in kW from the PV panels and a cumulative daily display of the kWh's produced. The meter shall be suitable for mounting within the metering enclosure of MDB1.

17.0 Testing and Commissioning

The Contractor shall include for testing of all new plant and equipment to ensure that the systems are set to work in the appropriate manner once the works have been undertaken.

All testing and commissioning shall be carried out in accordance with BSRIA and CIBSE Commissioning Codes, together with test procedures defined within British Standards and Standard Specification Clauses, which may be undertaken by a specialist third party commissioning engineering company. Refer to LendLease Prelims and Main Contractor requirements.

A visual inspection of the installed equipment shall be made before any testing is carried out to confirm the correct selection and erection of material and workmanship.

Upon completion of the works, the whole installation shall be subject to tests required by the regulations and specifications.

Full testing and commissioning of the building services installation shall be undertaken. It should be noted that a practical completion certificate shall not be issued until all the installation and testing certificates are accepted by the Consulting Engineer. If further testing is required due to unsatisfactory test results, these shall be done at no extra cost to the contractor.

At all reasonable times during the installation, the client or Consulting Engineer shall be entitled to inspect, examine and test the systems in the premises. All the materials, equipment and workmanship to be supplied under the contract.

Once the contractor has completed the testing and commissioning of each service to fully comply with the specification and drawings, the contractor shall allow for the Consulting Engineer and the client representative to attend the witnessing of the completed installation. Such inspection, examination or testing if made shall not relieve the designer from any obligation under the contract.

The installer and designer shall verify the correct operation of the complete systems, including items of plant. They will ensure the system operate in accordance with the specified parameters.

Upon completion of all testing and commissioning the installer and designer shall provide two signed copies of the commissioning certificates and submit to Select Property the results being obtained. Signed copies shall also be enclosed within the printed copies of the Operating and Maintenance Manuals located on the site.

The Contractor shall allow for seasonal commissioning to be undertaken in the peak summer and winter conditions in accordance with the current regulations and to comply with BREEAM requirements.

Practical Completion information

The Contractor shall provide test results of the water, heating and cooling systems prior to Practical Completion. The tests should be taken no more than 5 days prior to the Practical Completion and the Contractor shall confirm that no works have been carried out to the systems in the period following the tests.

18.0 Operation and Maintenance Manuals

The Contractor shall be responsible for the production of all operation and maintenance manuals including 'As-Fitted' drawings and BIM model / Asset register for the complete mechanical, electrical and public health services installations.

The Operation and Maintenance Manuals shall be submitted to the contracted administrator for comment, not less than 4 weeks prior to practical completion with 3 full and final sets of documentation provided at completion.

19.0 Builders work

The Contractor shall ensure that all builders work penetrations are identified early and accurately by the Mechanical and Contractor. The contractor shall be responsible for detailing all builders work requirements associated with the installation of the above ground foul drainage, ventilation systems, dry riser installations etc as detailed within this specification.

The Contractor shall produce builders work drawings that show the requirements for building works necessary to facilitate the installation (other than where it is appropriate to mark out on site). This shall include the detailing of all holes through structural walls/slabs, through blockwork (where a lintel may be necessary) to be agreed with the design team.

The Contractor shall be responsible for cutting away and making good of all builder's work required.

20.0 Materials and Workmanship

All materials and equipment shall be new of the best quality, most suitable for the purpose specified and shall comply with all relevant British and European Standards Specifications. They shall be fully capable of withstanding variations of temperature humidity arising under working conditions without distortion or deterioration or the setting up of undue stress in any part, and also without affecting the suitability of the various parts of the works with which they have to perform.

The consulting engineer reserves the right to reject any part of the installation which is of inferior quality/standard and which does not comply with the complete specification, in which case the contractor shall carry out the necessary remedial work at his own expense, and without delay to the contract.

The complete works shall be carried out with due regard to the needs of inspection, cleaning, repair, replacement and the satisfactory operation under sudden variations of temperature, loading etc., as may be met under working conditions.

21.0 Co-ordination with Other Trades

In all areas such as false ceilings, builders work ducts, behind panels, in service corridors, on the roof level and any other location where differing services are run in close proximity, the contractor shall ensure that all services do not in any way impair or prevent the installation of other services.

The contractor shall also give particular attention to the requirement for the careful co-ordination of the services installation within the corridor.

Any alterations to the contractor's installations due to the lack of co-ordination on his part with other trades shall be carried out by the contractor at no additional cost to the Contract.

22.0 Maintenance Strategy

The Contractor shall include within his tender a separate figure for undertaking twelve months planned maintenance of all electrical systems within the building.

Refer to the Crookes Walker Electrical Standard Specification for the exact requirements.

The electrical services shall be designed with due regard for future maintenance. While sizing plant, the Contractor shall take into account the replacement and inspection and shall consider the application of standardised components wherever possible.

All health and safety risks to maintenance operatives shall be mitigated as far as is practicable and detailed method statements shall be included within the O&M manuals for all maintenance activities.

23.0 Plant Replacement Strategy

All heavy parts of plant shall be provided with some convenient means of slinging or handling during erection or overhaul, and items requiring extraordinary arrangements for removal for maintenance purposes shall be clearly identifiable, and detailed method statements describing the procedures required to carry out such works shall be included within the O&M manuals.

The Contractor shall allow in his tender for ensuring that all equipment which may require dismantling for normal routine maintenance purposes can be readily undertaken and the Contractor may be required to prove that dismantling and re-assembling can be carried out with a minimum amount of external work.

24.0 Economical life expectancy

The specified Mechanical and Electrical systems and plant equipment shall be in accordance with the following, which is taken from CIBSE Guide M- Appendix 12.A1

Type	Item	Typical Economic Life (Years)
Medium and low-pressure boiler plant	Steel boilers	15 to 20
	Sectional cast-iron boilers	15 to 25
Steel Chimneys		8 to 15
Heating Installations	Calorifiers and heat exchangers	20 to 25
	Control equipment	15 to 20
	Pipework installations	25 to 35
	Pumps	20 to 25
	Radiators, cast iron	20 to 25
	Radiators, steel	15 to 20
	Suspended ceiling heating	15 to 20
	Tanks (depends on material and location)	15 to 30
	Valves	20 to 35
Ventilation and air conditioning installations	Refrigerant plant, medium and large, compression and absorption	15 to 20
	Distribution systems	25 to 30
	Terminal units	15 to 25
	Cooler batteries	15 to 20
	Fans	15 to 20
	Heater batteries	15 to 20
	Package air handling units (under 35kW)	8 to 15
Laundries	Laundry plant (washing machines)	15 to 20
Kitchens	Cooking equipment	15 to 20
Electrical distribution network	Mains cables	25 to 30
	Switchgear and distribution equipment	25 to 30
Electrical installations in buildings	Final circuits and outlets	20 to 25
	Lighting installations	20 to 25
	Electric motors, etc.	20 to 25
Electrical generating plant	Generators	25 to 30
	Prime movers, diesel (continuously rated)	15 to 20
	Standby prime movers, diesel	25 to 30
Miscellaneous electrical equipment	Batteries, lead acid, sealed	Up to 10
		(static)
	Batteries, nickel alkaline, vented	20 to 25
	Call systems	20 to 25
	Clock systems	20 to 25
	Fire alarm systems	20 to 25
	Telephone systems	20 to 25

	Automatic temperature controls (including pneumatic)	15 to 20
Note: The above life estimates are based on good standards of plant maintenance		

25.0 Spares

The Contractor shall provide 5% spares with a minimum of 2 spares for the following items, but not limited to these:

- Lamps (All Types/Wattages)
- LED Luminaires
- MCBs (All Types/Ratings)
- Smoke/heat detectors
- Break glass points
- Socket Outlets
- Fused Connection Units
- Keys & Locks for all main switchboards and distribution boards
- Specialist tools as required
- Emergency lighting test keys (25 No.)
- Fire Alarm break glass test keys (25 No.)
- Access Control cards/fobs (100 No.)
- Carriage Truck for ACB's & Large Breakers (1 No.)

26.0 Schedule of Manufacturers

Electrical Services		
Item	Manufacturer / Supplier	Contacts:
LV Switchboard and Essential panel board	Devices / components – Schneider Electric	Chris Kennedy 07739 242776 chris.kennedy@schneider-electric.com
Consumer Unit & Switchgear	Schneider Electric	Chris Kennedy 07739 242776 chris.kennedy@schneider-electric.com
Surge Protection	Schneider Electric	Chris Kennedy 07739 242776 chris.kennedy@schneider-electric.com
Cable Trays	Swift – or equal and approved	
Trunking / Conduit	Walsall / Swift – or equal and approved	
Sub-Main Cables (BASEC Approved)	BICC/Batt Cables – or equal and approved	
Bus-bars	Schneider Electric	
Telephone Outlet	MK – or equal and approved	
Spur Unit	MK – or equal and approved	
Twin socket outlet And Combined Twin sockets outlets with integral USB	MK – or equal and approved	
Light Switch	MK – or equal and approved	
CCTV Equipment	Mayflex – or equal and approved	Mayflex Joseph McManus 07788 365070 Joseph.McManus@mayflex.com
Landlord Structured Cabling	Mayflex – or equal and approved	

Electrical Services		
Item	Manufacturer / Supplier	Contacts:
Door Access online and offline	NSP– or equal and approved	NSP Jonathan Moxham 0287360380 j.moxham@nspsecurity.com
Lighting	Whitecroft Lighting, Thorn, Luxonic – or equal and approved	Tim Clark 07711 053 864 Tim.Clark@whitecroftlight.com
Emergency Lighting	Whitecroft Lighting, Thorn, Luxonic – or equal and approved	Tim Clark 07711 053 864 Tim.Clark@whitecroftlight.com
External lighting	TBC	
Disabled Refuge and Disabled Toilet Alarms	Protec– or equal and approved	Mike Lythgoe 07973 663941 Mike.Lythgoe@protec.co.uk
Fire Alarms	Protec– or equal and approved	Mike Lythgoe 07973 663941 Mike.Lythgoe@protec.co.uk
Lightning Protection Installation	BEST	Nicholas Gill 0161 655 3000 ngill@bestservices.co.uk
PV Installation	IGen-Energy	Peter Hewart 07960348438 / 01615071593 phewart@igen-energy.com

Mechanical Services		
Item	Manufacturer / Supplier	Notes/Contact Details
Car Park Ventilation	Colt International Limited	Lee Metcalfe – 07515 197954
Core Smoke Ventilation	Colt International Limited	Lee Metcalfe – 07515 197954
Air Handling Plant	Air Source (Manchester) Swegon Dalair	
Sprinkler Systems	Pyro Protection Limited Hall and Kay	Tel: 01457 879222 Tel: 0161 872 7316
Boiler Plant	Lochinvar	
Pumps	Grundfos Armstrong	
Radiators	Stelrad	
Pressurisation Unit	Grundfos Mikrofill	
BMS/Controls	Trend Based System	
Water Storage Tanks	Decca Plastics	
Booster Sets	Grundfos	
Syphonic Drainage	Polypipe	

Appendix 1 – CDM Risk Assessments

Appendix 2 – Tender Summaries

Globe and Simpson (Building C) Summary of Mechanical, Electrical and Public Health Services Costs

App 2.1 Mechanical Services

Item	Description	Price £
	Preliminaries	
	Design	
	Mechanical & Public Health Installation Works	
	Incoming Gas and Water	
	LTHW Heating	
	Chilled Water Installation (Shell and Core)	
	Domestic Hot & Cold Water Services (inc Cat 5 system)	
	General Ventilation	
	Toilet and Bin Store Extract	
	Gas Installation	
	Dry riser	
	Smoke Control & Firefighting Lobby Vent	
	Car Park Ventilation	
	Above Ground Drainage	
	Syphonic Rainwater Drainage	
	Sump Pumps	
	Sprinkler Installation	
	BMS & Automatic Controls	
	Thermal Insulation	
	Builders work (BWIC)	

	Testing & Commissioning (including seasonal commissioning)	
	Telcom Data Room Cooling	
	Operation & Maintenance Manuals	
	FM Staff training	
	12 Months Maintenance	
	Any items not listed above (please specify)	
	Total	£

Mechanical Services Total in Words and figures _____

The above figure includes Main Contractors discount, profit and overheads but is exclusive of Value Added Tax.

Signature _____

For and on behalf of _____

Address _____

Date _____

App 2.1 Electrical Services

Item	Description	Price £
	Preliminaries	
	Design	
	Electrical Services Installations	
	Incoming Utilities	
	Life-safety / Standby Generator	
	Main LV Switchgear (including rising busbar & DB's)	
	Submain Distribution	
	Power cabling to all mechanical plant, equipment and ancillary services	
	Containment systems	
	General Power	
	General & Emergency Lighting	
	External Lighting – Building mounted and public realm	
	External Lighting – Art Wall Lighting provision	
	Lighting Controls	
	Telecoms (Data / ICT cable installation (including passive equipment, comms & hubs)	
	Fire Detection and Alarm System	
	Disabled Refuge Alarm / Comms System	
	Security Installation (including Access Control, CCTV, Intercom & Intruder)	
	Earthing & Bonding	
	Lightning & Surge Protection	
	Lifts (power supplies / security / access / controls interface)	

	PV System	
	Builders work (BWIC)	
	Testing & Commissioning (including seasonal commissioning)	
	Operation & Maintenance Manuals	
	FM Staff training	
	12 Months Maintenance	
	Any items not listed above (please specify)	
	Mobile phone signal survey prior to PC	
	Substation electromagnetic field study	
	Additional measures to reduce the Magnetic field levels from substation to room above	
	Total	£

Electrical Services Total in Words and figures_____

The above figure includes Main Contractors discount, profit and overheads but is exclusive of Value Added Tax.

Signature _____

For and on behalf of _____

Address _____

Date _____

App 2.2 Acknowledgement of Tender Addenda

During the Tender Period we understand that it may be necessary to issue revised or additional information in the form of a 'Tender Addendum'.

We hereby acknowledge, where applicable, that the following Tender Addendums have been received and incorporated, without qualification, into our tender offer

	Acknowledgement of Receipt		Incorporated Without Qualification into Tender Offer	
	Date	Signed	Date	Signed
Tender Addendum No. 1				
Tender Addendum No. 2				
Tender Addendum No. 3				
Tender Addendum No. 4				
Tender Addendum No. 5				