

JD Sports HQ, Bury, Hub (Phase 2)

Building Services – Performance Specification Part B

JD Sports Fashion Plc

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1.0

General Requirements

1.0 General Requirements

1.1 Introduction

This Performance Specification details the proposed design intent and performance requirements for the Mechanical, Electrical, Public Health (MEP), Controls, and Utilities required for the JD Sports HQ Hub building, Bury, Manchester and associated site works.

The JD Sports HQ site as a whole is to be delivered across two phases of works, of which this Performance Specification and associated drawings, schedules, and reports, details the Phase 2 performance requirements only. Each Phase of works is to be Tendered, programmed, and delivered separately. No works associated with Phase 1 to be included for within this Tender return.

Phase 2 includes the provision of a 3 Storey office building (Hub) and associated roof plant, carparking and landscaping around site, and MUGA pitch and paddle tennis court. Refer to the Project Managers (PM) project preliminaries and Architectural plans for site phasing.

Clearing of the site of existing statutory utility service connections, removal of any private utilities, and removal of existing buildings is being facilitated as an enabling works package by others.

No allowance shall be made within this Tender return for the enabling works, however, make due consideration and allowances in relation to an existing high pressure Cadent Gas main that is to remain in situ, traversing the North East corner of the site. Refer to the MEP and Main Contract Preliminaries for details along with the Stats mapping data and GRP / electromagnetic survey information for details. Request from the PM if not provided in the tender documents.

This Performance Specification is to be read in conjunction with the Mechanical, Electrical, Public Health, and site utilities design intent drawings, the MEP and Controls Workmanship Specifications, MEP Preliminaries and all other documentation including, sustainability, civil, structural, architectural, landscape, acoustic, vertical transportation, and fire disciplines, as well as the Main Contract Preliminaries and planning requirements.

The MEP requirements of this project are to design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, set to work, and demonstrate the complete Mechanical, Electrical, Public Health, Utilities, and Controls services to meet the requirements of this Performance Specification, the Materials & Workmanship Specifications, MEP Preliminaries and separate MEP design intent drawings and schedules.

The proposed works are to be carried out as a Design & Build (D&B) contract. The Contractor is responsible for the final design, sign off, co-ordination, supply, installation, testing, commissioning, setting to work, and demonstration of all elements of works to provide the Client with a fully operational system, finalising the design from its current level of information and detail.

Where Mechanical, Electrical, Public Health and Controls Services sizes have been indicated on the design intent drawings or within this Performance Specification, they should be treated as approximate to assist with Tendering. The Contractor shall validate and finalise the design prior to installation.

This spec only covers phase 2 works. To be read in conjunction with the following documents.

- JDHQ-CDL-HB-XX-SP-CC-48301 - BMS Sequence of Operation
- JDHQ-CDL-HB-XX-SP-CC-48302 - BMS Controls M&W Specification
- JDHQ-CDL-HB-XX-SP-Z-90301 - MEP Performance Spec WIP
- JDHQ-CDL-HB-XX-SP-Z-90302 - Mechanical M&W Specification
- JDHQ-CDL-HB-XX-SP-Z-90303 - Electrical M&W Specification
- JDHQ-CDL-HB-XX-SP-Z-90304 - Building Services Preliminaries

1.2 Mechanical and Public Health

Works are to generally include, but are not limited to, the design, co-ordination, supply, installation, testing, commissioning, setting to work, and demonstration of the following.

General / Enabling Works / Utilities / Phase 2 Site

- Incoming Statutory Wholesome Mains Cold Water (MCWS) supply (from the United Utilities network to buried boundary meter (pulsed output) & chamber) to serve the Wholesome hot & cold water systems and the Non-Wholesome system (Cat 5).
- Incoming Statutory Fire Mains Cold Water supply (from the United Utilities network to buried boundary meter (pulsed output) & chamber) to serve mains fed Fire Hydrants (within 90m of the Hub).
- Below ground Fire Hydrants.
- Below ground Wash Down point (to External Bin Store).
- External water point / fountains along running track (see Landscape Architect information for details)
- Buried service / trenches around site.
- Connections to the Below / Underground Drainage (Civil design by Kennedy Redford).
- The inspection, testing, commissioning and certification, of all the various elements of the installation, including seasonal commissioning.
- The supply of all operating and maintenance instructions / manuals (O&Ms), as built drawings, EPC certificates, As Built Part L model, building logbook, and manufacturer's literature.

Phase 2 -Hub

- Above Ground Rainwater Systems (outlet / downspout positions by Architect)
- Above Ground Foul Drainage Services (inc. showers, sinks, wash hand basins, WCs, gullies, water heaters, condensate, kitchen, café, kitchenettes, white goods etc.)
- Domestic Hot & Cold-Water Services (inc. showers, sinks, wash hand basins, white goods, Zip taps, Kitchen, Café, central storage hot & cold-water storage and booster sets etc.)
- Category 5 Water Services (inc. Packaged break tanks / booster, bib taps, wash down points etc.)
- Heating Systems (inc. VRF Condensers, Air Source Heat Pumps, pumps, buffers, radiators, FCUs, AHU built in VRF heat pumps, anti-condensation heaters, frost protection, trace heating etc.)
- Cooling Systems (inc. VRF Condensers, FCUs, DX / VRF, and AHU built in VRF heat pumps.)
- Mechanical Ventilation Systems (inc. Central AHUs, attenuators, cross talks, VAVs, grilles, diffusers, louvres, ductwork etc.)
- Natural Ventilation Systems (inc. Actuated / automated high-level windows, plant room louvred doors etc.)
- Fire stopping (inc. fire collars, fire/smoke dampers etc.)
- Metering (inc. water, heat, electric etc.)
- BMS.
- Associated BWIC proposed works.
- Flushing, cleaning, chlorination, and water treatment etc.

The complete works, installation and final system(s) and commissioning are to conform fully with the latest editions of the relevant British Standards and Statutory Instruments, including but not limited to:

- British Standards and BS Code of Practice.
- Building Regulations (latest versions).
- Design Guides e.g. CIBSE, CIPHE (formerly IoP), etc., incl. Technical Memoranda (HVCA & BSRIA).
- Local and Statutory Authority Requirements.
- BCO, inc. 2013 updates.

- Supply Authority Regulations.
- Commissioning Codes (CIBSE and BSRIA).
- IGEN, WRAS, NJUG.
- United Utilities design and workmanship standards.
- Guidance on Self-Lay Design, Permissible Materials, and Construction Arrangement.
- CE Marked (all equipment).
- HSE guidance.
- The Construction Design and Management Regulations (CDM).

The editions of the above documents listed throughout this document are correct at the time of writing however the installation must be undertaken in accordance with the document edition current at the time of installation.

Where requirements differ between any of the above documents then this should be brought to the attention of the PM who shall adjudicate.

In the event that legislation standards or industry guides referred to in this document are found to be out of date or superseded by a new document, the Contractor is required to utilise the most recent revision or latest replacement document.

1.3 Electrical Services

Works are to generally include, but are not limited to, the design (where applicable), supply, installation, testing, commissioning, setting to work, and demonstration of the following.

General / Enabling Works / Utilities / Site

- Incoming Statutory HV supply from Electricity North West (ENWL) to the onsite ENW substation.
- Future provision for a fibre link from an Openreach chamber on Pilsworth Road, comms ducts to be provided to the Hub building.
- Extension of the Fibre ring link from the existing JD buildings, Edinburgh House and Balmoral House.
- Comms, Security, External Lighting and EVC LV ducts to be extended from a manhole chamber on the boundary of the phase 1 development.
- The inspection, testing, commissioning and certification, of all the various elements of the installation, including seasonal commissioning
- The supply of all operating and maintenance instructions / manuals (O&Ms), as built drawings, EPC certificates, As Built Part L model, building logbook, and manufacturer's literature
- Incoming HV supply duct routes
- External LV supplies duct routes (Mechanical Plant, External Lighting, Security barriers, EVC's etc.)
- External lighting
- Access control for Vehicle Barrier and Pedestrian Gates
- Intercom Systems to link the existing pavilion building to the Vehicle Barriers and Pedestrian Gate
- External CCTV

Hub

- LV Switchgear (new Panelboard located within the Plantroom / Switchroom)
- Back-up Generator for whole building
- LV distribution and containment
- General small power, including supplies to mechanical equipment
- Containment systems
- General Lighting

- Lighting Controls
- External Lighting
- Emergency Lighting
- ICT infrastructure and structured cabling
- Fire detection and alarm system
- Security/Intruder Alarm
- Access control
- CCTV
- Intercom Systems to link reception to the main entrance.
- Disabled toilet alarm system
- Disabled Refuge Alarm System
- Hearing Aid/Induction Loop System
- PV Systems
- Earthing and bonding
- Lightning protection
- Fire stopping (inc. fire collars, fire/smoke dampers, fire curtains, gas suppression etc.) (CDP)
- Metering (inc. water, heat, electric etc.)

The complete works, installation and final system(s) and commissioning are to conform fully with the latest editions of the relevant British Standards and Statutory Instruments, including but not limited to:

- BS 7671 - The IET Wiring Regulations, latest edition
- British Standards and Building Services Applications, Codes of Practice and Building Regulations
- CIBSE Guides and Technical memoranda
- BSRIA Guidelines
- CIBSE SLL Code for Lighting (2022)
- BS EN 12464-2: Light & Lighting: Lighting of Workplaces, Outdoor workplaces
- BS EN 12464-1: Light and Lighting – lighting of workplaces. Indoor Workplaces
- CIBSE SLL LG6: The Exterior Environment
- CIBSE SLL LG7: Offices
- CIBSE SLL LG14: Control of Electric Lighting
- CIBSE SLL LG16: Lighting for Stairs
- CIBSE SLL LG12: Emergency Lighting
- BS EN 1838: Lighting applications – Emergency lighting
- BS EN 5266: Emergency Lighting
- BRE Digest 498 – Lighting Control
- Electricity at Work Act 1989
- CE Marked (all equipment)
- Health and Safety at Work Act 1974
- Equality Act 2010, including Part M
- Building Regulations
- Construction Design and Management (CDM) Regulations (2015)
- Code of Practice for fire safety in design BS 9999
- NACOSS Code of Practice

- Local and Statutory Authority Requirements, including the Local Authority Fire Officer, the Local Fire Brigade and the Local Police Force Policies.
- Supply Authority Regulations.
- Commissioning Codes (CIBSE and BSRIA)
- The Fire Strategy
- NICEIC guidelines

The editions of the above documents listed throughout this document are correct at the time of writing however the installation must be undertaken in accordance with the document edition current at the time of installation.

Where requirements differ between any of the above documents then this should be brought to the attention of the Contract Administrator who is to adjudicate.

In the event that legislation standards or industry guides referred to in this document are found to be out of date or superseded by a new document, the Contractor is required to utilise the most recent revision or latest replacement document.

1.4 Controls and BMS

Works are to include, but are not limited to, the design, co-ordination, supply, installation, testing, commissioning, setting to work, and demonstration of the following systems:

- A central BMS controls system (Trend IQ4 or Tridium, open protocol system)
- Satellite outstations
- Local controls

Provide all Works associated with any aspect of Mechanical or Electrical controls in accordance with the separate Controls Performance Scope document and any controls requirements detailed within each separate system section.

1.5 Fire Protection

Refer to the Fire Consultant and Architect's documentation and drawings for details of the fire strategy. The final design and installation is to be fully compliant with the fire strategy. All service penetrations through fire compartments to be suitably fire stopped with appropriate access for maintenance and reset.

1.6 Existing Site and Services

All existing buildings on the site are to be made safe and demolished prior to construction (by others) as part of an enabling works package.

Clearing of the site of existing statutory above and below ground utility service connections, and removal of any private utilities is being facilitated as an enabling works package (by others).

Stats mapping data was requested from the various statutory utility providers with assets in the surrounding area, in particular along Pilsworth Road and Hollins Brook Way, which was received in February 2022.

Stats mapping data confirmed that an existing 406mm Cadent Gas High Pressure (HP) pipeline currently runs across the North East corner of the site as shown below. It is intended to retain the pipeline in situ, with the development designed and installed around the pipeline in full compliance with the Cadent Gas guidance documents.

A 9m/30ft either side no dig zone is applicable, based on information provided by Cadent Gas and within the conveyancing information provided with the land sale. In order to carry out any works above the area of the pipe and the no dig zone, including any changes of level, it will be necessary to gain approval from Cadent Gas for the proposals.

Adequate protection is required above the pipelines in accordance with Cadent / National Grid standards (T/SP/SSW/22 and T/SP/CE/12 National Grid guidance documents).

Initial dialogue and correspondence with Cadent Gas has commenced and is ongoing. Due allowance to be made within the Tender return for liaison with Cadent Gas, any protection required, and for any Cadent Gas site monitoring required.

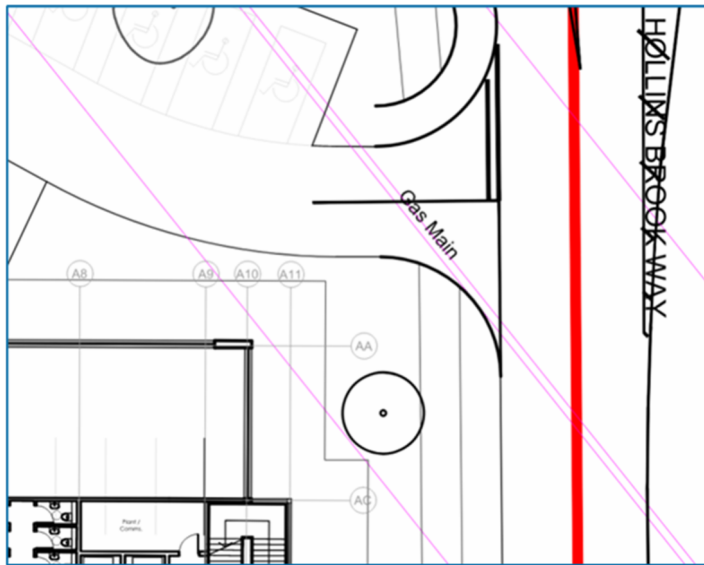


Figure 1-1: Cadent Gas HP Pipeline

Prior to starting works on site, due diligence checks and surveys are to be carried out by the Contractor, as necessary, to validate and confirm the site is clear, including procuring their own GPR / electromagnetic survey if existing surveys are over 6 months old (HSE requirements).

Contractor is to refer to the GPR survey by others which indicates various LV/HV cables situated within the ground following the demolition of the previous building. The contractor is to test these cables to ensure they are dead then cut them back to the site boundary and label accordingly.

Obtain and refer to the existing utility drawings and documentation relevant to the site to help verify the precise details of any existing utility services. Obtain and refer to GPR survey reports and drawings for details of any other existing buried services on the site as a whole.

Visit site during the Tender period in order to familiarise with the site and any associated constraints.

1.7 Road Widening Works

There are a number of known utility company assets within the footpath which are affected by the proposed works to provide a new entrance, widen the existing site entrance, and widen Pilsworth Road.

The Highways Consultant (Eddisons) is responsible for carrying out the highways design and TPS is responsible for all associated utility company diversion applications as part of their scope of services. Refer to their design information and the utility tracker for details. Request from the CA if not received as part of the tender documents.

Currently known utility providers affected include:

- United Utilities – lowering/relocating services within the footpath
- Instalcom (CenturyLink) – lowering/relocating services within the footpath
- Vodafone – lowering/relocating cables in the footpath installed within ducting belonging to Virgin Media
- Virgin Media – lowering/relocating cables and ducts within the footpath
- Openreach – lowering/relocating cables and ducts within the footpath
- ENW – lowering/relocating cables within the footpath

1.8 Utilities

All statutory utility final applications, procurement, and management to and on site etc. by the Contractor (Utility quotations are to be paid directly by the Client).

The following utility provisions are to be provided to the site:

- Wholesome water supply
- Fire hydrant supply
- Power
- Comms

1.9 Due Diligence

As part of this project, a number of due diligence checks must be carried out prior to starting the works, including the following:

- Obtain the latest architectural, civil, structural, fire strategy, landscaping etc. drawings, specifications and reports which must be fully complied with.
- Obtain the stats mapping data, and the GPR & Electromagnetic survey information, in particular in relation to the retained high pressure Cadent Gas main.
- Obtain any existing site information.
- Visit site and ascertain any site-specific constraints that may affect the installation, including understanding when noisy works can be carried out, disruption, and downtime challenges associated.
- Refer to design team joint designer's risk assessments and update these as necessary to reflect the final designs and installation.
- Refer to the design team joint access and maintenance strategy.

Should any of the above assessments/investigations highlight any untoward issues with the existing site they are to be brought to the attention of the Client's design team, who in turn are to inform the Client.

1.10 RAL Colours

Liaise with the Interior Designer, Architect and Client team over final required RAL colours of any visible services.

Generally, all exposed ductwork (internally lined / insulated – Client requirement) and tray work is to be galvanised finish (except the gym which is to be sprayed). Exposed pipework to be foil faced insulation finish (sprayed in gym).

Generally, all electrical containment is to be galvanised finish, and all electrical equipment is to be black in colour.

All grilles and diffusers are to be RAL coloured to suit the ceiling / raft / soffit colour they are mounted within. Make due allowance within the Tender return for all visible grilles, diffusers, and facias to be colour matched accordingly. Refer to the Interior Designer's and Gym Specialist designer's final packages for final RAL colours.

1.11 Phasing

Refer to the Main Contract Preliminaries for proposed phasing of the works. The works associated with this Performance Specification relate to Phase 2 only.

2.0

Design Philosophy and Criteria

2.0 Design Philosophy and Criteria

2.1 Introduction

This Performance Specification is to be read in conjunction with other MEP documents, Interior Design, Architectural, Civil, Structural, Landscape, Acoustic, Fire, Planning and any other Consultants reports, drawings, specifications, and any other relevant documentation prepared by the other members of the design team.

2.2 Section sub-heading / Heading 2 Design Philosophy

The design philosophy has the following, but not limited to, key MEP design aspects:

- A fabric first approach. Energy efficient fabric design, including a well-insulated and sealed building minimising solar gains, fabric heat loss, and infiltration losses.
- Ventilation (AHU with local VAVs) and natural ventilation (motorised natural ventilation actuated openings).
- Flexible, controllable and energy efficient engineering systems to provide final environmental control (such as ASHPs and low flow & return temperatures, low fan energy & low embodied carbon FCUs).
- A building that is easy to operate and maintain and to adapt for changing occupancy needs.

2.3 Flexibility

The building services are to be flexible, adaptable, and easily accessible for service and maintenance.

2.4 Resilience/Backup

- Domestic Hot Water: Modular air source heat pumps and buffers are proposed, reducing the impact of individual module failure on the building heating / units going into defrost.
- Pumps: Where pumps are provided, duplicate pumps are to be provided giving 100% standby capacity.
- Water Booster Sets: Central booster pumps sets are to be provided as duty, assist(s), standby or duty, standby to allow continuity of service in the event of a single pump failure.
- Water storage tanks: Central sectional water storage tanks are to be split / sectional to allow continuity of service in the event that one half of the tank being out of operation due to cleaning or fault. Twin raised ball valves to also be provided.
- Emergency Lighting: The emergency lighting system is to provide a minimum of 3 hours battery backup, during mains failure mode.
- Comms: All external and internal fibre connections will be routed to ensure diverse routes.
- Generator: Back-up generator to provide back-up power to the whole Hub building.

2.5 Energy Efficiency

- No reliance on natural gas.
- Optimised façade to maximise daylight whilst minimising solar gains and heat loss. Thermal insulation levels for all building elements are enhanced beyond minimum Building Regulation standards, thereby substantially reducing the building's heat losses.
- Air tightness prioritised with low levels of permeability preventing heat loss via uncontrolled infiltration.
- Flexible, controllable and energy efficient engineering systems to provide final environmental control.
- A building that is easy to operate and maintain.
- VRF condensers as the primary heating/cooling source
- Air Source Heat Pumps (ASHPs) as the primary heat source to the LTHW underfloor heating system.

- High temperature CO2 ASHP as the primary heat source to the domestic hot water system.
- Low fan energy (SFP) FCUs and AHUs.
- Heating and cooling pumps will incorporate inverter driven speed controllers, to ensure that water circulated for heating accurately matches requirements.
- Temperature control will be provided in each space (via the BMS and local control to cellular spaces).
- Energy efficient lighting and controls to be installed throughout (LED lighting).
- Heat recovery to AHUs.
- PVs.
- Metering, sub-metering, and monitoring in accordance with TM39. Whilst sub-metering itself does not save energy, it provides information about how much energy is being used and where it is being used. It is action taken as a result of installing meters and using the information the meters provide that can achieve quantifiable energy savings. Meters to be linked to the BMS for monitoring and analysis.

2.6 Maintainability

All plant and equipment are to be installed in accordance with manufacturer's recommendations, ensuring it can be accessed for maintenance. Plant replacement strategies are also to be in place.

The design of the MEP services follows the general principles below:

- Isolating valves to be installed, to permit local isolation of services, to avoid large sections of the building to be shut down in the event of a minor component fault. Where pipework is concealed in ceiling voids or in boxing, access is still to be provided by removable panels.
- Access and maintenance hatches are to be provided throughout, where required, to allow access to all services concealed behind fixed elements of the building. For example, services or MEP equipment located above plasterboard ceilings etc.
- Engineering services plant to be housed in dedicated plant rooms / external plant decks with adequate access for service and maintenance.
- Due consideration for general maintenance of each service is to be made when setting out and installing each MEP service.
- Access hatch to roof top plant deck.

2.7 Local Council Policy

The works are also required to comply with any local council policy.

2.8 Part L Compliance

The works are to comply with the latest version of The Building Regulations Approved Document L, Conservation of fuel and power, Volume 2: Buildings other than dwellings.

Provision of an Energy Performance Certificate is required at the completion of works. The Contractor is responsible for producing an as-built Part L model to prove compliance using approved software and for carrying out all required Building Control submissions for BRUKL and EPC, etc.

A RIBA 3 design stage assessment has been carried out by the design team. The Contractor is responsible for developing this through RIBA 4a onwards and providing all as-built modelling and final certification.

2.9 Mechanical and Public Health

The building services installations are to be designed / installed in accordance with British or European Standards and Legislation applicable under English Law. Where good engineering practice is not covered by British Standards or Legislation the relevant guides produced by the Chartered Institute of Building Services Engineers (CIBSE) apply.

The basis of design data has been taken from the following documentation (latest versions):

- British Standards and BS Code of Practice.
- Building Regulations (latest versions).
- Design Guides e.g. CIBSE, CIPHE (formerly IoP), etc., incl. Technical Memoranda (HVCA & BSRIA).
- Local and Statutory Authority Requirements.
- Supply Authority Regulations.
- Commissioning Codes (CIBSE and BSRIA).
- BCO Guide to Specification, including 2013 updates.
- IGEN, WRAS, NJUG.
- United Utilities design and workmanship standards.
- Guidance on Self-Lay Design, Permissible Materials, and Construction Arrangement.
- CE Marked (all equipment).
- HSE guidance.
- The Construction Design and Management Regulations (CDM).

2.10 External Design Parameters

	Summer	Winter
Outdoor Design Temperatures	29°C db, 19°C wb.	-4.0°C (saturated)
Outdoor Design Temperatures for heat rejection plant	35.0°C.	-10.0°C

Table 2-1:

- The above external parameters to be utilised for plant sizing.
- Manchester TRY (Test Reference Year) values to be utilised for energy calculations including future predicted climate change weather files.
- Manchester DSY (Design Summer Year) values to be utilised to assess overheating including future predicted climate change weather files.

2.11 Internal Design Conditions

	Winter	Summer	Relative Humidity
Open Plan Offices	20°C ±2°C	24°C ±2°C	Un-controlled
Cellular Meeting Rooms / Board Rooms / Private Office	20°C ±2°C	24°C ±2°C	Un-controlled
Breakout Areas	20°C ±2°C	24°C ±2°C	Un-controlled
Lecture Theatre	20°C ±2°C	24°C ±2°C	Un-controlled
Atrium / Pit	18°C ±2°C At occupied height	Mixed Mode / Natural Vent (see notes below)	Un-controlled
Toilets	18°C ±2°C	Un-controlled	Humidity stat
Change / Shower	22°C ±2°C	Un-controlled	Humidity stat
Gym / Studio	17°C ±2°C	18°C ±2°C	Un-controlled

	Winter	Summer	Relative Humidity
Restaurant / Cafe	20°C ±2°C	24°C ±2°C	Un-controlled
Small Teams Room	20°C ±2°C	Un-controlled	Un-controlled
Circulation	18°C ±2°C	Un-controlled	Un-controlled
Hub / Comms Rooms	22°C ±2°C	22°C ±2°C	Un-controlled
Podcast Studio	20°C ±2°C	24°C ±2°C	Un-controlled
Kitchen	18°C ±2°C	26°C ±2°C	Un-controlled

Table 2-2:

Notes:

The ± 2°C is the control 'dead band' for system reaction time / modulation.

Systems to meet the set point temperature at occupied level, however allowance in peak summer to reach 24+2 = 26°C (office / restaurant floors) where space temperatures are measured at ceiling void level (e.g. back of a FCU) where the space temperature at this height would naturally be higher than the space temperature at occupied level.

Internal design humidity: Not controlled (expected 40-60% RH based on UK environment and internal conditions).

When relying on natural ventilation, as part of a mixed mode strategy, the internal temperature should not exceed 25°C for more than 5% of the occupied hours and 28°C for more than 1%.

2.12 Building Fabric

The following building fabric performance is to be provided. In the case that final As Built performance levels do not meet the following minimum values, energy savings and performance are to be offset by enhancing other elements of the installation accordingly. See preliminary BRUKL for values modelled.

Fabric Detail	Design
Roof area weighted thermal conductivity, U-value (W/m²K)	0.14
Ground Floor area weighted thermal conductivity, U-value (W/m²K)	0.14
External Walls area weighted thermal conductivity, U-value (W/m²K)	0.18
External Doors area weighted thermal conductivity, U-value (W/m²K)	1.40

Fabric Detail	Design
External Windows & Roof Lights (including glazing, frame, and thermal bridging) area weighted thermal conductivity, U-value (W/m ² K)	1.40
External Windows & Roof Lights total solar transmission, effective G-value (%)	0.40
External Windows & Roof Lights Visual Light Transmission (%)	0.70
Infiltration rate (m ³ /(hr.m ²))	2.5 – 3.0

Table 2-3:

2.13 Occupancy & Ventilation Parameters

Refer to final Architectural General Arrangements for proposed occupancy levels.

Demand based mechanical ventilation systems to control to 800PPM.

Room	Occupancy	Minimum Ventilation	Noise Rating
Open Plan Offices	See Interior Design Plans	14/s/p supply & extract	NR40
Cellular Meeting Rooms / Board Rooms / Private Office	See Interior Design Plans Large boardroom to have a diversified occupancy of 70%.	14/s/p supply & extract	NR35
Podcast Studio	See Interior Design Plans	14/s/p supply & extract VAV dampers	NR25
Breakout Areas	See Interior Design Plans No doubling up of occupancy to open plan office areas and breakout / transient spaces (used by same people).	14/s/p supply & extract	NR40
Lecture Theatre	See Interior Design Plans	14/s/p supply & extract	NR30
Atrium / Pit	See Interior Design Plans Fresh air to be based on the 'day to day' occupancy rather than a brief 'town hall' event.	14/s/p supply & extract Mixed Mode / Automated Windows Extract at high level to balance with Supply to meeting/security room on ground floor	NR40

Room	Occupancy	Minimum Ventilation	Noise Rating
Toilets	N/A	6 ACH supply & extract	NR45
Change / Shower	N/A	6 ACH supply & extract	NR45
Gym / Studio	See Interior Design Plans	20l/s/p supply & extract	NR45
Restaurant / Cafe	See Interior Design Plans	14/s/p supply & extract	NR40
Small Teams Room	See Interior Design Plans	14/s/p supply & extract	NR35
Circulation	N/A	Natural infiltration 0.5l/s/m ² supply & extract	NR40
Hub / Comms Rooms	N/A	14/s/p supply only	NR45
Kitchen	N/A	Refer to Dine catering design canopy requirements.	NR55

Table 2-4

The above NR criteria are based on building services noise being constant. For variable air volume (VAV) and modulating terminal units, relaxation on NR levels appropriate for worst case peak conditions (to +5 dB relaxation at maximum design duty) to avoid overdesign, providing the design NR criteria is achieved under typical (non-peak) conditions. The Association of Noise Consultants Guidelines Part 1: Noise from Building Services 2011 says: "The typical duty may be taken to be that which is not exceeded for more than, say, 10 days of the year or 5 per cent of the operating time."

2.14 Efficiencies

	SFPs (W//s) and Efficiencies
AHUs	1.6 W//s

	SFPs (W//s) and Efficiencies
Heat Recovery	80%
Kitchen supply AHU	0.8 W//s
Kitchen extract	0.5 W//s
Local extract	0.3 W//s
ERP	2018
Ducted FCUs	0.3 W//s
Eurovent	Certified (heat recovery)
Filters (General)	To BS EN 16798-3

Table 2-5:

2.15 Ductwork Velocity

Maximum ductwork velocity as per CIBSE guide recommendations and / or to maintain noise levels in spaces served (more onerous of the two), typically as below

	Maximum Duct Velocities
Risers	< 6m/s
Main Branch from AHU	< 4m/s
Final 'Run-outs'	< 2.5m/s

Table 2-6:

2.16 Casual Gains

	Heat Gain (Sensible unless stated otherwise)
Lighting	6 W/m ²
Equipment in office areas	16 W/m ²
Occupants (metabolic)	90W (sensible) 50W (latent)
Solar Gains	To suit glazing G-value and calculated using IES or equivalent, approximately as below (perimeter 4.5m deep zones): North – 25W/m ² South – 60W/m ² East – 60W/m ² West – 50W/m ² Uplift for corner zones.

Table 2-7:

2.17 Water Services Design Parameters

Service	Temperature
LTHW F & R Temps	50/45°C Weather compensated F&R temperatures (directly at the ASHP) to improve efficiency mid-season.
Terminal Heat Loss Margin	15%
Diversity	100% No diversity to be applied to central plant sizing or pipework sizing.
Min Nominal COP (For Part L modelling only) – LTHW Heat Pump	3.47 To be based on the standard rating conditions stated in BS EN 14511-2 (7°C ambient, 45/40 F&R)
Min SCOP (For Part L modelling only) – LTHW Heat Pump	3.09 (mid-way between 2.88 (55 flow) and 3.31 (35 flow)) To be based on BS EN 14825 with average climate data; in conjunction with the Ecodesign Commission Regulation No. 2016/2281, at 45/40 F&R
Terminal Heat Gain Margin	15%
Diversity	85% Cooling diversity to be applied to central plant sizing and main riser pipework sizing. Final % based on Contractor's detailed design / IES modelling.
Min nominal EER / SEER – DX / VRF Cooling	EER 3.9 SEER 6
Min SCOP (For Part L modelling only) – DHW Heat Pump (QTon)	3.64
HWS Storage	75°C (Max storage) – all in accordance with the Water Regulations. Min 3000l storage volume (2No. 1500l tanks) in accordance with the QTon requirements, to suit final DHW demand. Water softening / conditioning to be provided to suit local water quality and QTon requirements.
HWS Outlet Temperature (at point of use)	38-41°C (at TMV3 Mixing Valve)
Cold Water Temperature	11°C (Max ideally), however this is ultimately dependent upon the temperature of the cold-water supply to site from United Utilities.
CWS Outlet Temperature (at point of use)	20°C max. (to comply with requirements of the Water Regulations & HSE ACoP L8 / HSG274 Part 2) however ideally no greater than 2°C difference to the temperature of the water entering the site.
Cold Water Storage (wholesome)	45 litres per person daily demand (based on a diversified occupancy of 1 person / 8m ²) 33% storage volume 2 hour refill rate Duty, assist, standby booster set All located in ground floor plant room
Cold Water Storage (Cat 5)	2No. packaged Cat 5 break tank & booster set, 1No. for roof plant, and 1No. for external bin store wash down (in GRP enclosure).

Service	Temperature
Maximum pipe-work velocities	up to 40mm dia: <1.0m/s
Maximum pipe-work velocities Above Ground Drainage	50mm dia to 80mm dia: <1.5m/s
Maximum pipe-work velocities Above Ground Drainage	100mm dia and above: <2.0m/s
	System III, as described in BS EN 12056-2:2000

Table 2-8

2.18 Utility Provisions

Service	Requirements	Statutory Network Provider
Wholesome Mains Cold Water (MCWS)	1No. metered MCWS (wholesome) to site boundary c/w pulsed output meter dedicated to the Hub building. 1No. metered MCWS (fire hydrant supply) to site boundary c/w pulsed output meter for site wide fire hydrant.	United Utilities Quotation ref: 02495697
Natural Gas	N/A	Cadent Gas Whilst no natural gas supply is proposed, contact will be required regarding the existing, retained high pressure gas main and associated plant protections. See the utility tracker for details.
Power	1No. 1000 kVA supply to serve the site. New HV substation located on site, tails to be terminated within the LV panel located within the ground floor switchroom.	Electricity North West Quotation ref: 5500233913H
Comms	1No. new Openreach Fibre to the Premises (FTTP) to terminate into the second floor comms room. The Hub building is to be connected to the wider JD fibre ring which includes the existing buildings and the creche.	Coordinated by JD

Table 2-9:

2.19 Acoustic Criteria (Building Services)

Refer to the separate Acoustic report and Architectural details for the proposed acoustic design criteria for each space. The final installation of the MEP services is to be fully compliant with the requirements stipulated within the Specification and separate Client consultant team documents.

Appropriate measures to be adopted to ensure that noise levels internally and externally are achieved. Measures to include, but not limited to, the following:

- Low noise equipment
- Anti-vibration mounts
- Double skin casings
- In duct attenuators
- Cross talk attenuation
- Flexible acoustic duct sections
- Low velocity
- Acoustic lagging and lining to ductwork (such as Mufti-lag where riser branches pass over cellular offices spaces)
- Plant screening

The final MEP design and installation is to achieve the required noise criteria and implement any necessary acoustic treatment required even if not specifically referred to.

2.20 Lighting Criteria (Building Services)

The lighting shall fully comply with the requirements of the Building Regulations Approved Document Part L2A, CIBSE Lighting Guides and all other statutory documents. The following lighting design parameters are set up for the general lighting design: -

Location/Space	Illuminance (Eav)	Uniformity	UGR	Controls	Working Plane
Open Offices	500lux	0.6	19	PIR presence & Daylight dimming	0.75m AFFL (task area)
Circulation/Stairs/Storage Rooms	100lux	0.4	25	Corridor hold (0700-1900) / PIR presence out of hours	0m AFFL
Lift Lobbies/Waiting Areas/Reception Circulation/Breakout	200lux	0.4	22	Corridor hold (0700-1900) / PIR presence out of hours	0m AFFL
WCs/Shower/Changing Rooms	200lux	0.4	22	PIR presence	0m AFFL
Plant Rooms	200lux	0.4	25	Manual switch / PIR absence	0m AFFL
Kitchens	500lux	0.6	22	Manual switch / PIR absence	0.75m AFFL (task area)
Meeting Rooms/Multi-Functional/Podcast Studio (house lighting) /Lecture Theatre	500lux	0.6	19	Scene Select Plate (SSP) / PIR absence	0.75m AFFL (task area)
Open Meeting/Collab Breakout	300lux	0.6	19	Corridor hold (0700-1900) / PIR presence out of hours	0.75m AFFL (task area)

Location/Space	Illuminance (Eav)	Uniformity	UGR	Controls	Working Plane
Teams Rooms/Catering Managers Office	300lux	0.6	19	PIR presence	
Reception Desk	300lux	0.6	22	Scene Select Plate (SSP) / PIR absence	0.75m AFFL (task area)
Print Zone	300lux	0.4	19	Corridor hold (0700-1900) / PIR presence out of hours	0.75m AFFL (task area)
Café	200lux	0.4	22	Corridor hold (0700-1900) / PIR presence out of hours	0.75m AFFL
Microwave Station Teapoints/Servery	300lux	0.4	22	Corridor hold (0700-1900) / PIR presence out of hours	0.75m AFFL
Shop/Display	300lux - TBC with Client	-	-	Scene Select Plate (SSP)	-
Gym (Lighting by Briggs Hillier)	300lux	0.4	22	TBC with Client	0m AFFL

Table 2-10

Emergency lighting will be provided throughout the building, designed to comply with British Standard BS 5266. The following lighting design parameters are set up for the emergency lighting design: -

Location/Space	Illuminance (Eav)
Defined Escape Routes	Not less than 1lux
Open Areas	Not less than 0.5lux
High Risk Task Areas	Not less than 10% of the average of the normal lighting at the location of the point of the risk; or 15lux minimum.

Table 2-11:

2.21 Fire Strategy (Building Services)

Refer to the separate fire engineering report for the proposed fire strategy.

The final installation is to fully comply with the requirements of the fire strategy. All service penetrations through fire compartmentation are to be adequately protected to maintain fire rating integrity.

2.22 BREEAM Rating

It is understood that there is no BREEAM rating is currently being targeted, refer to Kennedy Redford package for further information.

2.23 Energy Performance Rating

A minimum EPC rating of B is required. The Contractor is to provide the final As Built EPC

3.0

Detailed System Descriptions

3.0 Detailed System Descriptions

3.1 Incoming Utilities (Stats)

3.1.1 General

To facilitate the development of the JD Hub building, a number of statutory utility services are required to serve the Phase 2 element of the site, noting that Phase 1 and Phase 2 are to be served independently from each other.

New statutory utility service connections are to be served from the local utility networks, routed to site, and terminated at the site boundary, ready for extension in and around the Phase 2 site.

Quotations have been obtained for each of the required utility provisions to help inform the cost plan, however it is the responsibility of the Contractor to validate / update accordingly to suit the final design requirements.

No allowance is to be made within the Tender return in respect of payment of the firm quotations (to be paid directly by Client), however there should be due allowance made for the validation of the final peak loads / demand required, management of the various utility companies on and off site, including any common civil works, and ensuring overall programme delivery.

Include for liaising with the various utility providers and agreeing the final demarcation between where their works terminate and where the on-site utility works begin, ensuring the end Client is provided with a fully functioning and operational installation. It is the responsibility of the Contractor to ascertain the final demarcation, based on the final accepted firm utility quotations, and make sufficient allowances accordingly for the interface between the two elements of works. This is to include any necessary valve arrangements, such as isolation, double check valves, pressure reducing valves, etc. required by the utility provider at the site boundary, and access chambers, draw pits etc. No additional monies are to be awarded to the Contractor due to post Tender return ambiguity between them and the utility providers.

The following sections provide details of the proposed statutory utility service connections to be provided to the JD Hub building as part of Phase 2.

3.1.2 Mains Cold Water Service

Utility Providers

United Utilities are the local water network operator, who own and maintain the wholesome water network (and drainage network) in the surrounding area.

Point of Connection (POC)

The POC to the United Utilities network is to be from their local network along Pilsworth Road.

Requirements

The Phase 2 site is to be served with a single, bulk metered, wholesome water supply and a separate, dedicated, unmetered fire supply. All meters to be pulsed output for monitoring on the BMS.

The supplies are to be routed from the final POC to the site boundary complete with bulk fiscal meters. The meters are to be located at the site boundary within below ground chambers with suitable access and valve arrangements, ready for extension into the site.

3.1.3 Power

Utility Providers

The District Network Operator (DNO) is Electricity North West (ENWL) which operates the electrical network within the surrounding area.

Requirements

A Maximum Demand calculation has been carried out based on power densities listed within the BSRIA Rules of Thumb BG9/20211 and Stage 3 Mechanical Plant selections. It is anticipated that the site will require 1000 kVA served via a ENWL HV substation located within the Visitors Carpark. The substation will be owned, operated and maintained by ENWL.

Point of Connection (POC)

The POC to the ENWL electrical network shall be from their local network along Pilsworth Road.

3.1.4 Telecoms

The new fibre to the premises (FTTP) connection is to be supplied from the existing JD building as part of the wider JD fibre ring. The contractor is to liaise with the design team of the existing building refurbishment projects in Edinburgh/Balmoral house to confirm location of the fibre links. An existing BT Openreach fibre incomer that currently connects into Balmoral house is to be rerouted on Pilsworth Road to enter the Hub building, please refer to the site wide utility drawing for further details.

3.2 Site Wide Utility Infrastructure

3.2.1 General

As detailed within the sections above, quotations for statutory utility services have previously been obtained to provide new, dedicated, utility connections to serve the Phase 2 site.

Once finalised, the new utility connections are to be routed to site and terminated at the boundary, ready for extension in and around the site. The Contractor is to take overall responsibility and liaison upon appointment and to manage all works associated with bringing statutory utilities to site.

Statutory utility services are to be extended from the final boundary position, into the Phase 2 site, and routed to serve the various elements of the proposed site, as detailed on the accompanying design intent Tender drawings.

All associated private (downstream of utility meters) site wide infrastructure distribution (buried services) are to be provided from the agreed demarcation at the site boundary to each site structure, plant, equipment.

The following sections provide details of the proposed site wide infrastructure to be provided to the Phase 2 site.

All final setting out of ducts, pipework, cabling, and associated draw pits, chambers, and manholes are to be co-ordinated with the Structural and Civil Engineers, Landscape Architect, and Architect.

All ducts, pipework, and cabling to be slow radius bends, and also compatible with the cables contained.

All ducts are to be complete with draw wires.

Draw pits to be provided in all changes of ductwork direction, changes in gradient and at least every 50m (max) separation. Access chambers and manhole covers to be provided to all buried valves.

All ducts and pipework to be buried in accordance with NJUG and BSRIA BG37/2011 recommendations, any relevant 'self-lay' utility guidance from the stats, and to be installed to be self-draining away from the any buildings served and provided with sealed ends to avoid vermin.

All buried services to be laid on a minimum of 200mm deep bed of builder's sand or A10 material to BS EN 12602. All buried services to have a minimum 150mm deep cover of builder's sand or A10 material to BS EN 12602. Backfill to be compacted in layers of 250mm (max). Initial layer of 100mm. Do not use heavy compaction equipment.

Tracer tape to be installed above each buried service, approximately 200mm below finished floor level.

Cable protection covers to be installed above cable ducts.

3.2.2 Mains Cold Water Service (Wholesome)

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, flush, clean, chlorinate, set to work, and demonstrate a mains cold water service (MCWS) capable of providing an adequate supply of cold wholesome water to the Hub building and associated Phase 2 site, based on the design intent drawings and design parameters indicated within sections 4 and 5. In addition, a dedicated, unmetered mains pressure fire main is to be provided to serve a mains fed fire hydrant for the Phase 2 site.

A dedicated, metered, incoming mains cold water (MCWS) wholesome supply is to be provided to the Phase 2 site boundary. The utility fiscal meter is to be located within an external chamber on the boundary of the site to United Utilities requirements. An isolation valve and double check valve is to be provided at the site boundary. Pulsed output facility to the BMS is to be provided.

MCWS is to be routed from the boundary fiscal meter to the Hub building point of entry, before entering the building via a slow radius bend within the ground floor plant room (water tank room). The building entry MCWS is to convert from MDPE blue (Barrier Pipe) to copper pipework complete with stop tap, double check valves, pressure reducing valve, drain cock, strainer, sub-meter with pulsed output to BMS, and physical water conditioner (plant room).

3.2.3 Mains Cold Water Service (Fire Supply)

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, flush, clean, chlorinate, set to work, and demonstrate a mains fed fire hydrant, capable of providing an adequate supply of mains pressure water to a below ground fire hydrant outlet to the Phase 2 site, based on the design intent drawings and the design parameters indicated within sections 4 and 5.

A dedicated, unmetered (subject to network agreement), incoming fire main is to be provided off the local United Utilities network. The utility meter is to be located within an external chamber on the boundary of the site to United Utilities requirements. An isolation valve and double check valve is to be provided at the site boundary. Pulsed output facility to the BMS is to be provided (in the event United Utilities require the supply to be metered).

The dedicated fire supply is to be routed from the boundary to serve a fire hydrant outlet, located within 90m of the Hub building entrance. Final positions to be set out and agreed by the Contractor with the Fire Consultant and local Fire Service.

Fire hydrants are to be of the below ground type, located within dedicated chambers, with the following, but not limited to features:

- Dedicated below ground chamber and access manhole
- BS 750 : 2012, EN 1074 Parts 1 & 2, EN 14339:2005 compliant
- Insulated
- Fully maintainable
- Auto-frost drain valve
- Fixed stopper
- Corrosion resistant

All isolation points, and other valve arrangements, to be accessible via access chambers and manholes.

Where natural venting is not feasible, air valves must be installed with regard to the topography of the land.

3.2.4 Power

The incoming HV supply of 1000kVA for the site shall be taken from ENWL network located on Pilsworth road. ENWL will connect a new HV mains service cable to the existing network and install it to the substation. It is the contractors responsibility to instal the LV cables from the ENWL LV cabinet located within the substation to the main LV panel.

The Contractor shall be responsible for the onsite excavations and reinstatements up to the ENWL boundary including rigid ducts in line with ENWL requirements. ENWL shall be responsible for excavations and reinstatements from the site boundary back to the POC.

Refer to ENWL drawings which details ENWL and the Customer (Contractor) responsibilities.

Refer to Cundall Combined Sitewide External Utility Service drawing for the proposed underground routes.

The phase 2 site houses a ENWL substation where the new electrical transformer shall be installed.

The incoming LV supplies shall be installed within underground ducts and enter the switch room from the North elevation.

The Contractor shall liaise with ENWL and ensure any expired quotations are updated.

The contractor is to confirm the details of Electric Vehicle Chargers and/or heat pumps etc or other low carbon technologies or motor loads that may be adopted. On acceptance there is a requirement for a full harmonic study by the contractor to ensure the proposed equipment is within G5-5 limits. Manufacturers details of the finally selected equipment will be required post acceptance and this quotation is subject to the necessary post acceptance studies to be carried out by the contractor including Harmonics, G55 and Flicker (P28).

3.2.5 Data Comms

The Contractor shall be responsible for the onsite excavations and duct laying to enable a new fibre links to the building. The Contractor will ensure the incoming fibre links are diverse, with two entry points via the LV switchroom and the Ground Floor South riser. The fibre shall route through the Hub building in a diverse route and towards the first floor comms room. Refer to Cundall External Utilities Services Phase 2 drawing for the proposed external route – the new connections will be established from Edinburgh and Balmoral House. The Contractor will also be responsible to install a new communications supply from BT/Openreach manhole chamber located on the Pilsworth road to the Hub building, the client has been in communication with the network provider to relocate one of the two current fibre supplies to the Hub building.

Install, test and commission the complete end to end fibre link.

3.2.6 External Lighting

Supply, install, test and commission an external lighting infrastructure to cover the external lighting at the external areas, as shown on the Cundall Stage 3 External Lighting Layout and described within the associated Cundall External Lighting section of this specification

The external lighting cabling is to be routed utilising the external lighting ductwork network, consisting of external lighting ducts, the contractor is to make an allowance for the quantities and location of the external lighting ducts.

Below the formation of the trench, refilling is to be compacted in layers no greater than 150mm.

Backfilling is to be undertaken immediately after the work has been completed.

Backfill within 450mm of the pipe crown is to be carefully placed and compacted in thin layers using hand tools. Fill above the initial 450mm layer shall be deposited in layers not exceeding 300mm loose depth and compacted to a dry density not less than the adjoining soil.

Mechanical compacting appliances may only be used on backfill above the initial 450mm layer.

Under carriageways, trenches above the initial 450mm layer are to be backfilled with 40mm all-in gravel aggregate to BS EN 1610, Table B17.

3.2.7 BMS Site Infrastructure

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, set to work, and demonstrate an optical Fibre Ethernet network infrastructure and all necessary plant control panels (PCP) outstations to

serve the site utility and sub-meters (pulsed output) and any other Phase 2 site wide ancillaries based on the design intent drawings and design parameters indicated within sections 4 and 5.

The BMS Infrastructure around the site is to be accommodated within the Comms ducts. See comms sections above. Refer to the separate BMS controls performance specifications for further details.

3.3 Mechanical and Public Health

3.3.1 Rainwater Pipework

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, set to work, and demonstrate a gravity rainwater drainage system capable of providing adequate roof coverage and drainage to the Hub building based on the Architect's drawings the design parameters indicated within sections 4 and 5.

All gutters are to be detailed, designed, and specified by the architect. All roof outlets from gutters are to be detailed, designed, and specified by the architect. If there should be any external rainwater pipework included, then this is to be detailed and specified by the Architect.

Roof drainage terminal positions and guttering have been indicated by the Architect. Provide a gravity rainwater pipework system to serve all roof levels for connection to the below ground drainage systems at ground floor level. Gutter connection locations as per the Architect's drawings / roof terminal locations.

All internal rainwater pipework is to be thermally insulated from the underside of the roof outlet, along the "horizontal" length to the vertical stack, where pipework is located within a habitable area. The length of insulation / pipework should be 3m min.; where this is not achievable, insulation should be provided to the vertical stack accordingly. This is to ensure that no condensation occurs on the pipework.

Base the rainwater drainage system on a Category Risk 2 design rate with a building life span of 60 years.

In order to minimise the risk of flooding to enter the building fabric due to either blocked outlets or rainfall intensities exceeding the selected design category, design and provide a minimum of 'N+1' outlets per respective roof area.

If necessary / required any weirs and / or overflows to a roof are to be specified and detailed by the architect.

Ensure that all internal rainwater pipework can withstand the head of water likely to occur in the event of a blockage.

Install all rainwater pipes to a gradient equivalent to 1 : 60, but to suit the individual flow characteristics of each rainwater pipe, to achieve a minimum self-cleansing velocity.

Make all branches to horizontal rainwater pipework at high level on any floor using 45° branches swept in the direction of flow. These branch connections are to incorporate swept and full radiused branches.

The use of short radius bends in the rainwater drainage above ground systems is not permitted.

Acoustically insulate rainwater pipes located in areas that have been determined as being "sensitive to noise", ensuring compliance with the requirements of the acoustic specialist. In addition, insulate high level rainwater pipework from the individual roof outlet upto the point at which the pipework connects to the primary rainwater stack, i.e. changes from the "horizontal" to the vertical stack, in order to minimise the risk of condensation forming / occurring on the pipework within any habitable room / corridor.

Install access doors / caps on rainwater pipework to facilitate rodding and maintenance access to installed pipework. Co-ordinate access through architectural casings with pipe accessories.

Provide access doors to all main rainwater pipes / stacks in accordance with the Building Regulations and BS EN 12056, as follows:

Vertically

1. at lowest floor level, at topmost floor level and at every 3rd level, as a minimum, located at finished floor level plus 1350mm at each installed position, to the centreline of the access fitting
2. provide additional access as Installers requirements, to facilitate access for testing

3. install access on vertical pipework above and below any offset

Horizontally

1. where shown on the public health systems drawings
2. all changes in direction

All rainwater pipework to be designed to drop within designated service ducts, risers, boxing in, or integrated ceiling voids. Co-ordinate removable access panels with the drainage access points to enable maintenance to rainwater pipework. Where pipework is designed to be exposed, install to a high standard, true to line, with adequate support fixings, in accordance with the requirements of BS EN 12056 and the manufacturer's recommendations.

Air test all rainwater pipework at various stages and on completion of the installation to ensure compliance with the requirements of the Building Regulations and BS EN 12056.

Carry out continuity bonding to all new metal drainage systems pipework and test to ensure earth continuity in accordance with BS 7671 and this specification.

Cast Iron pipework used for all primary stacks shall be labelled in accordance with the appropriate British Standard and shall include a British Kitemark to indicate the appropriate quality standard.

3.3.2 Foul Drainage Above Ground

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, set to work, and demonstrate a gravity foul drainage system to the Hub Building based on the design intent drawings and the design parameters indicated within sections 3, 4 and 5.

Provide all foul drainage above ground pipework to serve the sanitary appliances and other drainage outlets throughout the building, for connection to the below ground drainage systems at ground floor level, including the following, but not limited to:

Phase 2 Site

- Cycle Store Gullies

Hub

- WCs
- WHBs
- Showers
- Sinks
- Kitchen
- Café
- Brew Points
- Water points / vending
- White Goods
- Condensate
- Safety discharge
- Gullies (plant rooms, changing area, kitchen)

The above ground foul drainage system is to be based upon System III as defined in BS EN 12056-2:2000 with additional relief ventilation pipework provided as necessary and using the tabulated discharge units as shown in Table 2 within this BS EN document.

All primary stacks to be provided with vents to atmosphere.

Install all drainage pipework to convey discharges without cross flow, backflow, leakage or blockage. Adequately test, clean and maintain the systems at all times throughout the construction process, until the project is fully handed over.

Ensure the foul drainage above ground systems meets the requirements of BS EN 12056-2 and is based on the discharge unit method (DU). The frequency factor used in the flow calculations is taken from BS EN 12056-2 Table 3, but specifically as follows:

Usage of appliances frequency factor K

▪ intermittent use for residential/office/dwelling houses	0.5
▪ frequent use for hospitals/schools/hotels/restaurants	0.7
▪ congested use for public areas	1.0
▪ special use e.g. laboratories	1.2

For this type of development, a frequency factor of 0.5 is to be utilised.

Ensure that WC overflows are the internal / integral type, as permitted within the current Water Regulations.

The design of the underground drainage system(s) is to be undertaken by others, and all details relating to this drainage are to be provided by them. The above ground foul drainage is to connect to the underground drainage via connections / couplings provided by them. Any gullies, channels, outlets, pipework etc. at or below ground and lower ground floor slab level, is to be detailed and specified by the civil / structural engineer.

The foul drainage above ground system installation is to be based on the modified primary ventilated stack (System III) principles as defined in BS EN 12056-2, with additional relief ventilation pipework provided as necessary. Convey all effluent from the various sanitary appliances, drainage outlets, etc. by gravity to the various connections to the below ground drainage systems.

Provide adequate drainage facilities for the mechanical services equipment and plant. Discharge all drainage from plant rooms and mechanical equipment into floor gullies which are trapped using appropriate running traps (to reduce the risk on individual traps "drying out"), connected to the foul drainage above ground system.

Install all soil / foul "floats" above the level of the slab that it serves. Soil / foul "floats" below the slab level in ceiling voids are not acceptable.

Install WC outlets to the main discharge pipes utilising a uPVC manifold system. Ensure that the main floats have a minimum fall of 1 degree (18mm/m) and connect to the horizontal outlet of the WC's via purpose made and angled WC connectors. Ensure that the angle of each connector is specific to suit the location of the WC to the float height. Terminate access provision to the ends of WC floats above the spill over level of connected WC appliances on that floor. Do not use telescopic WC connectors.

The use of short radius bends in the foul drainage above ground system is not permitted.

Make all branches to horizontal discharge pipework at high level any floor using 45° branches swept in the direction of flow where possible. These branch connections are to incorporate swept and fully radiused branches.

Install all discharge pipework to a gradient equivalent to 1:60 (for a 100mm dia. nom. pipe size), but to suit the individual flow characteristics of each discharge / foul pipe, to achieve a minimum self-cleansing velocity. Where a 50mm dia. nom. pipe is utilised, the gradient should increase to an equivalent of 1:40.

Install access doors / caps on sanitary pipework to facilitate rodding and maintenance access to installed pipework. Co-ordinate access through architectural casings with pipe accessories ensuring that access to the pipe access door is unobstructed.

Provide access doors to all main / primary foul discharge pipes in accordance with the Building Regulations and BS EN 12056, as follows:

Vertically

1. at every floor level, located at finished floor level plus 1350mm at each installed position, to the centre line of the access fitting.
2. on stub stack connections at finished floor level plus 1350mm to the centreline of the access fitting or above the fittings spill-over level

3. as required to facilitate access for testing
4. on vertical pipework above and below any offset

Horizontally

1. where shown on the public health systems drawings
2. all changes in direction
3. on all horizontal floats (use of “standpipe”)

Ensure all traps to appliances have deep seals in compliance with BS EN 12056 and the Building Regulations.

Where ventilating pipework is necessary to suit either the below or the above ground drainage systems, terminate through the roof to meet architectural and technical requirements.

Install all discharge and ventilation pipework installation within designated service ducts or integrated ceiling voids. Co-ordinate removable access panels with the drainage access points to enable maintenance to discharge pipework. Where pipework is designed to be exposed, install to a high standard, true to line, with adequate support fixings.

Test all discharge and ventilation pipework at various stages and on completion of the installation to ensure compliance with the requirements of the Building Regulations and BS EN 12056.

Continuity bond and test all new metal drainage systems pipework to ensure earth continuity in accordance with BS 7671 and this specification.

All primary and secondary stacks are to be labelled in accordance with the appropriate British Standard and include a British Kitemark to indicate the appropriate quality standard.

Where plastic soil / foul vent pipework penetrates fire compartment walls or floors, proprietary intumescent collars / sleeves are to be fitted to maintain compartment integrity.

Copper sleeves are to be provided to plastic waste pipework below 50mm diameter, where penetrating fire compartment walls.

Provide condensate drainage for the mechanical services equipment and plant. All condensate drainage from mechanical equipment is to be gravity falls to drain (preferable) complete with HepVo waterless traps. All safety discharge valves are to discharge to drain via a tundish.

Any tea point water boiler / chiller taps to be provided with matching font drains to the Interior Designer's specification.

Allowance should be made for boxing out and acoustically insulating the stacks to the Interior Designer's detail and any acoustic requirements.

3.3.3 Domestic Cold-Water Service (Wholesome)

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, flush, clean, chlorinate, set to work, and demonstrate a boosted cold water service (BCWS) capable of providing an adequate supply of domestic cold wholesome water to the Hub building based on the design drawings and design parameters indicated within sections 3, 4 and 5.

A dedicated, metered, incoming mains cold water (MCWS) supply is to be provided. The utility fiscal meter is to be located within an external chamber on the boundary of the site to United Utilities requirements. An isolation valve and double check valve is to be provided at the site boundary. Pulsed output facility to the BMS is to be provided.

MCWS is to be routed from the boundary fiscal meter to the Hub point of entry, before entering the building via a slow radius bend in an agreed location.

The building entry MCWS is to convert from MDPE blue (Barrier Pipe) to copper pipework complete with stop tap, double check valves, pressure reducing valve, drain cock, strainer, sub-meter with pulsed output to BMS, and physical water conditioner upon entering the building / plant room.

External water bottle filling stations (no hose union tap) to be served from the MCWS with isolation and double check valves.

Washout valve arrangements are to be provided to allow operational flushing of sections of buried pipework and to allow a full drain down of the buried water station pipework during the winter months. Washout points to be provided on the end of branch mains and every 250m.

Central Plant

The cold water is to be delivered to a central 'wholesome' sectional and split cold-water storage tank installation, located within the ground floor plant room.

The water storage tank is to be provided with the following, but not limited to, features:

- Sectional / split tank (minimum of 2 sections, to allow half to be drained and cleaned in isolation to the other)
- Thermally insulated
- Externally flanged sections on raised piers
- Raised ball valve access chambers
- Vent cowl
- Keraflo Aylesbury twin disc delayed action valves (variable)
- High & low-level alarms
- Temperature gauges
- Constant read contents gauges
- Overflow & overflow warning pipes
- Inlet & outlets to be arranged to promote cross flow and avoid water stagnation
- BMS sensors
- Drain cocks

A 'wholesome' cold-water booster set is also to be provided within the plant room to serve the 'wholesome' domestic cold-water to the Hub, complete with duty, assist, and standby pump operation.

The 'wholesome' cold-water booster set is to be sized to accommodate the peak draw off demand requirements of the Hub based on the performance requirements of this specification and final interior design, using an effective / diversified occupancy density rather than actual workplace occupancy density.

The booster set is to be of the packaged type, provided with the following, but not limited to, features:

- Duty / Assist / Standby pumps (3 pumps minimum)
- Inverter driven VSDs
- Hydraulic Accumulator vessel
- NRVs, IVs, PRVs etc.
- Control panel and associated integrated controls c/w 'Hand' 'Auto' 'Off' switches
- Anti-vibration / flexible connections.
- Fully WRAS approved (listed within the latest WRAS Products and Materials Directory)
- Soft fill mode
- Vacuum breakers
- BMS interface

From the plant room, BCWS is to be distributed throughout the Hub building to serve the various sanitary outlets, generally as below:

Hub

- WCs
- WHBs
- Showers
- Sinks
- Kitchen
- Café
- Brew Points
- Zip Taps
- White Goods
- Pressurisation units
- Domestic hot water generation
- CAT 5 units

The following volumes and flow rates are to be adhered to in the final sanitaryware proposed. Where sanitaryware proposed doesn't meet the below 'as standard', include for flow restrictor devices accordingly to meet the reduced flow rates (as applicable):

- WC effective flush 3.75 litres or less
- Basin taps including DDA 5lpm or less at 3bar
- Showers 6lpm or less Flow rate of each shower at the outlet using cold water (T 30°C), in litres per minute measured at a dynamic pressure: 3 ± 0.2 bar (0.3 ± 0.02 MPa) for high pressure (Type 1) supply systems
- Urinal 1.5 l/bowl/hour or less
- Kitchenette tap 6lpm or less at 3bar
- Domestic sized dishwashers if specified 12 litres/cycle or less
- Washing machines if specified (assumed domestic type) 40 litres per use or less, commercial no more than 7.5 litres/kg

The water meter installations are to include pulsed output for connection to the BMS system to log water consumption, monitor and for major leak detection purposes. The leak detection system is to be capable of detecting a major leak on the mains water supply within the building and between the building / external plant and the boundary meter. The leak detection system is to be:

- Audible when activated
- Activated when the flow of water passing through the water meter is at a flow rate above a pre-set maximum for a pre-set period of time
- Able to identify different flow and therefore leakage rates, e.g. continuous, high, and / or low level, over set periods
- Programmable to suit the owner / occupiers water consumption criteria
- Designed to avoid false alarms caused by normal operation

Flow control devices that regulate the supply of water to each WC area / facility according to demand are to be installed to minimise water leaks and wastage from sanitary fittings. Solenoid valves are to be provided on the main branches serving the various toilet / changing areas and brew points, café, and kitchen linked to local presence detection within each zone served. The presence detector (PIR) device is to detect occupancy or movement in an area to switch water on and turn it off when the presence is removed.

Anti-shock, air release, and vacuum breakers to be provided at the top of each riser.

Leak Detection

A leak detection system (in addition to the major leak detection via the BMS and solenoid / PIRs) is to be provided for the continuous protection from the risk of water and other liquids leakage within the following areas:

- Main Comms
 - Floor void and low level level sense cables around the Comms and Hub areas

The complete liquids leak detection system is to be based on a digital monitoring unit, addressable sense cables, jumper cables and all required auxiliary equipment. This system will detect and locate multiple leaks simultaneously as well as cable break faults. The digital monitoring unit panel is to be located within the plant room.

A remote sounder to be provided within the reception area complete with mute facility, to trigger in the event of a leak detected.

Sense cables are to be provided at finished floor level and within the floor void (separate circuits) beneath the relevant areas above.

The leak detection system is to be provided by TTK UK Ltd and of the FG-NET range or equal.

3.3.4 Domestic Hot-Water Service (Wholesome)

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, flush, clean, chlorinate, set to work, and demonstrate a domestic hot water systems capable of providing an adequate supply of domestic hot wholesome water to the Hub building based on the design intent drawings and design parameters indicated within sections 3, 4 and 5.

Domestic hot water is to be provided via a central domestic hot water storage system using high temperature (HT) Air Source Heat Pumps (ASHP) and storage cylinders / buffers and local electric point of use for boiled water, generally as below:

Central DHW

- WHBs
- Cleaner's sinks
- Kitchen appliances and sinks
- Café appliances and sinks
- Showers
- Brew Point sinks

Local Electric

- Tea Points – Zip tap boiled / chilled (specification by Interior Designer)

Central Plant

Central domestic hot water is proposed to be generated via high temperature Air Source Heat Pumps (ASHP) such as the Mitsubishi HI Q-Ton or Mitsubishi QAHV ASHPs, located at roof level, with central hot water storage within the ground floor plant room.

The ASHPs shall utilise CO2 as refrigerant (GWP of 1) that absorbs 'free' heat from the outside air, and a compressor to raise its temperature. An onboard heat exchanger uses heat from the refrigerant to generate domestic hot water at >65°C which is stored within the DHWS calorifiers within the plant room.

From the central storage, domestic hot water flow (DHWS-F) is to be distributed through the Hub building to serve the various sanitary outlets. A pumped secondary domestic hot water return (DHWS-R) is to be provided to circulate around the building and ensure hot water temperatures are achieved at all outlets within 30 seconds of opening the tap / outlet.

The central high temperature AHSP and associated storage calorifiers are to be provided with the following, but not limited to, features:

- High efficiency ASHPs
- CO2 refrigerant
- Operational to -10°C
- 3No. ASHP, 2No. vitrified storage cylinders (insulated jacket)
- IVs, NRVs, Drain Cocks, Air Vents, Expansion vessel / unvented kit, TMV, PRVs, strainers etc.
- Pressure sensors and dials
- Temperature sensors and dials
- Meters
- Controls / monitoring system
- Primary pumps
- Secondary recirculation pumps
- Water softener / physical water conditioner (to suit water quality requirements of the ASHP system)
- BMS integration
- Plate heat exchanger (for QAHV option only)

From the plant room, DHWS F&R is to be distributed throughout the Hub building via the mechanical risers, to serve the various sanitary outlets, as summarised above and based on the final interior Design layouts.

All major branches off the rising mains are to be provided with isolation valves, strainer / filter ball valves, and thermostatic balancing valve (on DHWS R).

Dedicated sub-branches (BCWS and DHWS F&R) are to be provided to the first floor kitchen and ground floor café and ground floor gym / changing with sub-metering (flow and heat). Meters to be pulsed output to the BMS.

All external pipework serving the ASHP is to be trace heated to protect against freezing. The electric trace heating tape is to be spiral wrapped including all isolating and control valves. The trace heating is to be controlled from an external ambient air temperature sensor.

Local Electric

Brew Points are to be provided with local electric chiller / boiler taps (such as Billi Taps, to Interior Designer's specification) to be provided complete with matching drainage font and natural ventilation grillage to the kitchen unit housing the associated under sink equipment.

The following volumes and flow rates are to be adhered to in the final sanitaryware proposed. Where sanitaryware proposed doesn't meet the below 'as standard', include for flow restrictor devices accordingly to meet the reduced flow rates (as applicable):

- WC effective flush 3.75 litres or less
- Basin taps including DDA 5lpm or less at 3bar
- Showers 6lpm or less Flow rate of each shower at the outlet using cold water (T 30°C), in litres per minute measured at a dynamic pressure: 3 ± 0.2 bar (0.3 ± 0.02 MPa) for high pressure (Type 1) supply systems
- Urinal 1.5 l/bowl/hour or less
- Kitchenette tap 6lpm or less at 3bar
- Domestic sized dishwashers if specified 12 litres/cycle or less
- Washing machines if specified (assumed domestic type) 40 litres per use or less, commercial no more than 7.5 litres/kg

The water meter installations are to include pulsed output for connection to the BMS system to log water consumption, monitor and for major leak detection purposes. The leak detection system is to be capable of detecting a major leak on

the mains water supply within the building and between the building / external plant and the boundary meter. The leak detection system is to be:

- Audible when activated
- Activated when the flow of water passing through the water meter is at a flow rate above a pre-set maximum for a pre-set period of time
- Able to identify different flow and therefore leakage rates, e.g. continuous, high, and / or low level, over set periods
- Programmable to suit the owner / occupiers water consumption criteria
- Designed to avoid false alarms caused by normal operation

Flow control devices that regulate the supply of water to each WC area / facility according to demand are to be installed to minimise water leaks and wastage from sanitary fittings. Solenoid valves are to be provided on the main branches serving the various toilet / changing areas and brew points, café, and kitchen linked to local presence detection within each zone served. The presence detector (PIR) device is to detect occupancy or movement in an area to switch water on and turn it off when the presence is removed.

Anti-shock, air release, and vacuum breakers to be provided at the top of each riser.

3.3.5 Category 5 Water Service (Non-wholesome)

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, flush, clean, chlorinate, set to work, and demonstrate a Category 5 boosted cold water service (Cat 5) capable of providing an adequate supply of Cat 5 water to the Hub building roof plant (wash down) and external areas based on the design intent drawings and design parameters indicated within sections 3, 4 and 5.

Cat 5 water supplies are to be provided to serve areas requiring a water supply that are thought to pose a potential risk of back siphonage and cross contamination to the wholesome water supply.

Cat 5 water is to be provided via packaged Cat 5 break tanks & booster sets, with sufficient air gap to prevent back siphonage and cross contamination.

Washout valve arrangements are to be provided to allow operational flushing of sections of pipework and to allow a full drain down of the buried Category 5 pipework during the winter months. Washout points to be provided on the end of branch mains and every 250m.

A dedicated Cat 5 packaged unit is proposed within the roof top plant, and one at ground floor level, located externally within a GRP enclosure to serve the cycle store, and additional units to serve irrigation points proposed to the following outlets:

Hub

- External roof deck (washdown)

External

- Cycle store wash down
- External irrigation points (see Landscape design for details)

Central Plant

The Cat 5 break tank / booster set is to be of the packaged type, externally mounted (cycle store), provided with the following, but not limited to, features:

- Duty / Assist pumps
- Inverter driven VSDs
- Hydraulic Accumulator vessel
- NRVs, IVs, PRVs etc.
- Packaged controls.

- Anti-vibration / flexible connections.
- Fully WRAS approved (listed within the latest WRAS Products and Materials Directory)
- BMS interface.
- GRP enclosure c/w concrete plinth and lockable door (where external).
- Frost protection heater & thermostat (where external).
- Hose union tap within the GRP enclosure (where external).

Cat 5 BCWS is to be routed to serve external hose union taps at roof level. Externally, CAT 5 BCWS is to be buried and routed to serve the irrigation points.

All major branches off the rising mains are to be provided with isolation valves.

All external pipework to be trace heated.

Outlets

The cycle store wash down hose union tap is to be located within the GRP enclosure complete with frost protection or to serve a below ground wash down point adjacent to the bin store.

External hose union taps are to be frost resistant based on the 'Kemper Frosti-plus' range of hose union taps with protective sheaths.

Irrigation Points are to be of the below ground type, providing 'Category 5' water for general irrigation / non-potable use. Irrigation Points are to be provided with following, but not limited to, features:

- Ball valve, with hose union, frost resistant, fitting
- Telescopic pipe standpipe arrangement
- Insulation
- Isolation valve
- Pressure reducing valve
- Talbot type chamber with lockable lid
- Long water box key

All CAT 5 units to be sub-metered. The water meter installations are to include pulsed output for connection to the BMS system to log water consumption, monitor and for major leak detection purposes. The leak detection system is to be capable of detecting a major leak on the mains water supply within the building and between the building / external plant and the boundary meter. The leak detection system is to be:

- Audible when activated
- Activated when the flow of water passing through the water meter is at a flow rate above a pre-set maximum for a pre-set period of time
- Able to identify different flow and therefore leakage rates, e.g. continuous, high, and / or low level, over set periods
- Programmable to suit the owner / occupiers water consumption criteria
- Designed to avoid false alarms caused by normal operation

3.3.6 VRF/LTHW Heating Systems

Design supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, flush, clean, dose, set to work, and demonstrate an Air source Heat Pump (ASHP) system to provide Low Temperature Hot Water (LTHW) to the various terminal heating units throughout the Hub building, based on the design intent drawings and design parameters indicated within sections 3, 4 and 5.

Central Plant

LTHW is to be generated via modular ASHPs, located an external screened compounded at roof level. ASHPs are to be provided as modular for resilience.

The ASHPs are to be directly weather compensated via integral controls, rather than varying the temperature on the secondary circuits via a mixing valve.

Under normal operation, all units to operate with a fixed volume flow rate through all units. Target flow temperature to be achieved at the buffer, with the integral heat pump controls to modulate the various units to achieve the common flow set point at the buffer.

In the event a single module is isolated or goes into fault, the remaining operational units are to over compensate to achieve the common flow set point at the common buffer.

The ASHP are to be located on big foot type framing systems within an external, open air, screened plant area at roof level.

ASHPs to be installed with sufficient free space / area around the units in accordance with the Manufacturer's requirements.

Common LTHW flow & return heating pipework (reverse return) is to be routed from the ASHP to the plant room on GF, complete with adequate weatherproof detail.

All external pipework serving the ASHP is to be trace heated to protect against freezing. The electric trace heating tape is to be spiral wrapped including all isolating and control valves. The trace heating is to be controlled from an external ambient air temperature sensor.

A primary pumped LTHW flow & return circuit is to be provided, with a common set of primary pumps serving the ASHP array. Primary pump sets to be located within the internal plant room on ground floor.

The primary pumped circuit is to feed into a series of buffer vessels within the plant room, which in turn is to serve the secondary pumped circuit.

Each circulating pump set to be of the packaged type, provided with the following, but not limited to, features:

- Twin pump duty / standby arrangement (primary), duty / assist / standby (secondary)
- Variable speed drives
- Non-return valve
- Isolation valves
- Flexible connections
- Pressure sensors / gauges
- ERP 2018 A rating
- Digital display
- In-built energy metering
- Wireless communication
- Auto Adapt constant pressure control
- In-built differential-pressure and temperature sensors with the capability for remote pressure / temperature sensing (along index run)

Buffer vessels are to be provided in between the primary and secondary LTHW circuits, sized to prolong ASHP operation periods / prevent short cycling, increase the system water content, and provide a stored capacity of heating for use during ASHP defrost cycles.

The buffer is to be provided with the following, but not limited to, features:

- Minimum buffer capacity to suit final ASHP selection, minimum system volumes, and to cover defrost cycles.
- Mild steel tank
- Insulated jacket & cladding
- 3 bar working pressure
- 4No. sensor pockets for BMS sensing

- Adjustable feet for levelling
- Air vent / safety valve
- Drain cock

The LTHW heating system is to be pressurised from a pressurisation unit and expansion vessel located within the plant room complete with a quick fill connections. Once the system is filled the quick fill connection is to be disconnected with minimal dead legs.

Pressurisation units and expansion vessels are to be suitable for the system heights and working pressures:

- Duty/standby pumps that automatically reset upon mains power disruption.
- A hard-wired control circuit to disable the ASHP and pumps under high/low pressure conditions. The unit is to automatically reset when designed pressure conditions are achieved.
- Control panel incorporating all necessary control circuits, pump run/trip lamps and high/low system pressure lamps together with panel live lamp.

Expansion vessels are to be of sufficient capacity to accommodate the as installed expansion volume under maximum load conditions and system static head.

Allow for bringing treated water onto site to fill the system and for testing / commissioning purposes. On no account is raw water to be used for any forms or testing including pressure testing.

A combined air/dirt separator (magnetic) is to be provided on the hottest part of the system on the common flow from the ASHPs, provided with isolation valves, drain cock, and air vent.

A water treatment dosing vessel is to be provided across the LTHW primary circuit, complete with isolation valves and drain cock, sized to suit the water content final volume.

Secondary LTHW flow & return to be routed from the buffer vessel to serve the Atrium area with UFH.

No 3-port mixing valve to be provided. ASHPs to be directly weather compensated.

All systems with electric compressors to comply with the requirements of BS EN 378:2016(211) (parts 2 and 3).

ASHP systems using refrigerants to have DELC of $\leq 1000 \text{ kgCO}_2\text{e/kW}$ heating capacity.

All refrigerants to have a GWP ≤ 700 .

All heating and hot water is supplied by non-combustion systems (all electric).

3.3.7 Space Heating

The Contractor shall design supply, install, test, commission and set to work VRF heat recovery systems to provide comfort cooling and heating to the building.

- The installation shall be designed & installed in accordance with the recommendations of:
- Building Regulations 2013
- CIBSE Guides
- Institute of Refrigeration guidance documents
- British Standards
- BS:EN:378 Parts 1, 2 and 3
- BCO Guidelines
- F-gas Regulations
- The Building Regulations Part L2A, 2013 and supplementary document Non-Domestic Building Services Compliance Guide, 2013.

3.3.8 System Description

Heating and cooling of the offices, restaurant, café, gym, podcast studio, multifaith room security room and theatre spaces will be provided by 2 pipe, high COP VRF systems. Independent systems shall be provided per floor to serve north and south sides of the building. Should a tenancy be fully cellularised, and independent room control required, additional control boxes may be required as part of a system reconfiguration.

The control boxes to be c/w isolation valves and proprietary acoustic lining. BC boxes to be located within the depth of the steelwork on each floor, close to core areas above anticipated tea point locations to prevent nuisance noise.

The system shall be installed to provide comfort cooling and heating to serve the office accommodation areas, theatre, restaurant, café, meeting rooms and gym. The system shall maintain a comfortable and stable environment for the occupants of the building. The system shall provide comfort cooling to offset the effects of the summer fabric heat gains and internal gains due to equipment, lights and occupancy. The system shall also provide terminal heating to offset the winter fabric heat losses.

In order to select FCUs the Contractor shall undertake detailed calculation of the heating and cooling loads for each area utilising a dynamic simulation software such as IES or TAS.

Refrigeration pipework shall be sized by appropriately qualified personnel taking into account actual system lengths and lifts. Refrigeration pipework shall be sized and installed to ensure return to the compressor under all operating conditions. The internal units shall be chassis type soffit suspended installation. The units shall be selected on medium speed and off coil air temperature of 10degC below the room temperature to prevent condensation or dumping of air from the terminal diffusers. Depending on installation location for the multi branch selector box, additional countermeasures i.e. 3rd party leak detection alarm or ventilation may be required to be fitted to the unit. R32 systems capacity may be lower than R410a counterparts resulting in larger systems being required, this is due to different testing methods for R32 systems.

All internal refrigeration pipework, condensate pipework and interconnecting wiring shall be routed on cable tray from the indoor units to the external interface. Riser space on either side of the core has been allocated for refrigerant pipework; to both reduce the length of pipework to the roof, and to allow each floor plate to be sub-divided into two separate tenancies.

Condensate drainage pipework from the indoor VRF units shall run to a fall to connect/discharge into the condensate stacks. Condensate from indoor units to core shall be discharged by gravity where possible but also via a pumped system. These shall be discreet, quiet in operation and include necessary interlocks with its associated indoor unit to prevent the indoor unit from operating should the pump fail.

A 22mm copper condensate connection shall be taken from the units at a continuous fall, to discharge into the nearest stacks via a glass trap or alternate suitable trap allowing for visual inspection, tundish and air brake.

The design, selection, and installation of heat rejection units supports shall be in-line with manufacturer's recommendations for maintenance and adequate airflow for heat rejection.

All penetrations from internal to external spaces (external interfaces) shall be designed, installed and made weatherproof.

The contractor shall take appropriate precautions to prevent the discharge of refrigerant gases to atmosphere and also discharge of systems inside the building.

The Contractor shall make do consideration to external noise requirements and, if necessary, external units shall be acoustically treated to meet the acoustic report, planning requirements or any other limiting external noise requirements.

The Contractor shall provide Unistrut framing to mount external units on. The design, selection, and installation of heat rejection units supports shall be in-line with manufacturer's recommendations for maintenance and adequate airflow for heat rejection.

All penetrations from internal to external spaces (external interfaces) shall be designed, installed, and made weatherproof.

All indoor and external units are to be installed such that there is sufficient space and access to allow manufacturers recommended maintenance strategy to be implemented. Where access panels are required in ceilings these shall be coordinated and agreed with the Architect prior to installation.

3.3.9 Control Requirements

Central controllers shall have the facility to control each individual indoor unit, annual scheduling, time programme, optimum start/stop, weather compensation, night time setback and energy usage reporting. Location of the central controllers to be agreed with the architect as part of the detailed design. Each fan coil unit to have its own temperature sensor. A remote temperature sensor to be on a flying lead to give a true representation of room air temperature in each area. The remote sensor shall be as discreet as possible and the Contractor shall locate each sensor in a suitable location within each zone away from any grilles, lighting or windows.

The VRF system shall operate under self-contained controls basis supplied as a package with the VRF system.

The Contractor shall provide a wall mounted controller to the ground floor reception area for the control of units local to the reception desk(s) whereon staff are permanently based.

Units shall be provided with the facility for future installation of remote room controllers to facilitate future tenant cellularisation.

The systems shall use refrigerants with low ozone depletion capacity (e.g., R32)

To be read with Cundall Material and Workmanship Specification.

Terminal Units

The Hub building is to be provided with a mixture of VRF ducted fan coil units, LTHW underfloor heating, electric panel heaters.

VRF pipework is to be routed from the roof to floors below, down risers, and offsetting across the floor plates within ceiling voids and exposed soffit areas, to serve the proposed terminal units.

Refer to the drawings and schedules for more details.

3.3.10 Fan Coil Units

Ducted FCUs heating/cooling units to be of the packaged type, suspended from the soffit within a raft or exposed, provided with, but not limited to, the following:

- Fully packaged 'plug and play' unit factory pre-commissioned.
- Factory fitted controls, fan controller, Bacnet MS/TP, (Siemens DXR), return air sensor.
 - Where fresh air is ducted to the back of an Ducted Fan coil unit, fresh air to be ducted to one of the filters that does not have the return air sensor behind it to prevent an artificial temperature reading from the space served (return air sensor sits behind 1 of the 3 filters).
- Factory fitted transformers and low maintenance condensate pump
- BMS interface (Bacnet MS/TP)
- Low energy SFP 0.06 - 0.1W/l/s (peak range), fan is variable speed.
- Low embodied carbon
- Colour matched facia grille (to raft, ceiling, or soffit), final RAL colour to be agreed with interior designer/client.
- Hinged bottom facia to allow access to valves, coils, filters, sensors (to avoid access panels to these components)
- Isolation valves, flushing bypass, drain cock (remote from the unit, in an accessible location, ideally exposed soffit location to avoid access panels). Where no exposed soffit or accessible or demountable ceiling is close by, units can be grouped onto common IVs, flushing bypass, drain cocks to minimise access panels. In this scenario, PICVs could be used to isolate individual units for service / maintenance purposes if required.
- Flexible connections

Where FCUs units are provided within cellular spaces, units to be provided with FCUs wall mounted controllers (temperature control, CO2 sensing) with end user control (Siemens QMX3-P74 or equal).

FCUs units are pre tested / commissioned (air and water side) at the factory, reduction in commissioning on site and speed of install to be reflected in the Tender return.

Fan Coil Units (FCU) to be of the packaged chassis ducted type, suspended from the soffit and provided with, but not limited to, the following:

- BMS controls, fan controller, BMS interface, return air sensor
- Secondary, insulated ductwork with VCDs (internally insulated, exposed galv finish). See ventilation section for details
- Supply diffusers & plenums. See ventilation section for details
- SFP <0.3W/l/s (peak)
- Flexible connections

Where FCUs are provided within the atrium / reception area or cellular spaces, a BMS wall mounted thermostat (adjustable) c/w end user limited +/- control is to be provided. Dead band to be provided in conjunction with the underfloor heating.

3.3.11 Underfloor Heating

Underfloor heating is to be provided within the atrium with, but not limited to, the following:

- Manifold c/w isolation valves, flow gauge, flow temperature gauge, flow adjustment, pressure gauge, return temperature gauge
- Actuators
- Fill/drain valve, air vent
- Strainer, flushing bypass
- 2-port PICVs on pipework serving the manifold
- U/F heating pipework and screed
- BMS controls (control of 2-port PICV zone valves)
- BMS Thermostats (adjustable) c/w end user limited +/- control.

3.3.12 Electric Panel Heaters

All electric panel radiators to be of high-quality pressed steel and sympathetic to the aesthetics of the spaces served.

Wall mounted electric panel heaters with linked temperature sensors and build in programmer are to be installed in each toilet room, and shower/changing area as a primary source of heating.

Wall mounted electric panel heaters in security room are to act as a source of heating outside of normal operating hours, the means of control for this function are an integrated and programmable timer.

Wall mounted electric panel heaters in plant room, water tank room and LV switch room are to act as a source of frost protection outside of normal operating hours, the means of control for this function are an integrated and programmable timer.

Each radiator to be installed complete with the required number of proprietary mounting brackets. The type and location of all radiators to be agreed with the Architect prior to installation.

3.3.13 Door Air Curtains

Door air curtains are to be provided within atrium area and café external door.

The main lobbied entrance door, adjacent to the reception desk, is to be provided with a draught lobby (no air curtain).

The 3No. double doors into the atrium area (opposite side of the atrium to the reception) are to each be provided with exposed, vertical standing type door air curtains with LTHW heating and local wall mounted controllers.

A LTHW slimline over door heater is to be provided above the café external door with local wall controller.

Exposed door air curtains to be provided with colour matched fixings, to suit the Interior Design.

Final style and RAL colour of door air curtains to be agreed with the Interior Designer.

The door air curtains are to be provided by Teddington Air Curtain Systems or equal.

General

All pipework across the floor plates to be copper.

Allow for bringing treated water onto site to fill the system and for testing / commissioning purposes. On no account is raw water to be used for any forms or testing including pressure testing.

Generally, all pipework in exposed areas to be foil faced installed in a neat manner. Any visible pipework within the gym area to be sprayed / coated black to the gym designer's specification.

Grilles and diffusers (including perforated grilles to FCUs units) to be RAL coloured to suit the ceiling / raft they are mounted within. Refer to the Interior Designer's package for final RAL colours of grilles & diffusers.

3.3.14 Comfort Cooling

Terminal Units

The Hub building is to be provided with a mixture of VRF fan coil units for cooling.

VRF pipework is to be routed from the condensers on the roof to down risers and offsetting across the floor plates within ceiling voids and exposed soffit areas, to serve the proposed terminal units.

General

Generally, all pipework in exposed areas to be foil faced installed in a neat manner. Any visible pipework within the gym area to be sprayed / coated black to the gym designer's specification.

Grilles and diffusers (including perforated grilles to FCUs units) to be RAL coloured to suit the ceiling / raft they are mounted within. Refer to the Interior Designer's package for final RAL colours of grilles & diffusers.

3.3.15 DX Heating & Cooling

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, flush, clean, set to work, and demonstrate DX cooling systems to the Comms and Hub rooms, based on the design intent drawings and design parameters indicated within sections 4 and 5. Toshiba is to be utilised for the tender return, who JD received corporate discounted rates for. Alternatives to be considered as below the line option costs.

The following areas and equipment are proposed with DX comfort heating & cooling systems:

Hub

- Comms Room
 - Ceiling suspended type DX cooling units, N+1 (typically 3 duty units, 1 standby unit).
- Hub Rooms
 - Wall mounted type DX cooling units, N (typically 1 unit per hub room).

Central Plant

The DX systems are to comprise of high efficiency air cooled condensers located at roof level located externally within the screen plant area.

Condensers to be floor standing type, mounted on raised access framing systems.

Condenser units to be installed with sufficient free space around each unit in accordance with the Manufacturer's guidance for efficient operation and access for maintenance.

From the condensers, the refrigerant pipework is to be routed from the roof via the central risers to each area served, with refrigerant pipework located on tray. Systems to be based on R32 refrigerant (preferred).

Terminal Units

The refrigerant pipework is to be distributed from the external condenser units to each individual indoor terminal unit served.

Terminal units to be ceiling suspended or wall mounted type, to suit the final cooling demand.

General

The installations are to be designed & installed in accordance with the recommendations of:

- CIBSE Guidelines
- Institute of Refrigeration guidance documents
- BS EN:378 Parts 1, 2 and 3

The systems are to maintain a comfortable and stable environment based on the design criteria within this performance specification.

The systems are to provide comfort cooling to offset the effects of the summer fabric and solar heat gains, fresh air loads, natural infiltration loads and internal gains due to equipment, lights, and occupancy.

Refrigeration pipework is to be sized by appropriately qualified personnel considering actual system lengths and lifts. Refrigeration pipework is to be sized and installed to ensure return of oil to the compressor under all operating conditions. Oil traps are to be formed in refrigerant lines wherever there is the possibility of entrained oil accumulating. These are to be designed with short pitch centres to avoid trapping large quantities of oil and are to be of double riser pipe type if necessary, for a system with capacity control.

No overloading or diversity is to be provided to outdoor unit sizing, this is to allow future overloading and additional fan coil units to be added onto the system at a later date. The selection of indoor and outdoor units is to consider any de-rating due to internal and external design conditions in summer and winter.

Make due consideration to external noise requirements and, if necessary, the units are to be acoustically treated to meet the acoustic report, planning requirements or any other limiting external noise requirements.

All refrigeration pipework, condensate pipework and interconnecting wiring is to be routed on cable tray from the units to the interface co-ordinated with lighting, ductwork, structure and drainage.

Ensure all DX systems are installed in accordance with the manufacturer's requirements and installed by the manufacturer's approved installers.

Condensate drainage pipework from the DX units are to run to a fall to connect/discharge into the foul drainage stacks. Condensate drains from units are to be installed to a minimum 1 in 100 fall, by gravity, wherever possible. A plastic condensate connection is to be taken from the units at a continuous fall, to discharge into the foul drainage stacks via a suitable non-return trap such as Hepvo or equal and approved. All drip trays are to be thermally insulated.

Provide big foot type framing to mount external outdoor units on. The design, selection, and installation of heat rejection units supports or mounts is to be in-line with manufacturer's recommendations for maintenance and adequate airflow for heat rejection.

All units are to be installed such that there is sufficient space and access to allow manufacturers recommended maintenance strategy to be implemented. Where access panels are required in ceilings these are to be coordinated and agreed with the Architect prior to installation.

Appropriate precautions are to be taken to prevent the discharge of refrigerant gases to atmosphere and discharge of systems inside the building.

Include performance testing of the completed installations as described herein.

Include all necessary power supplies to external condenser units, internal units and any supplementary controls equipment.

Include for the thermal insulation of all refrigerant pipework.

All insulation materials installed for building services shall have an 'A+' or 'A' Green Guide Rating (www.thegreenguide.org.uk) and have zero ozone depletion potential.

The DX systems are to operate under self-contained controls basis supplied as a package with the DX system, however full visibility and control is to be provided on the central BMS system.

The system is to operate with a central control device linked to the BMS with local controls on a room by room basis. All functionality of the central controller is to be relayed to the BMS.

Generally, all exposed ductwork (internally lined / insulated) and tray work is to be galvanised finish. Exposed pipework to be foil faced insulation finish.

Grilles and diffusers (including perforated grilles to FCUs units) to be RAL coloured to suit the ceiling / raft they are mounted within. Refer to the Interior Designer's package for final RAL colours of grilles & diffusers.

Controls Requirement

Each space is to be provided with a local wall mounted controller with restricted end user control.

A central controller to be provided within the BMS control panel with full BMS integration.

Auto-changeover facility to be provided to cycle the lead unit (where N+1 provided).

3.3.16 Central Mechanical Ventilation

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, clean, set to work, and demonstrate central mechanical ventilation Air Handling Unit (AHU) systems and kitchen supply & extract systems capable of providing an adequate supply of fresh air and balanced extract based on the design criteria.

The Hub building is to be provided with 6No. central AHUs and a separate kitchen supply & extract system to provide balanced tempered fresh air supply and extract, generally as below:

AHU Systems

The AHU plant is to be located at roof level on the external, screened, plant decks (North and South). The 6No. supply & extract AHUs are to be of stacked configuration, balanced supply & extract type suitable for mounting externally with the following, but not limited to components and features:

- 50mm aluminium pentapost construction, double skinned
- Insulated galvanised panels with Plastisol coating
- 100mm base frame
- Pitched roof
- Heat recovery min 80% with purge sector to prevent carryover leakage
- VRF built in heat pumps to heat / cool the fresh air.
- EC plug fans or plenum fans, SFP 1.6W/l/s
- Modulating control in conjunction with VAV dampers (constant pressure, variable volume), temperature, and CO2 sensors, in conjunction with the natural ventilation systems
- Pre-wired packaged controls
- Supply & extract filters to BS EN 16798-3

- Access panels
- Viewing windows & lights
- Supply, extract, intake, and exhaust attenuators
- Big-foot type framing systems

Intake and discharge from each AHU to be ducted away at roof level, with adequate separation between intake and exhaust, terminating with intake and discharge cowls.

Distances between intakes and exhausts are to be maximised to eliminate cross contamination of air streams. Intake cowls to be as close to AHUs as possible, with discharge ducted away from intakes accordingly. Discharge to be directed through plant screening where possible.

From the central AHU plant, ducted tempered supply and extract is to be routed across the roof and down risers to serve the various spaces within the Hub at each floor level. Adequate weatherproofing to be provided where ducts penetrate the roof.

All external supply and extract ductwork to be thermally insulated, weatherproofed, and alu clad. Intake and exhaust to each AHU to be uninsulated.

All supply ductwork within the risers to be insulated, with extract uninsulated. All fresh air primary ductwork downstream of the riser (and ducted FCU secondary ductwork) to be internally lined / insulated with an exposed galvanised finish (no external insulation, Client request) to match the un-insulated extract ductwork.

From each riser, supply and extract branches route across each wing / floor plate to serve the various rooms / zones. Each main supply and extract branch off the riser to be provided with attenuation.

The AHUs are to provide tempered fresh air at 18°C all year round and balanced extract to the spaces served. Delivering the fresh air at this temperature is to assist the terminal units in cooling the spaces served (cooling provided as a result of supplying the fresh air at 18°C is to be used to reduce the terminal cooling capacity required).

During winter / heating season, the heat loss associated with the delivery of fresh air at a lower temperature than the space temperature set point is to be added to the terminal unit heating capacity. Delivering the fresh air at 18°C during the heating season gives opportunity for spaces, such as occupied internal rooms / spaces, to be provided with an element of 'free cooling' by only partially heating the fresh air.

Variable Air Volume (VAV) dampers are to be provided on the supply branches to these spaces to modulate and vary the amount of fresh air delivered to the space based on sensed temperature and CO₂. Ductwork is to be zoned into perimeter and internal zones, with common VAV supply dampers serving each zone, to allow perimeter / open plan areas to operate as mixed mode, whilst internal zones continue to be provided with full mechanical ventilation.

Where common fresh air supply ductwork / VAV serves multiple occupied cellular spaces, such as Teams rooms etc. each cellular room is to be provided with individual CO₂ / temperature sensors linked to the common VAV damper, controlling to the lowest common denominator of the various rooms served.

A common extract bellmouth and VAV damper is to be provided for each main extract branch from the riser, with the VAV damper modulating to balance with the variable supply as part of a variable volume, constant pressure system.

VAVs to be Bacnet.

Bellmouths to be provided with high free area grating.

Fresh air supply is to generally be delivered to the back of FCUs or directly into spaces via supply diffusers. Where the fresh air volume flow rate is excessive in relation to the FCU total flow rate (i.e., where fresh air to the back of the FCU would significantly impact the temperature measured within the FCU return air), the fresh air is to be delivered into the space via a mixture of direct supply diffusers and back of the FCU.

Where fresh air is delivered towards the back of FCUs, the fresh air ductwork is to be arranged to discharge in parallel to the back of the FCU, to allow fresh air to either be drawn into the FCU (while the FCU is operational) or bypass the FCU and be delivered directly into the space at high level (when the FCU is switched off).

All fresh air supply (and extract where applicable) branches into cellular spaces to be provided with cross talk attenuation to maintain the acoustic performance (R_w) of the partition / room served.

Where no dedicated extract duct is provided, an attenuated return air make-up path is to be provided via a cross talk attenuator. Within the meeting hub area, return air cross talk attenuators to be co-ordinated with the perimeter bulkhead detail, discharging into the bulkhead with a perimeter shadow gap or slow grille to allow an air path from the bulkhead into the business lounge area.

Generally, supply diffusers are to be of the perforated swirl type to suit the final suspended ceiling system and match the FCUs perforated grille facia, slot diffusers, or drum louvres.

Where exposed soffit swirl diffusers are proposed, the exposed supply swirl diffusers are to be provided with Coanda plates.

In cellular rooms such as Board Rooms, CEO, Business Lounge, Teams Rooms, supply diffusers to be linear slot diffusers with matching return air slots.

Within the gym and restaurant, drum type supply louvres are proposed, directly mounted onto the secondary supply ductwork (internally insulated / lined, exposed galvanised finish) from ducted FCUs.

Where cellular spaces have enclosed suspended ceilings, the ceilings are to be provided with a shadow gap around the perimeter or either side of suspended linear lights, to allow air to recirculate back into the ceiling void (preferred option, to provide a less cluttered ceiling). Alternatively, return air grilles are to be provided (to match the supply diffusers or FCUs grille facia) to allow recirculation of air, complete with non-vision cowl above the ceiling. Final shadow gap locations and dimensions to be agreed with the Interior Designer.

All supply and extract grilles / diffusers to be hard ducted where in exposed soffit areas (no flexible ductwork on show).

All fresh air supply ductwork between the AHU units and supply diffusers / back of FCUs to be thermally insulated, including thermally insulated and acoustically lined plenums.

All fresh air primary ductwork downstream of the riser (and ducted FCU secondary) ductwork to be insulated with an exposed galvanised finish (no external insulation, Client request) to match the un-insulated extract ductwork.

Balanced extract is to be via hard ducted extract grilles to match the supply or bellmouths, with the exception of the toilet / shower areas which are proposed as extract valves, and the café / BOH areas which are proposed with perforated extract grilles.

Allow for acoustic flex ductwork for final grille / diffuser termination, except in exposed soffit areas which are to be hard ducted with acoustically lined plenums.

Generally, all exposed ductwork (internally lined / insulated) and tray work is to be galvanised finish. Exposed pipework to be foil faced insulation finish.

Grilles and diffusers (including perforated grilles to FCUs units) to be RAL coloured to suit the ceiling / raft they are mounted within. Refer to the Interior Designer's package for final RAL colours of grilles & diffusers.

Kitchen Supply & Extract System

A commercial kitchen is proposed at first floor level of the Hub. A dedicated kitchen extract system is proposed, serving kitchen canopies. Make-up air is proposed via a dedicated supply only AHU. Refer to the catering specialist design for final canopy details.

The kitchen supply and extract ventilation plant is to be located at roof level on the external, screened, plant deck. Separate supply AHU and extract fans are to be provided, suitable for external mounting, with the following, but not limited to components and features:

- 50mm aluminium pentapost construction, double skinned
- Insulated galvanised panels with Plastisol coating.
- 100mm base frame
- Pitched roof

- Supply fan at 85% of the extract rate (negatively pressurised space)
- VRF built in heat pumps to the supply AHU (to 18°C variable)
- Bifurcated extract fans
- Interlock with the kitchen cooking appliances
- Pre-wired packaged controls
- Supply filters to BS EN 16798-3
- Extract grease filters
- Odour control to suit environment such as ozone injection or plasma ionisation
- Access panels
- Viewing windows & lights
- Supply, extract, intake, and exhaust attenuators (melinex lined to the extract and exhaust attenuators)
- Big-foot type framing systems
- Fire rated ductwork
- Local controller (on / off / speed and temperature control).

Intake and discharge from the kitchen ventilation plant is to be ducted away at roof level, with adequate separation between intake and exhaust, terminating with intake and discharge cowls.

Distances between intakes and exhausts are to be maximised to eliminate cross contamination of air streams. Intake cowls to be as close to AHUs as possible, with discharge ducted away from intakes accordingly. Discharge to be directed through plant screening where possible.

From the central kitchen ventilation plant, ducted tempered supply and extract is to be routed across the roof and down risers to serve first floor kitchen. Adequate weatherproofing to be provided where ducts penetrate the roof.

All external supply and extract ductwork to be thermally insulated, weatherproofed, and alu clad. Intake and exhaust to each AHU to be uninsulated.

All supply and extract ductwork within the risers to be insulated.

All supply make-up air ductwork downstream of the riser to be internally lined / insulated with an exposed galvanised finish (no external insulation, Client request).

Kitchen extract ductwork to be externally insulated (due to high temperature and grease) using rigid Kooltherm type insulation to provide a neat, similar finish to the exposed galv. No mineral wool duct wrap acceptable.

Extract is to be ducted to the kitchen canopy to suit the final canopy design.

Fresh air supply (tempered) and extract branches to be routed from the riser to the kitchen, with fresh air delivered to the space via ceiling mounted supply diffusers or supply air connection on the canopy, subject to final canopy design by the catering consultant. Supply diffusers to be of the pressed swirl type to suit the final suspended ceiling system.

All supply and extract ductwork between the roof ventilation plant and the kitchen area to be fire rated ductwork.

A local end user on / off / speed / temperature controller to be provided within the kitchen with BMS interface and override.

General

All supply, extract, intake, and discharge ductwork to be galvanised steel in accordance with DW144 and BS EN 1506.

Volume control dampers to be provided to each ductwork branch.

All rectangular ductwork 90 degree bends to be provided with turning veins, short radius preferred.

Grilles are to be 0.7mm galvanised steel plenums with baffle plates.

Cross talk attenuators to be provided where common ductwork serves multiple rooms, to maintain the room acoustic performance / reverberation levels targeted.

Any common ductwork passing over multiple room is to be provided with Multi-lag type acoustic wrap (where concealed).

Ductwork passing through fire compartments are to be provided with adequate fire protection, such as fire and / or smoke dampers, to suit the final Fire Strategy and in compliance with DW145. Any fire / smoke dampers to be provided with suitable access to reset, service, and maintain. Remote indication, local to each damper, to be provided.

Access to be provided in all ductwork for inspection, maintenance, and commissioning in accordance with HVCA DW145 and HVCA TR19, including the provision of access panels highlighted within TR19 as being provided by a cleaning specialist.

All access panels to be provided with safety chains.

Condense from the AHUs is to be via a gravity system, connecting to soil vent pipes or gullies via waterless traps local to each unit.

Ventilation requirements are to be in accordance with the relevant guidelines and fans are to be capable of achieving the required volumetric flow at the final installed pressure drop.

All insulation materials installed for building services shall have an 'A+' or 'A' Green Guide Rating (www.thegreenguide.org.uk) and have zero ozone depletion potential.

Where ducted ventilation systems are utilised, they are to fulfil the following requirements:

- Compliance with HVCA codes of practice.
- Incorporate where necessary fire / smoke dampers complete with installation build in, or surface mount frames and with blades out of the air stream in accordance with DW145.
- Not exceed velocities stated earlier in this specification.
- Not cause excessive pressure drops to limit the specific fan powers to the level set out in this specification.
- Be leak tested to the relevant HVCA DW143 Class (at least Class A) to comply with part L.

Air transfer grilles are to be designed in accordance with the associated fan duty and provided to ensure adequate ventilation rates.

All grilles and diffusers to be powder coat finish.

All grille colours and locations to be coordinated and agreed with the Interior Designer's.

Ducting to be manufactured from continuously hot-dip zinc coated and iron zinc alloy coated steel to BS 2989; quality: Z2G.275. This specification covers low and medium pressure ducting as classified by the HVCA DW/144 specification.

Ducting gauges and jointing methods to be suitable for the design pressures and cross-sectional areas specified, as defined by the DW/144 specification. All ducting is to be manufactured off-site by sheet metal Fabrication specialists.

Copies of detailed dimensioned "shop" fabrication / installation drawings shall be made available to the Client retained design team for review.

Maximum spacing between joints and stiffeners to be as indicated by the DW/144 Specification. Cross joints to be by bolted flanges to each section. Use of self-tapping screws is not permitted. 90° branch off takes to be made with a "shoe" fitting. Bends to be normally "medium" radius, or square with turning vanes. Double skin type turning vanes to be used at centres detailed in the DW/144 Specification. Where taper pieces are used the angle of each side is to not exceed 15°, without the use of splitters. Particular care to be given to the design and manufacture of fan discharge expansion pieces.

Jointing methods to be suitable for the design pressures and diameters as defined in the DW/144 Specification. Bends up to 400mm dia. to be pressed type, medium or long radius. Larger size bends to be of segmented construction. Branch off takes to be made using a "shoe" fitting. Flexible ductwork only to be used for final connections and the length to be kept to a minimum, no greater than 300mm.

Sealants to permanently retain adhesion and elasticity through a temperature range from 0°C to 70°C. Gaskets used for flanged joints shall be as detailed in DW/144. Self-adhesive tape shall not be used as a primary sealant.

Bracketing shall be designed to adequately support ducting loads. The weight of any applied insulation shall be taken into consideration. Special support arrangements shall be made to support duct mounted items such as fans and attenuators. Measures shall be taken to minimise transmission of vibration to the building structure. Minimum spacing for hangers shall be as detailed in the DW/144 Specification.

Horizontal ducting shall be normally supported on rolled steel channels suspended by hanger rods from the building structure, a suitable compressible pad shall be placed between the channel support and the duct. The final mounting height shall be capable of adjustment by means of threaded rod and lock-nuts. Vertical ducts shall be supported at floor slabs or from walls. The support shall coincide with a stiffening or joint angle frame. Consideration shall be given to anti-vibration mounts where necessary. Centres for supports shall not exceed 4.0 metres.

Horizontal ducting shall be normally supported using single adjustable drop rods, and split brackets with eye-bolts. Compressible packing shall be inserted between the duct and bracket. Details of supports shall be as defined in the DW/144 Specification.

Where a continuous vapour seal is required, bracketing shall be over the insulation. Suitable reinforcement sections shall be provided at support points as detailed in the DW/144 Specification.

Access doors shall be sized and positioned such that whole of the ductwork installation can be inspected internally and cleaned. Access doors shall be fitted adjacent to fire dampers to allow access to both dampers and fusible links. Access doors shall be fitted to allow access to motorised control dampers and linkages, and adjacent to manual dampers, filters, heating and cooling coils, and humidifiers. The positions and sizes of all access/inspection doors shall be agreed with the Architect in writing before manufacture begins. Sizes and types shall comply with the DW/144 Specification. Where ducting is to be insulated an extended frame shall be provided.

Dampers to have the same face area as the duct into which they are installed. The positions and types of damper shall be determined by the Contractor. Exact locations of all dampers shall be agreed in writing with the Architect before manufacture commences.

Balancing dampers to be opposed blade type with lockable external quadrant control in accessible position.

Fire / smoke dampers to be of the multi-leaf shutter type, out of air stream when open. Frames shall be provided to DW 145 to suit wall/floor construction.

Ensure that all installation frames are built into the structure of the wall by the main Contractor and any gaps are filled with intumescent sealant. If it is not possible to build installation frames into the wall then the Contractor is to supply and install purpose made supports and fixings and ensure that the main Contractor provides adequate fire integrity provision for the installation.

Weather louvres secured to external walls must be installed using a suitable sealant. Where required plenum boxes shall be installed behind the air terminals.

Attenuators to be circular or rectangular, constructed from galvanised steel plate, having a perforated inner casing and filled with mineral wool, covered with a stable fibre layer to prevent fibres entering the air flow. Rectangular attenuators shall have matching duct flanges. The attenuators are to be individually supported to the structure using anti-vibration mountings as necessary.

Circular, rectangular and oval ducting shall be insulated where required with flexible Mineral Wool ductwrap with factory applied Bright Class O reinforced aluminium foil. All joints closely butted and sealed with 100mm wide matching self-adhesive foil tape. All duct insulation shall be fully adhered to the duct and firmly secured by proprietary insulation pins, 20 mm aluminium bands or 50 mm mesh galvanised wire netting according to the manufacturers' installation recommendations. The Contractor shall ensure there are no exposed fibrous ends, all ends shall be tape sealed.

External ductwork to be thermally insulated as above with the addition of PIB weather proofing and aluminium cladding and associated sealant to provide a water tight construction.

All insulation materials installed for building services shall have an 'A+' or 'A' Green Guide Rating (www.thegreenguide.org.uk) and have zero ozone depletion potential.

All ductwork systems to be leakage tested whether designated low, medium or high pressure or under positive or negative pressure, unless otherwise stated in writing by the PM.

Leakage testing procedures to be carried out in accordance with HVCA DW/143. All air distribution systems to be set to work and regulated as detailed in CIBSE Commissioning Codes. Before any testing commences or fans are run, all sections of the ductwork system and plant items are to be inspected and cleaned to current standards, as detailed in the BSRIA standard "Specification for Ventilation Hygiene".

Before testing and commissioning commences the Commissioning Engineer must have in his possession all relevant information as detailed in CIBSE Code A and any BREEAM requirements.

Records of results to be made on site, as testing and commissioning progresses. Records of what adjustments were made, and revised results must be kept and be made available to the PM. Seven working days' notice of the commencement of testing and commissioning to be given in writing to the PM.

Copies of test certificates, tabulated details of final flow rates, and all other test data to be included in the Operating and Maintenance Manuals and Building User Guides.

Generally, all exposed ductwork (internally lined / insulated) and tray work is to be galvanised finish. Exposed pipework to be foil faced insulation finish.

Grilles and diffusers (including perforated grilles to FCUs units) to be RAL coloured to suit the ceiling / raft they are mounted within. Refer to the Interior Designer's package for final RAL colours of grilles & diffusers.

Controls Requirement

The control operation of the AHU systems and the kitchen supply & extract units is summarised below. Refer to the separate BMS controls specifications for further details and the natural ventilation section.

AHU-001 – Toilets (North)

The AHU is to be provided with packaged controls with full BMS integration for control.

The supply air temperature is to be supplied at 18°C all year round.

The toilet AHUs are to operate at a fixed volume flow rate (negatively pressurised).

Internal temperature monitored. External temperature monitored.

AHU-002 – General (North)

The AHU is to be provided with packaged controls with full BMS integration for control.

The AHU is to modulate the volume flow rate based on VAV damper operation (constant pressure), and temperature and CO2 levels via local wall mounted BMS sensors within the office/meeting areas.

The VAVs are to operate to maintain mechanical ventilation based on sensed temperature and CO2.

The supply air temperature is to be supplied at 18°C all year round to assist the terminal units with cooling provision. Final setpoints based on the Contractor's TM52 assessment.

Internal temperature and CO2 monitored. External temperature monitored.

AHU-003 – Gym

The AHU is to be provided with packaged controls with full BMS integration for control.

The AHU is to modulate the volume flow rate based on VAV damper operation (constant pressure), and temperature and CO2 levels via local wall mounted BMS sensors within the gym area.

VAVs to the Gym and Studio to maintain mechanical ventilation based on sensed temperature and CO2.

The supply air temperature is to be supplied at 18°C all year round to assist the terminal units with cooling provision. Final setpoints based on the Contractor's TM52 assessment.

Internal temperature and CO2 monitored. External temperature monitored.

See natural ventilation section below for further details of the mixed mode strategy.

AHU-004 – Toilets (South)

The AHU is to be provided with packaged controls with full BMS integration for control.

The supply air temperature is to be supplied at 18°C all year round. Where serving changing areas (higher room design temperature), the associated heat loss of supplying air at 18°C to be added to the terminal heaters (radiant panels).

The toilet AHUs are to operate at a fixed volume flow rate (negatively pressurised).

Internal temperature monitored. External temperature monitored.

AHU-005 – General (South)

The AHU is to be provided with packaged controls with full BMS integration for control.

The AHU is to modulate the volume flow rate based on VAV damper operation (constant pressure), and temperature and CO2 levels via local wall mounted BMS sensors in each occupied room or open plan zones served.

VAVs to the south office/meeting areas are to maintain mechanical ventilation based on sensed temperature and CO2

The supply air temperature is to be supplied at 18°C all year round to assist the terminal units will cooling provision. Final setpoints based on the Contractor's TM52 assessment.

Internal temperature and CO2 monitored. External temperature monitored.

AHU-006 – Restaurant

The AHU is to be provided with packaged controls with full BMS integration for control.

The AHU is to modulate the volume flow rate based on VAV damper operation (constant pressure), and temperature and CO2 levels via local wall mounted BMS sensors within the Restaurant and Café areas.

VAVs to the restaurant areas are to maintain mechanical ventilation based on sensed temperature and CO2

The supply air temperature is to be supplied at 18°C all year round to assist the terminal units will cooling provision. Final setpoints based on the Contractor's TM52 assessment.

Internal temperature and CO2 monitored. External temperature monitored.

Kitchen Supply & Extract (AHU-007 & EF-001)

The fans are to be provided with packaged controls with full BMS integration for control.

Internal temperature and CO2 and humidity monitored. External temperature monitored.

A local end user controller is to be provided with on / off / speed / temperature control with BMS override.

Electrical interlock to be provided between the kitchen ventilation plant and the electrical catering equipment (where under canopies).

3.3.17 Natural Ventilation Systems

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, clean, set to work, and demonstrate natural ventilation systems, as part of natural ventilation strategy

Atrium

- Cross ventilation (façade openings on 2 sides)
- High level modulating / actuated natural ventilation openings (top hung windows) at ground level
- High level modulating / actuated natural ventilation openings (top hung windows) at the top of the atrium
- Roof light actuated openings.
- Natural ventilation to the atrium for comfort and smoke clearance purposes.

A TM52 assessment is to be carried out by the Contractor to model and finalise the free area requirements of the natural ventilation systems, currently estimated at 5% of the floor area as openable area.

The high level motorised / modulating openings, mounted through the external façade, are to be provided with actuators (with cover caps to suit final window design), controls logic, control panel, and end-user control (Window Master)..

3.3.18 Local Extract Ventilation – Fire Suppression Gas Extract

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, clean, set to work, and demonstrate local a local extract ventilation system to the Comms Room (gas extract) capable of providing an adequate extract air change rate to the Comms Room based on the design intent drawings and design parameters indicated within sections 4 and 5.

Provide a dedicated gas extract system to clear the Comms Roomn of suppression gas and smoke should the system be deployed. This is to be a manually activated extract system with a local key switch located externally to the Comms Room and is to include, but not be limited to, the following components:

- Inline extract fan & controls
- Fire rated ductwork to the external façade / louvre
- Actionair ES50 (or equal) high pressure air tight motorised fire damper
- Manual key switch
- Pressure relief
- Visible alarm outside the room

The gas extract ductwork is to be ducted to low level and to the floor void within the Comms Room to allow removal of all suppression gas and smoke.

The extract ductwork is to be fire rated with an Actionair Energy Shield ES50 (or equal) range of fire damper located within the ductwork where the ductwork penetrates the Comms Room construction. The motorised damper is to be provided with an open/close Belimo (or equivalent manufacturer) actuator. Under normal conditions the damper is to be shut (power on – open, power off – close).

The fresh air supply ductwork (from the general AHU) is to be provided with an Actionair Energy Shield ES50 (or equal) range of fire damper located within the ductwork where the ductwork penetrates the Comms Room construction. The motorised damper is to be provided with an open/close Belimo (or equivalent manufacturer) actuator. Under normal conditions the damper is to be open (power on – open, power off – close).

Controls

The following describes the proposed control strategy for the gas extract system:

- Under normal operating conditions the dedicated gas extract fire damper is to be shut, and the fresh air supply is open.
- Upon fire detection a signal is to be sent to activate the gas suppression (30 second countdown). Fresh air damper is to close.
- Once the gas suppression system has been discharged and confirmation that the fire has been extinguished (by fire service or as agreed), the manual extract fan is to be activated via a key switch operation at the fan/damper panel (by specialist) located outside the room. The controller is to open the damper on the extract ductwork and activate the extract fan until the room is cleared of gas (4ACH). The door is to be opened and used as make up air path.
- Once cleared, the controller is to be set to the off position, switching off the extract fan and closing the damper on the extract fan and opening up the fresh air damper.
- Normal operation is to be resumed and the gas suppression signal de-activated.

3.3.19 Gas Suppression and Smoke Detection

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, clean, set to work, and demonstrate a cylinder based gas suppression system, dedicated extract ventilation system and VESDA type early warning air aspiration system to serve the Comms Room based on the Tender drawings and design parameters indicated within sections 4 and 5.

The gas suppression system is to be designed by the Contractor's specialist manufacturer / installer.

Complete the design of the gaseous fire-extinguishing system, submitting drawings, technical information, calculations and manufacturers' literature. The responsibility for the design and installation is to be solely with the Contractor and the specialist manufacturer who is to make sure the design and installation fully complies with all relevant Regulations and best practice guidelines.

The Comms Room is to be protected by means of a cylinder based FM200 or IG55 type gas fire suppression system, c/w associated pipework and ceiling mounted / high level nozzles.

The system is to be designed with a main gas storage capacity, capable of providing sufficient gas to suppress a fire in the zone protected.

The gas fire suppression system is to generally be comprised of the following items:

- Pipework.
- Discharge nozzles.
- Storage cylinders with electrically operated discharge actuator arrangements.
- Gas system control and indication panels.
- Automatic detection (via house fire alarm system & VESDA type system).
- Alarm circuits connected to audible, visual or combined alarms.
- Pressure relief damper.
- Manual control facilities.
- Local control and status indicating devices.
- Auxiliary circuits connected to automatically interface with other systems.
- Interface with the existing fire alarm system.
- Local key switch-controlled extract ventilation for evacuation of discharged gas etc. after a fire incident.

The gas system is to be of the non-looped, high pressure type protecting the Comms Room.

One bank of cylinders is to be installed. The cylinder bank is to consist of sufficient cylinders to protect the new Comms Room. Final details to be confirmed by the specialist.

All pipes and fittings used in the construction of the system to comply with the PED requirements.

The main building fire alarm system and new VESDA system are to be arranged to interface with the control systems of the gas installations. The discharge of the cylinders will be independently controlled by the gas system control panels following notification of a second stage fire alarm condition by the fire detection system and VESDA systems.

The appointed specialist is to be responsible for calculating the required storage requirements. The cylinders are to conform and be tested by an independent 3rd party body.

All cylinders are to be monitored for low pressure. Low pressure in any of the cylinders is to result in a general fault on the main control panel which is to be transferred to the Fire alarm system as may be required by the relevant trade Contractor.

Include for supplying and installing distinctive smelling odourisers on the systems adjacent to the location of the gas storage cylinders.

The gas discharge manifold is to be constructed using pipe grade Sch 160 with welded branches.

The material specification for the low pressure piping downstream of the system directional valve or pressure regulator is to be as follows:

- All pipe sizes up to and including 40 mm: Either to BS 10255; BS EN 10216-1:2002, BS EN 10217-1:2002, BS EN 10216-1:2013; BS 1740; BS 3799. ASTM A106 or Schedule 40 Galvanised
- Above 40 mm: Either to BS EN 10216-1:2002, BS EN 10217-1:2002, BS EN 10216-1:2013 or Schedule 80 Galvanised
- Fittings should be selected from the following British Standards:
 - All pipe sizes: BS 3799 Forged steel fittings
 - BS 1640 Welded fittings

Pipe supports, and hangers, are to be of good quality. All supports are to be taken from the building structure and not from secondary arrangements such as ceiling supports or raised floor pedestals.

All system piping is to be adequately bonded and earthed to minimise the risk of electrostatic discharge.

Engineered discharge nozzles are to be provided, within the manufacturers guidelines, to distribute the extinguishing agent throughout the protected area. The nozzles are to be designed to provide proper extinguishing quantity and distribution.

All nozzles are to be installed in such a way as to direct the flow of gas in a safe direction and should not be installed where neat extinguishing agent is able to flow directly out of the space, such as through fire or pressure relief dampers.

Ensure that nozzles are directed to minimise damage to the building fabric.

Weighted pressure relief dampers are to be provided as part of the system. In some instances, the pressure vent will need to be discharged externally via transfer ducts provided as part of the mechanical services installations.

Agree the final pressure relief method with the specialist.

Control

The gas extinguishing agent will only be automatically released when combustion has been detected by the VESDA type system operating on a separate trigger zone off the main fire detection system within the risk area. In this way, a safety factor can be built into the design of the gas systems actuation arrangements to limit the risk of inadvertent discharge due to false alarms.

Gas discharge will only occur following confirmation to the gas system of a level 2 fire alarm condition via the fire detection system within the specific risk area that has been affected by fire and then only after a 30 second count down period.

The gas extinguishing installation is to be controlled by a dedicated panel located adjacent to the main entry door to the protected space (Comms Room). These panels are to signal the gas system to operate upon receipt of a level 2 alarm condition in preparation for gas release into the system (after a 30 second time delay – see below).

Return signals are to be sent from the local gas extinguishing panels in confirmation of actuation.

The signals indicated at the gas extinguishing panels are to include as a minimum;

- System on automatic/manual
- Gas discharged - Fire
- Gas discharged - manual release
- Timer delay button actuated
- Common Fault

Interface units are to be installed adjacent to the control panel to relay signals from the fire detection system indicating first and second stage alarm conditions from the fire detection system. The control panel is to also feedback a fire, gas discharged, system in manual and fault condition back to the main house fire alarm panel via addressable modules. The detection system interface units are to be supplied under the fire alarm package.

A level 1 alarm is to be indicated at the gas system control panel by means of a buzzer and amber beacon supplied as part of the fire suppression contract. Bells signifying receipt of a level 2 fire alarm condition and the commencement of a 30 second countdown to system discharge is to be supplied and wired to the gas control panels also as part of the fire suppression contract. The bells are to be of the under-dome type with a fully enclosed operating mechanism.

Delay Timer Pushbuttons are to be supplied and wired to the gas control panels as part of the fire suppression contract. The manual delay timer buttons units provided are to be made of polycarbonate/moulded ABS material and finished in white (These buttons are otherwise known as hold off buttons). Install the delay timer buttons at each exit from the protected space and at the main control panel located at the entrance in the protected space.

Status Indicator Units are to be supplied and wired to the gas control panels as part of the fire suppression contract. The status indicator units are to be fitted adjacent to each secondary entry point into the protected space to give visual indication of the system status. The signals are to include as a minimum:

- System on automatic
- System on manual
- Gas discharged.

Separate power supplies to each item of equipment are to be provided.

An automatic text messaging system is to be provided to send alerts by SMS to be nominated individuals upon level 1 alarm activation.

3.3.20 Metering

All meters, without exception, are to be pulsed output, hardwired to the BMS.

Metering to be provided in full compliance with the requirements of this performance specification.

3.3.21 energy Metering

Install energy metering systems that enable at least 90% of the estimated annual energy consumption of each fuel to be assigned to the various end-use categories of energy-consuming systems in accordance with CIBSE TM39 Building Energy Metering.

The energy-consuming systems are to be metered according to the total useful floor area. An energy monitoring and management system is to be provided as part of the BMS, in line with JD's energy monitoring and reporting strategies utilised across their portfolio. The end energy consuming uses are to be identifiable to building users either through labelling or data outputs.

The following major mechanical and public health energy consuming systems are to be separately metered:

- Space heating
 - Electric sub-meter to the ASHPs/VRF Condensers
 - LTHW Heat meters inc.
 - Electrical sub metering to AHUs VRF heat pumps
 - Gym / Studio / Changing sub-metering
 - Kitchen / Café sub-metering
 - Restaurant sub-metering
- Space cooling
 - Electric sub-meter to the VRF Condensers
 - Electrical sub metering to AHUs VRF heat pumps
 - Gym / Studio / Changing sub-metering
 - Kitchen / Café sub-metering
 - Restaurant sub-metering

- Electrical sub-metering to DX cooling to Comms and Hubs
- Domestic hot water heating
 - Electric sub-meter to the high temperature ASHPs
 - DHW Flow and Heat meters
 - Gym / Studio / Changing sub-metering
 - Kitchen / Café sub-metering
 - Restaurant sub-metering
- Ventilation, i.e. fans (major, including fans in air handling units)
 - Electric sub-meters to AHUs
 - Electric sub-meters to Fans
- Pumps
 - Electric sub-meters to LTHW, CHW, DHW, BCWS pumps
- Controls
 - Electric sub-meters to BMS control panel (control power)

Energy meters to be located in the plant room / accessible locations and readable on the BMS and energy monitoring software to facilitate regular energy monitoring and readers by the building occupant/facilities manager.

Refer to the electrical section for details of electrical metering requirements for other electrical items.

Install a water meter on the mains water supply to the building (main boundary meter and sub meter at building entry).

Any water consuming plant or building areas, consuming 10% or more of the building's total water demand, are to be fitted with easily accessible sub-meters or have water monitoring equipment integral to the plant or area provided.

Each meter (main and sub) to have a pulsed output to enable connection to the BMS for the monitoring of water consumption.

All meters, without exception, are to be pulsed output, hardwired to the BMS.

All meters are to be of billable quality MID approved.

The following water consuming plant and building / site areas are to be separately metered with pulsed output to the BMS:

- MCWS main utility incomer
- MCWS main fire hydrant
- MCWS building entry to Hub
- MCWS to CAT 5 boosters
- MCWS to internal wholesome tank
- BCWS to Hub
- BCWS to domestic hot water system
- BCWS & DHW to kitchen / café
- BCWS & DHW to gym / changing
- BCWS & DHW to restaurant

3.3.22 Miscellaneous

General

All insulation materials installed for building services are to have an 'A+' or 'A' Green Guide Rating (www.thegreenguide.org.uk) and have zero ozone depletion potential.

All external pipework is to be trace heated to protect against freezing. The electric trace heating tape is to be spiral wrapped including all isolating and control valves. The trace heating is to be controlled from an external ambient air temperature sensor. Internal plant spaces with louvres / louvred doors or unheated areas to be treated as external and therefore either trace heated or provided with frost protection heaters.

Appoint a commissioning specialist, independent from the Mechanical and Electrical Subcontractor, and from the commissioning engineer to oversee the commissioning and testing activities on site for the Mechanical and Electrical services. The commissioning specialist acts as an independent consultant for the most important aspects of the M&E services which is their commissioning and performance. The commissioning specialist roles to include for:

- Fully BREEAM compliant (albeit no assessment / accreditation to be carried out)
- Commentary on installation drawings with regards to ease of commissioning
- Commentary on installations with regards to access for commissioning and future maintenance.
- Chairing of commissioning meetings
- Witnessing of commissioning on site

The specialist commissioning manager is to be appointed during the design stage and the scope of their responsibility is to include:

- Design input: commission-ability design reviews
- Commissioning management input to construction programming
- Commissioning management input during installation stages
- Management of commissioning, performance testing and handover/post-handover stages

Ultimately the commissioning specialist is to ensure that all systems are properly commissioned at handover. The Employer's representative engineer is to undertake spot checks of commissioning and review of commissioning records and O&M's.

3.3.23 BMS

Refer to the separate controls performance specification (JDHQ-CDL-HB-XX-SP-CC-48301 - BMS Sequence of Operation - Controls Performance Scope Specification) for outline requirements of the BMS system.

All controls requirements are to comply fully with the requirements indicated in the controls specification and the controls requirements outlined within each section of this specification.

Works are to include, but are not limited to, the design coordination, supply, installation, testing, commissioning, and setting to work the following systems (as applicable):

- A central BMS control supervisor (open protocol)
- Satellite outstations
- Local controls
- BMS Server / Head End in Security office with web access
- IP network / network switches
- HMIs (touch screen, 1 in roof plant room, 1 in ground floor FM / Security room), routers, gateways etc.

Provide all works associated with any aspect of mechanical, public health, or electrical controls in accordance with the controls Performance Scope document and any controls requirements detailed within each separate system section of this MEP Performance Specification.

3.4 Electrical Services

3.4.1 Low Voltage Distribution

Design, supply, install, test and commission an LV distribution system within the new development, in accordance with all the latest versions of the appropriate standards, including but not being limited to:

- BS 7671 - IET Wiring Regulations (18th Edition)
- BS EN 50525-1 – Electric cables. Low Voltage energy cables of rated voltages up to and including 450/750 V
- BS EN 61439-1 – Low Voltage switchgear and control gear assemblies. General rules.
- BS EN 60947 – Low Voltage switchgear and control gear
- BS EN 61009-1 – Residual current operated circuit breakers with integral overcurrent protection for household and similar uses.
- BS EN 60529 - Degrees of protection provided by enclosures (IP code)

The incoming supply fed from the 1000kVA ENW transformer in the external substation is to be connected to the Main LV Switchboard within the LV switch room on the ground floor. The contractor is to ensure the LV tails don't exceed a length of 15m as per the ENW requirement. The main incomer to be fitted with Air Circuit Breaker (ACB). Refer to the Main Low Voltage (LV) schematic drawing JDHQ-CDL-HB-XX-DR-E-15001 for further information.

The Main LV Panelboard shall be arranged as follows:

- Floor mounted
- Form 4 Type 6
- Front Access
- Bottom entry / top and bottom exit
- Busbar rating of 1600A
- Busbar fault rating of 50kA for 1 second
- Three phase MCCB outgoing devices
- Single phase MCCB outgoing devices
- All outgoing protective devices and meters shall be clearly labelled (including cable type and size) to indicate equipment served

The Main LV Panelboard shall supply the following non-exhaustive items:

- General Power and Lighting Distribution Boards
- Mechanical Control Panel
- Plantroom Distribution Board
- MCCB Panelboard
- External Lighting Distribution Board
- Electrical Vehicle (EV) Charging Distribution Board
- Water Booster Sets
- Lift
- Kitchen Distribution Board
- BMS Panel
- Fire Alarm Panel
- Combined Disabled alarm and refuse panel

In the event of a power failure on the primary supplies (Main LV supplies), the main LV panel is to be served from the 1000kVA generator. Changeover between source supplies shall be automatically managed through an integrated logic controller which will monitor and control the input based on supply source availability, upon detection of a loss of power the generator controller will open the Main LV panelboards main incoming ACB and close the generators ACB to provide back-up power to the whole building.

The Main LV switchboard is to be equipped with a breaker space for the installation of Power Factor Correction (PFC) / Harmonic Filter (HF) unit (measurements to be taken by the Contractor on-site when the building is operational to determine the extent of power factor correction required before sizing the PFC unit to achieve a minimum of 0.95 power factor).

Provide power factor correction, suitably rated for harmonic laden loads. Correction to be automatic to within 0.95 lag/lead.

The Moulded Case Circuit Breakers (MCCBs) are to be rated as indicated on the Main LV schematic to allow supplies to be distributed evenly throughout the building.

The Main LV switchboard is to consist of purpose made Main LV switchgear panels containing a current transformer, electrical sub-metering equipment and a main switch facility to accept the incoming low voltage supply cables.

The switchgear is to incorporate a mimic panel, noting the condition of the main incoming panel and essential services panels. The mimic is to incorporate engraved laminate with LED indication of MCCB / ACB condition, including open, closed and tripped.

The MCCB Panel Boards are to be TP&N, 18 Way, Schneider Electric Powerpact 4 or equal and approved. The Panel Boards Form 3b Type 2 and rated to a minimum of 36kA fault current withstand for a period of 1 second. The number of ways for each distribution board is indicated on the LV schematic.

The Panel Board input and output circuits are to be protected by MCCB circuit breakers.

Power supplies to all plant and equipment to be provided via control panels, panel boards and ancillary systems as required. Liaise with all required parties to determine and provide the final power supplies required for any plant and equipment required for CDP elements.

All items of plant are to be supplied via a suitably sized and rated isolators as indicated on the Electrical layouts and located adjacent to the equipment or plant being served. All isolators are to be suitably IP rated for the environment that they are operating in.

All electrical switchgear is to be sized to provide a minimum of 25% spare capacity in terms of load and outgoing ways.

Refer to the indicative LV Schematic JDHQ-CDL-HB-XX-DR-E-15001 for further details of the outgoing ways and cable sizes.

The Lighting and Power distribution boards indicated on the LV Schematic shall be 22 ways split metered TPN lighting and power boards to comply with the latest edition of Part L. The Plantroom, EV and External Lighting distribution boards shall be mixed use boards. All distribution boards shall comprise of MCB / RCBO outgoing devices, complete with appropriately rated integral isolators.

All distribution boards shall be the lockable type and installed such that they are inaccessible to unauthorised access.

All distribution boards shall be rated at 125A & 250A, three phase.

The Contractor shall install fire rated submain cabling (FP Plus) to serve the fire alarm panel and a combined disabled alarm and disabled refuge panel as indicated on the LV schematic.

All new switchgear and distribution boards shall include a minimum of 25% spare, in terms of physical and load capacity for future requirements.

All MCCBs are to be compatible with Schneider equipment.

All MCCBs are to be from Schneider NSX series of circuit breakers or equal and approved.

All circuit breakers are to be commissioned with correct operational settings prior to energising of circuits.

All installed services shall be compliant with the Cundall Electrical materials and workmanship specification.

All installations are to be compliant with the Building Regulations.

All switchboards, panel boards, mechanical control panels, distribution boards and equipment isolators are to be installed with a Traffolyte label fixed to a visible face of the item. The label is to include:

- Identification of system (Example – ‘Mechanical Plant Room’, ‘General Power -MECH/CP/12’, etc.)
- Device Location (Example – 12th Floor Roof, First Floor South Wing)
- Supply Circuit reference

- Supply cable size and type (Example - 35mm² XLPE/LSZH/SWA)
- CPC cable size and type (Example – 4mm² separate, integral)
- Voltage
- Earth loop Impedance

All systems shall be installed allowing for suitable access, maintenance and replacement in compliance with current version of the IET Guidance Note 1 - Selection and Erection.

Submain cables are to be multicore SWA/XLPE/LSZH cable with a CPC – sizes are indicated on the distribution board schedule / cable schedule.

All cables installed throughout the development to be N2XH flexible type cables. No other cable types are to be permissible

The installation shall be fully compliant with BS 7671.

Rubber matting at least 600mm wide in accordance with BS 921 in front of all electrical switchboards and switchgear is to be provided.

Provide restricted earth fault protection within Main LV switch board. Provide relays to trip the HV switchgear and to disconnect the HV / LV transformer in the event of an earth fault in the transformer LV windings or in the LV cables between the transformer and the Main LV switchboard.

3.5 Sub-metering

Metering of services shall be provided in accordance with Building Regulations and CIBSE TM 39.

Throughout the building, separate energy sub-meters shall be provided to monitor the in-use energy consumption. All energy sub-meters shall have a pulsed output and Modbus RS485 outputs to enable current or future connection to a Building Management System (BMS).

As a minimum, sub-meters shall be provided to monitor the following electrical systems:

- Incoming LV supply to the Main LV Panelboard
- All outgoing ways of the Main LV Panelboard
- Split Metered Lighting & Power DBs
- Major Plant items (i.e. Air Source Heat Pumps)
- Generator incoming

Generally, all energy sub-meters shall be located in an area of the building that allows for easy access to facilitate regular monitoring by the building staff and facilities manager. The energy sub-meters shall typically be located local to the major items of plant or integral to the distribution boards and switchgear.

Provide integral meters to the main LV panel to meter the incoming/ outgoing supplies. The LV switchboard to be fitted The LV incomer meter fully compliant with IEC 61000-4-30 (ed. 3 class A), IEC 62586-1/-2. Meter shall measure voltage, current, frequency, active, reactive, apparent power (total and per phase), power factor (total and per phase), current and voltage harmonic distortion to the 63rd waveform capture, detection of voltage sags and swells. The switchboard is to be also provided with an individual utility meter to allow for monitoring of the total power consumption.

Provide integral meters to the panel boards to meter the incoming/outgoing supplies.

Provide meters within split-metered lighting and power distribution boards for separate metering of the lighting and power circuits.

All meters need to provide following readings (but are not limited to) :

- Amps per phase and neutral
- kW Hours
- kW, kVA, kVAr

- Voltage
- Max demand Amps per phase
- Max demand kW, kVA
- Power factor

All items of plant and other systems with an energy requirement of 50kW or greater are to be supplied via an energy meter as detailed above.

Include for the commissioning and programming of all meters.

Detailed specification & installation layouts are to be included as part of Specialist's CDP package.

3.6 Secondary Electrical Supplies

3.6.1 Back-Up Generator

Supply, install, test and commission a standby generator and associated switchgear system in accordance with all the appropriate standards and documents.

The standby generator is to be externally installed in an acoustic container located in the visitor carpark to provide back-up power in the event of a primary mains failure to the whole building. This will be automatically managed through an integrated logic controller which will monitor and control the input based on supply source availability, the generator and DNO incoming supplies will be interlocked via the generator controller to ensure safe transition between back up supply and normal operation.

The generator is to be fed by biofuel and not red diesel. Include for a fuel polishing system.

The generator is to be installed within an acoustic standard enclosure with acoustic performance as per the Acoustics Report and Building's planning permission documentation, with a noise limit of 77db(A)@1m.

The generator fuel tank is to be sized to allow the generator to run autonomously for a minimum of 24 hours.

The generator is to be complete with but not limited to all controls, fuel tank, alternator, engine heater, battery charger, batteries, flue fan, flue, acoustic enclosure etc. for a fully functional system.

The generator rating to be 1000kVA at 0.8 power factor and in the event of a power supply failure, it is to provide emergency power back-up to the whole building.

If the DNO supply is healthy, the generator will not operate and will be in 'standby mode'. There will be a requirement for planned generator testing. This is to be scheduled for a suitable time and in agreement with JD, in accordance with the manufacturer's recommendations.

The generator is to be electrically interlocked to the main switchpanel, providing automatic start up and synchronisations, and providing full status reporting to the BMS replicating information available at the generator control panel.

In the event of a power outage/ loss of supply, the generator is to start automatically on detection of loss of power. The generator starting time to be 15sec.

The generator is to be complete with an automatic start / stop system such that the generator system is capable of automatically returning to the mains supply once the mains power supplies have been re-established. Allow for the generator to run for at least 15 minutes once the main power supplies have been re-established. Even if the main supplies have been re-established, allow for the generator to run for the time it takes the UPS system to fully recharge, before the generator can be switched off. This is to ensure that if there is a second mains failure soon after the first one, either the generator is still running or the UPS system has been fully recharged and can reengage to safely shut down the comms supplies.

A tripping battery is to be provided for the main switchboard. The autonomy of the battery to be 24 hours with 5 complete operation cycles of each circuit breaker.

The Generator incoming supplies are to be metered by a Schneider electric PM 8000 series electrical meter or equal and approved.

The input and output power connections to and from the generator system are to be isolatable local to the generator in order to safely isolate the unit for maintenance purposes.

Refer to the LV schematics for the circuit breaker indicative sizes on the main switchboard. All circuit breakers are to disconnect during overload or fault conditions in accordance with BS 7671.

Fuel is to be pumped via dedicated refuelling system provided with external pump for ease of refuelling. A fuel spill kit is to be provided within the generator enclosure.

Fuel is to be carried via suitably sized portable 'jerry' type fuel cans. A fuel spill kit is to be provided within the generator enclosure.

For the Containment requirements, refer to the associated section of this specification.

Design, supply, install, test and commission all interfacing for the power / controls cabling for the generator set control modules and associated switchgear. Generator controls is a CDP package. Life safety cables to be armoured fire-resistant cables red in colour and in accordance with the British Standards.

Include for testing and witnessing of the generator.

3.6.2 Uninterrupted Power Supplies (UPS)

Employ a specialist to design, supply, install, test and commission a new UPS system in accordance with all the appropriate standards, including but not being limited to:

- BS EN IEC 62040-3:2021 – Uninterruptible power systems (UPS) Method of specifying the performance and test requirements
- Uptime institute guidelines

A static UPS is to be provided to the main comms room on the 1st floor in N+1 configuration with wrap around by-pass and supplies from the main LV panel.

The UPS manufacturer and model is to be as per the clients specification of 2 number Eaton 93PS 30KW UPS.

Uninterruptable power supplies to be provided to the active cabinets located within a comms Room with 60 minutes autonomy.

Refer the Cundall Stage 3 LV schematics for further details.

3.7 Primary Containment and Cabling

The Contractor shall install a primary containment and cabling system in accordance with the requirements of BS 7671.

The containment and cabling system shall comprise the following:

System	Cable Containment	Cable Type
LV Distribution	Heavy Duty return flange galvanised steel cable tray / ladder	Armoured cables with copper conductors and low smoke, zero halogen outer sheath (XLPE/SWA/LSZH)
Lighting and Small Power	Galvanised Steel Trunking for High level and below RAF. Galvanised Steel Conduit drops to accessories	Single core cables low smoke, zero halogen outer sheath
Structured Cabling	Galvanised Steel Cable Basket Data mat for underfloor cabling	Cat 6a Horizontal cabling

System	Cable Containment	Cable Type
Fibre Cabling	Galvanised Steel Cable Basket	16 Core Multimode fibre for backbone cabling Single core Multimode fibre for incoming cables
Fire Alarm, BMS, Security, ELV	Galvanised Steel Cable Basket	ELV, BMS and Security shall be wired to specialist specification Fire Alarm shall be wired using enhanced soft skin fire resistant cabling Prysmian FP+ or similar

Table 3-1:

All containment shall be concealed within the ceiling void and steel conduits shall be recessed into walls.

All penetrations associated with containment services shall be fire stopped as necessary.

All containment systems shall be sized to provide 25% spare capacity.

3.8 Secondary Containment

The Contractor shall make allowances for a secondary containment system from the primary containment system to the point of use, including socket outlets, lighting switches, fire alarm break glass units, security control equipment etc.

This is to also include an extension of the primary containment runs of small power and lighting trunking, fire alarm cable tray and data cable tray to the larger individual rooms.

All conduits shall be fixed within wall cavities or chased into walls with the exception of plant rooms and other similar finishes with unfinished blockwork walls. In this instance, surface mounted galvanised steel conduit shall be provided.

All penetrations associated with secondary containment services shall be fire stopped as necessary to maintain the intended fire integrity.

3.9 General Small Power

Design, supply, install, test and commission a small power distribution system in accordance with all the appropriate standards, including but not being limited to:

- BS 7671 (18th Edition).
- Electricity at Work Act 1989
- BS EN 50525-1 – Electric cables. Low Voltage energy cables of rated voltages up to and including 450/750 V
- BS EN 61439-1 – Low Voltage switchgear and control gear assemblies. General rules.
- BS EN 60529 - Degrees of protection provided by enclosures (IP code)
- BS EN 60947 – Low Voltage switchgear and control gear
- BS EN 61009-1 – Residual current operated circuit breakers with integral overcurrent protection for household and similar uses.

Small power services to be provided throughout the development to serve small power outlets and all power accessories. For the quantity and location of small power outlets refer Cundall Power & Data drawings. These installations are to include but are not be limited to:

- Cleaner's sockets
- General 230V double or single socket outlets
- Fused connection units supplying various items of equipment throughout the buildings, such as hand dryers, fan coil units, air curtains etc.
- Supplies to electrical systems / services
- Supplies to mechanical systems / services
- Supplies for access control and CCTV systems

- Supplies for intruder alarm systems
- Isolators / double pole isolators supplying various items of equipment
- Supplies for ICT equipment
- Supplies to fire detection and alarm system
- Supplies to DDA systems
- Supplies for other/ specialist systems and equipment, such as BMS panels, sprinkler pump etc.
- Supplies to lighting control panels

General small power shall be wired using Twin & Earth cables with low smoke, zero halogen outer sheath.

All general socket outlets are to be DDA compliant.

The outlet types to be provided are generally as follows:

Area	Type of Installation
Offices, Meeting Rooms and all FOH areas	Brushed Steel Finish outlets
Café and Restaurant	Brushed Steel Finish outlets
Back of house areas i.e. stores	Surface mounted white plastic outlets and galvanised conduit
Plant spaces	Surface mounted metal clad outlets and galvanised conduit
Storage/ Main Kitchen	Surface mounted metal clad outlets and galvanised conduit

Table 3-2:

Contractor is to coordinate with the Architect/Interior Designer for the final finishes of the outlet types.

Small power installations within the development have been based on but not limited to the following:

- Final connection to all items of equipment to be complete with accessories, accessory mounting boxes and compatible accessory plates.
- Metallic Back box and sockets/accessories are to be linked by a dedicated copper cable link no less than 2.5mm.
- Small power circuits/outlets to be generally protected by MCB/RCBOs (generally 30mA trip units, 40ms) within the DB where the circuit originates.
- Where the small power installation requires penetrations through walls/ floors, the fire and acoustic integrity of the walls / floors affected to be made good upon completion. All major penetrations required for the electrical services to be fully coordinated and programmed into the erection of the building structure.
- Where necessary small power required to large items of plant (local or remote) to be supplied via local isolators.
- Electrical accessories to be flush mounted and finished with a white plastic front and tamper proof fixings, with the exception of all plant areas where surface mounted metal clad accessories are to be installed.
- Wiring is to be carried out using multicore LSZH cables contained within cable trunking
- All external power and lighting cabling to be UV protected.
- All outlets serving fixed equipment are to be labelled with details of the equipment connected there to.
- Provide IP44 rated equipment for all internal plant equipment that may be subjected to moisture and occasional water splashes.
- Provide IP65 rated equipment for all external plant equipment, and all external general supplies, as a minimum.
- All external lighting and power circuits to be protected via individual 30mA RCBOs fitted to the outgoing ways of the distribution board

3.9.1 Ring circuits

Ring circuits shall supply a maximum of 8 twin socket outlets each to minimise likelihood of nuisance tripping due to excessive earth leakage currents.

Circuits serving offices shall be provided with high integrity earthing via dual earth terminals and RCBO protection.

3.9.2 Cleaners' Sockets

Dedicated cleaners' sockets shall be provided in all spaces with spacing to suit equipment leads of 10m maximum.

Cleaning sockets shall be engraved to clearly indicate its intended purpose.

All cleaners' sockets shall be wired on dedicated circuits, separate to general power sockets with RCBO protection.

Circuits shall be wired as rings where serving multiple outlets or 20A radial circuits where serving up to two sockets.

3.9.3 Supplies to Fixed Equipment

Items of fixed equipment shall be served by dedicated radial circuits with final connection to equipment via fused connection units, isolators, unswitched outlets or socket outlets as necessary. Circuit protection shall be via suitably rated MCBs or RCBOs as necessary.

Where provided, hand dryers and hair dryers shall be supplied via a switched fused connection unit located within ceiling voids or at high level where accessible ceilings are not provided. From the fused connection unit, a vertical conduit drop shall be provided, recessed within the wall to the final location of the dryer where cabling will enter the rear of the unit via recessed conduit box. Refer to architectural sanitaryware information for details.

All power to specialist, mechanical and other ancillary systems shall be provided in accordance with the supplier's requirements.

3.9.4 White Goods

Under counter white goods such as fridges and dishwasher units shall be supplied by a single unswitched socket outlet located under the bench. This socket shall be wired via a switched fused connection unit mounted over the bench to allow isolation of the socket.

3.9.5 Labelling

All accessories supplying fixed equipment and sockets shall be clearly labelled to indicate the circuit reference.

Accessories serving fixed installations shall be labelled to indicate the item of equipment being served.

3.9.6 Kitchen Small Power

The Contractor shall design, supply, install, test and commission a small power system within the kitchens for both the café and restaurant areas in accordance with the requirements of BS 7671 and in line with Client's requirements.

Power has been allowed for assumed general socket outlets and shall be arranged as a ring or radial circuit protected by MCB or RCBO as necessary. Final equipment details shall be confirmed by the Client/appointed kitchen designer.

All accessories within kitchen areas shall be clearly labelled to indicate the circuit reference and equipment served.

3.9.7 Power to Mechanical Plant

Power supplies shall be installed throughout for mechanical systems in accordance with the requirements of BS 7671.

Mechanical plant located on the roof such as the Air Source Heat Pumps and AHU's shall be provided with a dedicated supply from the panel boards located on the roof.

A dedicated distribution board located within the ground floor and roof plantrooms will supply the mechanical plant equipment in this area.

Power to mechanical plant items and other associated systems shall be provided by surface mounted rotary isolators or switched fused connection units, depending on equipment rating. In instances where these items are installed externally,

these shall have a minimum ingress protection of IP65. In instances where items are installed within internal areas, all outlets shall be recessed within walls or above ceiling voids.

All new mechanical supplies shall be arranged as a radial circuit protected by suitably rated MCBs and MCCBs.

All accessories supplying mechanical equipment shall be clearly labelled to indicate the circuit reference and equipment being served.

All power to specialist, mechanical and other ancillary systems shall be provided in accordance with the supplier's requirements.

3.9.8 Supplies to EV and Electric Bikes Charging

As part of the phase 2 of the project, a total of 16 EV charging points shall be installed and shall be served from the external feeder pillar. As the 15 EV charging points located within the carpark of phase 1 are to be supplied from the phase 1 EV distribution board during phase 1 with the phase 1 contractor making an allowance for a manhole chamber on the boarder of phase 2 for future reconfiguration. Following the completion of phase 2 the submain cables are to be re-wired to the Hub buildings main switchpanel.

Provide sufficient electrical infrastructure for a load management system which is to ensure:

- Dynamic power management to all charging points, reducing the speed of charge to moderate total EVC electrical demand, striking balance between the number and the speed of charging points
- The proportion of site's total energy supply to EVC system is to be limited, when site load demand is at its peak.

The load management system is to limit the load of all 31 EV charging points to 105kW..

The EV charging points shall be served via underground ducts with SWA cables suitable for external environment.

The contractor is to design the underground LV and comms duct routes and sizes for the associated EV charging points.

Develop and further confirm the final requirements and ratings for the parking bay EVCs at the next design stage.

Electrical Bikes charging points are to be supplied from distribution board located in building's southern riser. Contractor is to provide appropriate underground LV duct routes and sizes for Electrical Bikes charging points.

3.10 General Lighting Systems

Design, procure, install, test and commission the complete lighting, lighting control and emergency lighting installations as described within this specification, shown on the indicative lighting drawings, and referenced in the luminaire schedule. Design in accordance with all the latest appropriate standards listed below:

- CIBSE SLL Code for Lighting (2022)
- BS EN 12464-2: Light & Lighting: Lighting of Workplaces, Outdoor workplaces
- BS EN 12464-1: Light and Lighting – lighting of workplaces. Indoor Workplaces
- CIBSE SLL LG6: The Exterior Environment
- CIBSE SLL LG7: Offices
- CIBSE SLL LG14: Control of Electric Lighting
- CIBSE SLL LG16: Lighting for Stairs
- CIBSE SLL LG12: Emergency Lighting
- BS EN 1838: Lighting applications – Emergency lighting
- BS EN 5266: Emergency Lighting
- BRE Digest 498 – Lighting Control
- BS 7671 - IET Wiring Regulations (18th Edition)
- Safety Signs, including Fire Safety Signs BS 5499
- The CIBSE Code for interior lighting

- Part L, M and B of the latest Building Regulations

Refer to the interior designers package for details of their latest CGIs and visualisations. Where there are additional lighting elements shown within the CGIs that are not shown on the Cundall lighting drawings or captured within the Cundall luminaire schedule – the CGIs should take precedence and the luminaire(s) should be allowed for within the Tender

Design the lighting in accordance with the lighting layout, control strategy and luminaire schedule included in the tender documents.

Undertake final onsite checks to co-ordinate the lighting installation and all luminaire positions with the architect's design details, furniture details and other MEP services (such as the mechanical services, fire alarm, security devices etc.) to avoid clashes.

Include all ancillary equipment such as suspension wires, end caps, jointing brackets, drivers, emergency battery packs, emergency LED identifier lights, louvres, labels as required to provide a complete scheme - in accordance with the luminaire schedule and to ensure luminaires are fully compatible with the specified ceiling types.

Install all contactor devices in their own enclosure of the same type and manufacturer as the distribution boards and located adjacent to the distribution board supplying the circuits being switched.

Refer to the interior designers package for the specifications of the feature lighting.

Provide all luminaire colours as per the luminaire schedule, however, confirm all colours with the architect/interior designer and lighting designer prior to ordering. Where luminaires are recessed into the ceiling match the bezel colour with the RAL colour of the ceiling tile or paint. The ceiling tile or paint RAL will take precedence over the colour quoted in the luminaire schedule.

Check all suspension or fixing heights of all lighting and lighting control elements prior to ordering and installing. Refer to the relevant architect's and interior designers sections to determine these heights. Provide shop drawings of luminaire lengths and mounting details for approval.

Provide fire alarm interface unit to each lighting control system to reset all lights to 100% illumination on fire alarm activation.

Where suspended luminaires are specified, provide manufacturers proprietary suspensions and counterweights in accordance with manufacturers recommendations. Ensure power and control cabling running to suspended luminaires are fixed neatly to one of the suspension fixings utilising cable fasteners. Final pendant suspension heights to be decided onsite with the architect & lighting designer. Do not cut the suspension cables until the final heights have been agreed.

Where luminaires are suspended from conduit or drop rods, the supports shall be straight and vertical with allowances made for any final height adjustment.

Where luminaires and lighting control equipment is to be installed in the ceiling, or ceiling tiles, check the ceiling component details and co-ordinate to ensure the light can be installed. E.g. check the T-Bar dimensions or the type of ceiling type.

Check if the battery pack can fit through the opening, there is sufficient depth to recess the downlight and ensure the luminaires are not supported by the ceiling system alone. Whilst these checks may have been completed during design, a final site check is required due potential changes in product dimensions.

Source all luminaires, lamps and control equipment from manufacturers who can provide a quick replacement service or can deliver items from stock.

Ensure that all drivers are specified / attained with a 5-year manufacturer's warranty on the lifetime. All drivers must comply with IEEE 1789 flicker requirements.

Internal wiring of any continuous suspended luminaires will be silicone rubber insulated flexible LSF cable or equal and approved heat-resisting cable.

All luminaires will be left in a clean condition on completion and care shall be taken to ensure all louvres are dust free.

Provide all luminaires as DALI dimmable unless specifically stated otherwise.

Provide samples of all luminaires for the approval of the client / interior designer and architect prior to orders being placed.

Set out all luminaires as per the architect's and interior designers RCP's and setting out drawings.

Carry out final coordination of the luminaires to reduce the risk of clashes.

Luminaires are to be provided with LED light sources throughout. Some light fittings require 3000K and some require 4000K, check the schedule prior to ordering.

Include for the supply and installation of all lamps. Install all lighting in a manner that allows safe access by personnel in order to carry out routine maintenance (i.e. lamp changing).

Allow for full liaison with the chosen lighting controls specialist to ensure full compatibility between luminaire ballasts and lighting control installations.

Ensure all necessary parts, accessories and components are allowed for, for all luminaire installations. Obtain installation instructions and guidance from the lighting manufacturers as to the appropriate and safe installation of all luminaires.

The electrical contractor will need to wire and install all integrated lighting within joinery on site. All lighting control equipment including power supplies is to be mounted in a nearby accessible location. All lighting within joinery is to be linked to the lighting control system. Refer to associated interior designers detailed drawings and elevations for final positions and dimensions of lighting elements within joinery and shelving, as these luminaires are not shown on the drawings, LED strip lighting specification to be as per the luminaire schedule.

Ensure the lighting and controls system commissioning is complete prior to handover. Rectify commissioning defects found after this time.

Provide mock-ups at the earliest opportunity for review by the architect, interior designer and lighting designer.

Agree the lighting controls strategy and PIR time settings for each area with the Client.

Refer to the Luminaire Schedule for the preferred lighting fittings and manufacturer.

Where a colour temperature of lamp is specified then the colour temperature of all of that type of fitting is to be within a 3-step macadam range. This is to prevent having two fittings in close proximity which have a noticeable difference in appearance.

Include for the supply and installation of all lamps.

Any proposed changes to the luminaire manufacturers or products specified are to be reviewed by the Client, lighting designer and architect.

Provide all comparative data listed below for the original and proposed alternative luminaires put forward for review by the lighting designer and architect.

Provide lead time details for each of the preferred lighting manufacturers to ensure delivery delays are avoided.

Submit all necessary details including but not limited to the following for the manufacturer/ product review:

- Luminaire photometry
- Lamp manufacturer and performance details (refer to LED specifications in System description section)
- Lumen Output, Beam Diameter, LOR, Circuit Watts, Ra, CCT, Lamp Lumen Failure (L), LED chip Failure (B) etc.
- Lux level calculation including vertical and horizontal lux plots
- Glare calculations
- Product construction and material details of luminaire
- Product dimensions
- Fixing details
- Light Output Ratios

- Luminaire optics performance
- All comparison data of the specified and alternative luminaires.

The contractor is to provide a provisional sum for the external and internal feature lighting, in agreement with the project QS. Indicative feature (decorative) luminaires have been included within the associated Luminaire Schedule to aid this exercise, however final specification and sign-off of feature luminaires is to be agreed with the Interior Designer & Architect.

As per section 6.0 of this specification the luminaire manufacturer is to be ProLight Design. The contact details are as follows:

Nick Whitehand
Nick@prolightdesign.com
01380 739911
07775 792662

Below the line costed alternatives may be provided within the tender return, in addition to the above.

3.10.1.1 Internal and External Lighting Levels, Zoning and Control

The Contractor shall ensure that the internal lighting in all relevant areas of the building is designed to provide an illuminance (lux) level appropriate to the tasks undertaken, accounting for building user concentration and comfort levels.

The Contractor shall design and install a lighting design strategy that provides illuminance levels in accordance with the SLL Code for Lighting 2022 and any other relevant industry standard.

For areas where computer screens are regularly used, the lighting design shall comply with CIBSE Lighting Guide 7 sections 3.3, 4.6, 4.7, 4.8 and 4.9.

All external lighting located within the construction zone shall be designed and installed to provide illuminance levels that enable users to perform outdoor visual tasks efficiently and accurately, especially during the night. All external lighting provided shall be specified and installed in accordance with BS 5489-1:2020 Lighting of roads and public amenity areas and BS EN 12464-2:2014 Light and lighting - Lighting of workplaces - Part 2: Outdoor workplaces.

3.10.1.2 Lighting Control

Provide a DALi addressable lighting control system. Supply DALi LCMs and Mains /Switched LCMs for control of all luminaires. The contractor is to engage with a lighting control specification manager to provide a complete system.

Provide all luminaires as DALi dimmable unless otherwise stated in the luminaire schedule. Check with the lighting manufacturer prior to ordering the luminaires that they are compatible with all of the system components. Where Mains or Phase dimming has been specified, provide additional control components to ensure suitable control.

Link 5amp sockets via control system. Provide additional control components to ensure suitable control of floor/table lights.

Provide all dimmable lighting with gradual dimming allowing luminaires to be dimmed from 5%-100% output in 1% increments.

Provide gradual/smooth turn on and turn off for all luminaires.

PIR's indicated on the drawings are to provide presence detection and absence detection. In areas where daylight is present, the PIR's are to be suitable for daylight dimming by utilising combined photocells. Agree the functionality of each prior to programming. The detection period of the PIRS's will be between 5 minutes and 60 minutes. See control description of each area to determine automatic shut off time. Provide PIR's capable of being adjusted in their sensitivity.

Provide sufficient quantity of PIRs for full coverage of the whole space with no blind spots, taking into account all walls and furniture placements, etc.

The programming of the lighting will be via a tablet app and future amendments will be via a tablet or phone app and be freely available to the clients FM team.

Agree a commissioning programme and 'day one' set up with the lighting designer and architect prior to commencing the commissioning.

Allow for additional commissioning time approximately 2 weeks after post occupancy to refine the system – taking on board the clients adjustments. The lighting controls manufacturer and the contractor are to propose a suitable commissioning programme and period and make it clear in the tender return what the allowance is.

Demonstrate the operation of the system to the client and engineers and make adjustments as required.

In all of the FOH areas the contractor is to allow for black finished switches and scene select plates.

The contractor is to provide a separate below the line cost option for a descoped of the lighting control system as a value engineering option.

3.10.2 Emergency Lighting

Design, supply, install, test and commission an emergency lighting installation in accordance with all the appropriate standards including but not limited to:

- The CIBSE Code for interior lighting
- CIBSE SLL LG12: Emergency Lighting
- BS EN 1838: Lighting applications – Emergency lighting
- BS EN 5266: Emergency Lighting
- Safety Signs, including Fire Safety Signs BS 5499

Provide new emergency lighting throughout the building. Generally, this is to be based on using self-contained emergency lighting to permit safe movement and escape from the building at times of power outages.

Provide an emergency lighting system to comply with BS 5266 and incorporating any requirements provided by the local Fire and Building Control officers.

In accordance with BS5266, high risk areas shall be provided with emergency illumination to a minimum of 10% of the general lux level or 15lux minimum. High risk areas shall be considered to include, but not limited to:

- Plant rooms
- Control panels
- DBs
- Kitchens

Provide internally illuminated BS5499 Part 1 exit luminaires throughout. The illuminated exit signs are to meet the European Signs directive format. Legends / pictograms for illuminated exit signs to be in accordance with BS ISO 7010. Directional arrows to meet the requirements of BS 5499.

The exit signs final positions are to be coordinated by the architect and the fire engineer, prior to installation.

Provide illuminated emergency wall mounted bulkhead fittings externally above/at the side of each external door.

Provide additional emergency lighting to highlight particular hazards, changes in direction, fire alarm and fire-fighting equipment, first aid points, changes in floor level, etc.

The emergency lighting system is to provide a minimum of 3 hours battery backup, during mains failure mode.

The emergency lighting will be a self-test system as part of the DALi lighting controls system via EMPRO ballasts linked via the BMS system to the chosen head end location. Liaise with the client to confirm the preferred location of where head end software is to be installed. Provide a separate below the line cost option saving for reducing this specification down to manual key switches within each room.

Emergency testing of all emergency lighting shall be by the DALi head end controller. Testing of luminaires shall be programmed to occur 'out of hours'. The system shall automatically email the results of the emergency lighting test to the facilities maintenance management.

3.10.3 External Lighting

Design, supply, co-ordinate (installation / working / fabrication drawings), install, test, commission, set to work, and demonstrate an external lighting installation where lighting is connected directly to building plots to cover the sitewide external areas based on the Landscape Architect's drawings, in accordance with all the appropriate standards.

Provide external lighting designed for safety and security, as defined by CIBSE Lighting Guide 6, CIBSE Lighting Guide 1 and BS EN 12464-2.

Area	Light Level & Uniformity
Vehicle Routes	10 lux Eav / 0.4 Uniformity
Car Parking	10 lux Eav / 0.4 Uniformity
EV Charging	50lux Eav / 0.4 Uniformity
Vehicle Charging Locations	50 lux Eav / 0.4 Uniformity
Vehicle Turning	50 lux Eav / 0.4 Uniformity
Generators/ASHP Plant	200 lux Eav / 0.4 Uniformity
Cycle/Refuse Store	20 lux Eav / 0.4 Uniformity
Loading	150 lux Eav / 0.4 Uniformity
Walkways and Building Perimeter (Pedestrians)	5 lux Eav / 0.4 Uniformity
External Emergency Lighting at Exit Doors	1 lux Min / 0.4 Uniformity

Table 3-3:

Install external lighting in compliance with Table 2 (and its accompanying notes) of the ILP Guidance notes for the reduction of obtrusive light, to avoid light pollution to the surrounding areas. Ensure the external lighting is installed to minimise disturbance to any potential wildlife in the area and ensure light spill does not occur into the nature reserve to the south.

Cundall external lighting drawing is approximate and indicative of design intent only, the final detailed design by the contractor as part of the D&B contract. Design the lighting system in accordance with the lighting spill plots and information issued as part of the Planning submission. Obtain from the CA if not received.

All external lighting located within the construction zone to be installed to provide illuminance levels that enable users to perform outdoor visual tasks efficiently and accurately, especially during the night.

The average initial luminous efficacy of the external light fittings within the construction zone (the building being developed and its external site areas) shall not be less than 70 luminaire lumens per circuit Watt.

External, building mounted and column mounted LED luminaires are to provide illumination to the surrounding hard standing parking and roads within the plot boundary.

External LED lighting bulkhead fittings are to be provided within 2m of an entry/ exit door and will also operate as emergency lighting in the event of power failure.

All external light fittings to be automatically controlled for prevention of operation during daylight hours and presence detection in areas of intermittent pedestrian traffic. The automatic external lighting control system is to prevent operation

during daylight hours through photocell and time clock arrangement with manual over-ride facility to control all external lighting.

All external lighting (except for safety and security lighting) is to be automatically switched off between 23:00 and 07:00. All safety or security lighting provided that is to be used between 23:00 and 07:00 needs to comply with the lower levels of lighting recommended during these hours, as per Table 2 of the ILP's guidance notes.

A key switch is to be installed to provide manual override of the external lighting (ON-OFF AUTO), located within the plant room.

The external lighting to the car park and pedestrian zones shall be supplied from the external lighting distribution board DB/EXT/01 and served via underground ducts with SWA cables suitable for external environment. Refer to the LV schematic for further details.

The contractor is to design the external lighting ducts for all lighting shown in phase 2.

External lighting for the MUGA and Paddle Tennis court is to be supplied by the specialist contractors, main contractor is to coordinate with the specialist contractor for the power requirements.

A provisional sum is to be allowed for feature landscape lighting, and agreed with the project QS, refer to the landscape architects package.

3.11 ICT Infrastructure and Structured Data Cabling

Employ a Data specialist to design, supply, install, test and commission a new structured cabling system in accordance with all the appropriate standards and documents, including but not being limited to:

- BS EN 50173 – 1 Information Technology – Generic Cabling Systems. General Requirements
- BS EN 50174 – 1 Information Technology – Cabling Installation Specification & Quality Assurance
- BS EN 50174 – 2 Information Technology – Cabling Installation, Installation Planning and Practices inside Buildings
- BS EN 50174 – 3 Information Technology – Cabling Installation, Installation Planning and Practices outside Buildings
- BS EN 6701 – Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance
- To Cat6a, Cca.S1a.d1.a1 IT cabling specification
- BS 6259 – Code of Practice for the design, planning, installation, testing and maintenance of sound systems
- BS EN 60728-1 – Cable networks for TV signals, sound signals and interactive services
- JD Sports PLC requirements

A structured cabling (telecoms / data) system is to serve the building with individual data points as indicated on the Small Power & Data drawings. The telephone and voice communications are to be Voice Over IP (VOIP).

Provide an ICT system to include but not be limited to:

- Cabling containment system
- Structured cabling including all termination and testing
- Comms cabinets/ server racks, user switches, all patch panels and leads (active equipment to be provided by JD)
- Data RJ45 outlets combined with brushed steel face plates; quantities and positions to be as indicated on the Cundall Stage 3 Small Power and Data Layouts.
- Associated required power supplies, as indicated on the Cundall Stage 3 Small Power and Data Layouts
- Back-up UPS supply where required
- Incoming ducts for incoming fibre/ copper cabling, and draw-pits

The incoming telecommunication and ICT (including fibre optic) service ducts to be routed via 2No. diverse routes into the first-floor comms rooms for the accommodation of equipment frames for service providers associated with the JD's Fibre Ring.

Generally, 2 No. 100mm diameter PVC ducts are to be provided at each of the two different intake point, as shown on the Cundall Stage 3 Combined External Electrical Services layout, and from there to be routed via diverse routes and be terminated in the main comms room on the first floor, complete with draw-wires, to enable JD to install telephone/data services into the building. An additional 100mm diameter PVC duct is to be installed from the BT chamber located on Pilsworth Road to allow for future connections, the contractor is to liaises with the S278 works contractor for exact locations.

From the main Comms Room, two diverse primary cable basket containment routes are to be installed. Vertical dedicated cable containment is to be provided in the 2 data risers, across all the floors.

Allowance has been made of Hub rooms within all floors, for sub-comms switches to be installed, to ensure the data cable lengths are kept to the recommended lengths. All patch panels on other floors are to be connected via 16 core multimode fibre optic cables to the main core switch within the Comms room on the first floor. Active equipment and connecting patch leads to the patch panel to be provided by JD.

The engineering services servicing the main Comms Room is to be constructed to meet the requirements of the client.

The main Comms room is to follow the infrastructure criteria/provisions listed below:

- Max 7kW per cabinet.
- Cabinet to be HPE 48U 800mmx1200mm G2 Enterprise Shock Rack
- 5 No cabinets, in hot aisle, cold aisle arrangement with space for an additional 3 if required.
- 10 No. Eaton ePDU 32a commando. Managed ePDU. Input IEC60309 32A (commando). Output C13 (20) C19 (4)
- 10 No. Eaton Environmental Monitoring Probe ePDU connectivity for each rack.
- Dedicated plant area, separated for flood / fire etc. Provision for M & E engineering to take place without accessing the server room.
- Significant autonomy / link to generator and UPS.
- 2 No. Eaton 93PS 30KW UPS
- Provision of SNMP link to UPS for shut down on imminent end of battery life.
- FM200 fire suppression system
- CCTV coverage throughout.
- Controlled access to the room
- Emergency lighting
- Phone and pc provision for 3 operators.
- Wifi.
- Diverse routed single mode fibre connectivity.
- On site witness testing of full system, with load bank and full load conditions for full duration.

All fibre terminations are to be LC. The fibre tray is to be in the top of the active patch cabinet.

Provide a diverse routed fibre ring to all additional cabinets within the building from incoming patch cabinet locations.

Direct links to be provided to each patch cabinet location.

Incoming fibre cables to be installed in ducts that are twin walled and resistant to acids, alkalis and corrosive soil elements. Sufficient external manhole and draw in points to be provided. The external duct network to be coordinated with the structural engineer.

Copper and fibre are not to be installed in the same ducts. Each duct size is to be calculated based on the services required plus an additional 50% extra for future services.

The overall utility network is to be part of JD's internal ICT system and close liaison is required with the IT department. The ICT network and infrastructure to the new Hub building is to be via an extension of the existing campus. A provisional connection is also required from an external telecom's operator - likely to be Openreach. All necessary ducts, draw ropes, chambers, sealing systems and frames for termination to be provided.

All cable containment for the entire ICT data structured cabling installation to be sized to make available an additional 50% of spare capacity for each cable tray. For the avoidance of doubt, any cable tray/basket shall be no more than 50% full.

Provision is made within the data containment to utilise the containment system for the future installation of comms, radio and terrestrial television systems.

Active equipment including switches, routers and telephones used by JD as part of their normal activity are to be supplied and installed by JD, unless otherwise noted.

All power supplies to the comms room/ server room/ patch rooms equipment to be served via dedicated distribution boards, fed from the main distribution system.

A dedicated earthing system to be provided for the ICT system with earth bars located in the main communication/ server rooms.

Each cabinet is to have a 10mm earth form main earth.

The exact sizing of each patch or equipment cabinet is to be agreed with the JD IT department.

Patch cabinets for networking purposes are to be located exclusively in dedicated Hub rooms, and not be shared with other equipment, e.g. AV patch and control rooms etc.

All IT Hub rooms are to be cooled to prevent damage to the active equipment. The heat gain from the active equipment is estimated at 500W/24 ports. The Contractor to install DX units within the Comms Room and the Hub Rooms to provide cooling to the equipment.

Uninterruptable power supplies to be provided to the active cabinets located within the second-floor comms room with 60 minutes autonomy. See the Cundall Stage 3 LV schematics for further details.

The premises connectivity system, or distribution system, to become the shared physical medium that allows telephones, reception printers and personal computers (PCs) and all other IP communications landlord devices to communicate with each other throughout the building through a combination of cables, adapters, connectors and other equipment such as wireless access points.

A telephone installation is to be provided to service as a minimum the following facilities:

- Security Systems (Intruder alarm, access control, CCTV)
- Fire alarm System
- BMS System
- Lift Motor Room (separate independent lines to each lift car controller)
- Redcare or equivalent telephone connection is to be provided for lift emergency calls.
- Reception Desk

The installation of a W-LAN system is to be provided. It is to be ensured that there is Wi-Fi provision and access within all the common areas of the building. Coverage consists of a network grid above the ceiling level as shown on Cundall's Stage 3 Small Power and Data Layouts. Each router position is based upon the provision of a dual RJ45 outlet, subject to the IT specialist's confirmation.

Final quantities and positions of the Wifi data ports to be confirmed by JD.

All IT data cabling is to be either fibre or rated at Category 6a (Cca.S1a.d1.a1) to comply with the British Standards. Category 6a handles 10 Gbps performance, supports higher power over ethernet loads (lower risk of overheating) plus offers a greater long-term performance, providing flexibility to longer leases/in-use operation.

Cat5e cabling is not to be accepted at any case because it is verging on dangerous in certain conditions for the latest/emerging Power over Ethernet standards.

The fibre cabling connecting the data cabinets as well as the cat6a cabling connecting the final data outlets to the comms racks is to be provided by the Contractor.

RJ45 outlets are to be provided within the reception area and wherever else the MEP services require a data/ telephone connection. The number of outlets in each area to be as per Cundall's Stage 3 Small Power and Data layouts and to be further developed during the next design stage, in accordance with all the MEP systems requirements. All outlets to be labelled and fitted with spring loaded sliding shutters to prevent the ingress of dirt and dust. Provide labelling as per the small power section. Labelling naming convention to be confirmed by the University. The complete system to be tested and commissioned in accordance with industry and University standards and test results are to be provided and included within the O&Ms.

All data points are to be Panduit CAT6a, mini com style.

The testing and commissioning of all structured cabling to support these and other systems is to be certified by the Contractor prior to the installation of the final JD supplied equipment.

Final commissioning of the JD supplied equipment is to be arranged by JD specialists. The Contractor is to include for attendance during the final commissioning.

The network, patch rooms and services are to be provided at the earliest opportunity by the Contractor, to allow JD to commission the data services required for the building services installation by the Contractor.

The Completion of the Hub rooms is to be ensured prior to any active equipment being installed; this includes the following:

- Room is to be cleaned and finished
- All services installations to be complete
- Air conditioning to be in operation and running
- Electrical installation and supplies are to be complete and stable – the testing of the electrical installation to be complete
- PDUs to be in the cabinets
- Earthing to cabinets to be in place
- All labelling to be in place on the cabinets
- Fibre test certificates confirming a pass to already be in the University of Huddersfield possession
- Any copper cabling that has been patched to be certified with certificates provided
- Locks to be fitted on the finished door
- Patch leads to be available.

The main comms cabinets are to serve CCTV, WIFI, AV, Security, Access Control and data / communications requirements throughout the building – subject to final confirmation by the Associated specialists.

Ensure the data infrastructure is fully installed, tested and commissioned before the Access Control, Security, CCTV and other systems that require data connectivity are to be commissioned, in order to avoid any programme delays and mitigate the need for recommissioning of any system.

3.12 Fire Detection and Alarm System

Employ a fire alarm specialist to design, supply, install, test and commission a complete new fire detection and alarm system to cover the new building in accordance with all the appropriate standards, including but not being limited to:

- BS 5839 – Fire Detection and Fire Alarms for buildings
- BS 9999 - Fire Safety in the Design, Management and Use of Buildings. Code of Practice
- BS EN 54 – Fire Detection and Fire Alarm System
- The Fire Strategy
- The Local Authorities/ Local Fire Brigade's/ Fire Officer's requirements
- The Building Control's requirements
- DDA requirements

- BS 6387 – Test method for resistance to fire cables required to maintain circuit integrity under fire conditions

This document may indicate elements related to fire systems. These are indicative only and design, final number, positioning and performance must be established as part of the CDP works to maintain the intent of the design fire strategy.

An L2 category fire alarm system is required to the new building as per the fire strategy.

The Contractor to employ a Fire Alarm specialist to provide a new open protocol analogue addressable Fire Detection & Alarm System (FDAS).

The Fire Alarm system to be controlled via a head end unit and to have the facility to integrate to the winder building and BMS. The system is to be fully linked to the network at the JD campus. Full allowance is to be made for all the necessary interface works.

Provide a cause and effect matrix.

The Fire Alarm system is to have battery backup with autonomy of 72 hours in quiescent mode and 30 minutes of operating capacity.

The system is to be installed in accordance with the overall fire strategy of the building and to be fully integrated to the Protect network on the existing campus. The installation to meet all requirements as indicated in the fire strategy and defined within BS 5839, whilst also meeting all the requirements of the Fire/Building Control Authorities and those of Equality Act 2010.

The Fire Alarm cabling is to be enhanced red LSOH soft skin cabling for example, FP Plus.

Network cable links between panels are to be carried out using enhanced fire rated cabling routed externally in cable ducts utilising LSOH SWA cables. A minimum cable csa of 2.5m2 is acceptable for network cabling.

A new Main Fire Alarm Panel is to be located on the Ground Floor, within the security room. This position is to be further confirmed and agreed with the Architects and the Fire Engineers.

The Contractor / Fire Alarm specialist to provide an accurate fire alarm zone chart adjacent the fire alarm panel.

The Main Fire Alarm Panel to be supplied directly from the main LV switchboard via dedicated red coloured and lockable MCCB as indicated on the LV schematic. The panel is to be provided with an integral battery back-up of 72 hours to maintain the installation in operation under mains failure conditions.

The Contractor / Fire Alarm specialist to ensure the Main Fire Alarm Panel are provided with a manual override key switch to prevent the shutting down of plant and override of lift during testing periods.

The Main Fire Alarm Panel is to serve multiple fire alarm loops serving optical smoke detectors, heat detectors, manual break glass call points, electronic alarm sounders, visual alarms (flashing beacons), strobes, pagers, interface units, and all other ancillary equipment necessary throughout the building as per the Fire Alarm specialists' drawings.

In addition to the main fire alarm control panel an Emergency Communication Panel is to be provided and located within the entrance lobby. The Emergency Communications Panel is to be supplied directly from the main LV switchboard via dedicated red coloured and lockable MCCB as indicated on the LV schematic. The panel is to be provided with an integral battery back-up of 72 hours to maintain the installation in operation under mains failure conditions.

Vertical loops are to be taken up risers to serve each floor. Horizontal loops to be taken around the floor level.

Ceiling void detection to be provided within any ceiling voids that have a depth of 800mm and above.

Heat detectors (only) to be provided in areas which could be subject to nuisance alarms should methods of smoke detection be provided, for example the Cafe, Kitchen etc.

FM200 fire suppression system is to be installed in the comms room. The FM200 panel is to be located within the comms room and be connected to the main fire alarm system, such that fire or fault on the system is indicated at the main fire alarm panel.

The Contractor / Fire Alarm specialist to provide fire detection in all shafts and risers as per the recommendations of BS 5839. Where detectors are provided in these areas, LED visual indicators are to be provided (ceiling or wall mounted depending on the area) to provide a means of visual indication as to which detector has been activated.

The Contractor / Fire Alarm specialist to provide manual call points at all final exits from the building and at intervals such that an occupant does not need to travel further than 45m to activate a call point.

The Equality Act 2010 requires a greater independence for those with hearing impairments, and so visual indication to be provided along on major escape routes, in public areas and DDA toilets to cater for the hard of hearing.

The Fire Alarm Panels to be capable of identifying the point of origin and denoting where any fire alarm device has been activated. An output signal to be provided to a remote BMS monitoring station. An output signal is also to be provided to a dedicated, 'Redcare line' or a similar remote monitoring station line, provided by the Contractor, that is to enable remote fire alarm monitoring.

Fire alarm interface units to be provided where required to control the operation of all fire linked or related equipment, to assist safe egress from the building and to protect sensitive equipment under fire / evacuation conditions which are to be in accordance with the Fire Strategy.

The systems that are to be interfaced where required to the fire alarm system, as a minimum, are listed as follows:

- Mechanical equipment outstations
- BMS outstation
- Motorised fire-smoke dampers
- Electronic access controls and security systems
- Lifts
- Disabled refuge panel
- Disabled refuge positions
- Disabled alarm panel
- Smoke extract fans and associated controls
- Sprinkler system
- Life-safety generator
- Fire curtains, if applicable
- Actuated opening vent
- Audio / video system, if applicable

The Fire Strategy is to define which areas need to be evacuated in the event of an alarm activation. The Contractor to ensure that the Fire Alarm specialists' design is aligned with the Fire Strategy.

The alarm activation and evacuation strategy Cause and Effect schedule is to be developed by the Contractor and agreed with the Fire Engineer, Fire Officer and Building Control Inspector.

The Fire Alarm system is to be interfaced with the access control system within the building such that access controlled door locking mechanisms disengage upon activation of the fire alarm system to allow safe egress from the building.

The Contractor / Fire Alarm specialist to also provide all access control systems a means of emergency over-ride on the secure side of the door to allow for emergency exit from the space. Access controlled external doors to be kept secure in order to maintain the security of the building. Emergency exits to these doors to be via push release or green break glass units.

The Contractor / Fire Alarm specialist to allow for the interfacing with mechanical services to enable controlled shutdown of plant and equipment upon fire alarm activation.

Any fire doors on magnetic door hold open devices are to be released to allow the correct use of fire doors on escape routes.

The Fire Alarm system to interface with lifts such that in the event of fire alarm activation, the lift descends to the primary designated floor and stop there with the doors fully opened. A secondary interface may also be required such that should the fire be detected on the primary designated floor, the lift is to travel to an alternative, secondary designated floor. This is to be confirmed and agreed with the Fire Officer / Fire Engineers.

The Fire Strategy to define the evacuation strategy.

Provide suitable power supplies, containment, and connections to support the installation. Refer to the other sections of this specification for further details.

Run all fire alarm cabling within a dedicated compartment of the galvanised steel wired basket for BMS/ security/ controls and within separate steel conduits. Provide metal clips / ties where required and as per the Wiring Regs, to secure all fire alarm cables to their positions.

Local dedicated 230volt power supplies via un-switched fused connection units to be provided to serve the main fire alarm equipment as required, including the fire alarm panel and the fire alarm repeater panels. Unless otherwise stated, all final power circuits serving the system are to be radial. Power supplies to the detectors/ alarms to be via the fire alarm panel and the fire alarm repeater panels, which are supplied from the main LV board, and to include all final connections, cabling and containment to suit the specific requirements of each system.

The system is to be designed and installed such that the number of devices on each loop has a minimum of 20% spare capacity for future use. No loop to be more than 80% loaded. There is to be a minimum of 25% spare capacity in the Fire Alarm Panel such that additional loops can be added in the future.

Supply the main fire alarm panel via a key operated double pole switch complete with LED indicator and "FIRE ALARM DO NOT SWITCH OFF" engraving.

All fire alarm devices are to be provided with permanent address label references affixed to the outlet base which is to be visible from a standing position on the floor beneath.

In addition to the procedures laid out in BS 5839, a successful full witness test of the entire system is required which is to be out of hours. Should this fail to demonstrate entirely the cause and effect and compliance with the statutory requirements, the system and therefore the building will not be accepted.

3.13 Security/ Intruder Alarm System

The Contractor is to employ a security specialist to design, supply, install, test and commission a new complete intruder alarm system in accordance with all the appropriate standards and documents, including but not limited to:

- NACOSS Code of Practice
- PD 6662 – Scheme for the Application of European Standards for Intrusion and Hold-up Alarm Systems
- EN 50131 – European Standards for Intruder Alarm Systems
- Security provisions to be designed in accordance with ACPO Secured by Design where possible

The information contained on the Security layout drawings is initial design intent for costing purposes only. The final detail design is to be completed by a security specialist in liaison with the client security team.

The security alarm system is to be installed to detect unauthorised access to any area of the building.

The alarm is to be capable of full and part set. The anticipated part set function would cover the podiatry, the external partner and the external entrance doors. The security alarm system is to be designed, installed and commissioned by an NSI registered installer.

Activation of the alarm to result in the Security Hub receiving an automated message.

The Security specialist to provide a multi-zone security system to give protection from unauthorised intrusion into the building.

The system is to be fully addressable with a lockable panel, located within the security office, and to be programmable on site to suit the operational procedures of the building.

The control panel is to accommodate a minimum of 64 alarm zones expandable to 168 zones, with 16 areas and 100 user codes. It is to have capacity for 1000 events with time and date record.

The intruder alarm system is to comprise as a minimum of fully monitored detection devices as follows:

- Door contacts on all external doors
- Door contacts on waiting lobby and the external fence doors, as well as any other rooms shown on the Cundall Stage 3 drawings
- Movement detectors to all ground floor areas with external glazing
- Movement detectors on the first and second floor to be limited to positions as shown on the Stage 3 Cundall drawings
- Security alarm panel installed within the ground floor security office and linked to the existing Security Pavillion.
- Remote keypad for activation of the alarm
- Panic buttons at the reception desk on the ground floor
- PA systems in the security office and reception desk linked back to the central security centre.
- The intruder alarm system is to also cover the access to the roof.
- External Fence Motion detection (TBC by JD)

The Security specialist to install intruder alarm system to all building perimeter access doors with each alarm device wired back to the central control and indication panel installed within the reception.

Panic alarm buttons are to be provided at the reception desks on the ground floor. The panic buttons are to be integral to the intruder alarm system. The panic alarm buttons is to report back to the central security centre.

The external site boundary fence is to be protected by motion detection that is to be linked back to the existing site security pavilion. The systems specification is to be confirmed by the client.

The intruder alarm system is to be linked to the existing security pavilion during phase 1 and during phase 2 the system is to be integrated into the new security office. During phase 1 all associated ducts are to be installed sitewide including a termination on the boundary of Phase 2 within a manhole chamber, that will be used to re-wire and extend the security cables to the new security office during Phase 2.

Suitable power supplies, RJ45 data points, containment, and connections to support the installation are to be provided. Power supplies are to be derived from the local distribution boards and are to include all final connections, cabling and containment to suit the specific requirements of the system. Local dedicated 230V power supplies via un-switched fused connection units are to be provided to serve equipment. All final power circuits serving the system are to be radial.

Allow for two unswitched fused connection unit for the intruder alarm panel in the security office.

The security cabling is to be installed within a dedicated ELV galvanised steel wire cable basket for data services, above ceiling voids, or within conduits elsewhere. Surface clipped alarm cabling on any exposed surface including soffits, ceilings, walls, will not be accepted.

Final connections are to be installed within conduits that are concealed in the building fabric or surface mounted conduits within the plant rooms.

The Intruder alarm system shall be interfaced with the following building systems.

- CCTV
- Door access control system

The intruder alarm system is to be linked to the CCTV system, to operate cameras on the activation of local intruder alarms.

The intruder alarm system is to incorporate 'double knock' for verification of alarms, such as the door contacts are also to have presence detection to verify the alarm.

All main panels are to be provided with integral 24-hour battery back-up.

All intrusion detection devices are to be installed with tamper-resistant hardware.

Display a plan layout adjacent to the control panel identifying the zoned areas being protected.

Contractor is to ensure the system meets the specification highlighted within the clients Intruder Alarm Specification document.

3.14 Access Control

The Contractor shall employ a NACOSS Gold approved security specialist to design, supply, install, test and commission a new access control system as indicated on the Security layout drawings and in accordance with the requirements of EN 50131, PD6662, BS 8243 and NSI recommendations.

The access control system shall be provided to the following areas:

- Main Entrances / Exits
- Security office
- GYM
- Switchroom / Plantroom
- Kitchen/café
- Reception
- Bike Store
- Generator enclosure
- Campus entrance turnstiles
- Car entrance barriers

The information contained on the Security layout drawings is initial design intent for costing purposes only. The final detail design is to be completed by a security specialist in liaison with the client security team.

Access controlled doors shall incorporate a failsafe open in the event of a fire alarm.

The system shall be designed and installed to provide a minimum of 25% spare capacity for additional devices to be added in future, if required.

The access vehicle barriers at the main entrances of the site will be ANPR type, manufacture to be confirmed by JD. The managing software for the barriers is to be located within the PC in the security office.

The access control system will match the existing installed systems to confirm cross compatibility across buildings, contractor to liaise with the Client to ensure compliance.

Contractor is to ensure the system meets the specification highlighted within the clients Access Control Specification document.

3.15 CCTV

Employ a security specialist to design, supply, install, test and commission a new IP Closed-Circuit Television (CCTV) system as indicated on the Security layout drawings and in accordance with the requirements of BS EN 62676.

The information contained on the Security layout drawings is initial design intent for costing purposes only. The final detail design is to be completed by a security specialist in liaison with the client security team.

The IP CCTV system shall broadly comprise of two systems which cover the internal areas of the Hub building, bike Store building, external plant space and the external site / car park.

The internal CCTV system shall comprise of a structured cabling system, fixed position cameras, network switching, network video recording and an on-site monitoring station located in the managers office on the first floor.

The external CCTV system shall generally comprise of a fibre optic / copper structured cabling system, infra-red cameras complete with anti-mist heaters, network switching, network video recording and an on-site monitoring station located in the ground floor security office area indicated on the Security layout drawings. The external CCTV is to be linked to the existing pavilion building during phase 1 with a future provision security duct being terminated within a manhole chamber on the boundary of phase 2. During phase 2 of the project the link is to be rewired to the security office.

External cameras are to provide coverage to the following areas:

- External building perimeters
- Building entrances – main entrance / exit doors
- External site perimeter
- External vehicular and pedestrian gates

Cameras served by fibre optic cabling shall be provided with a fibre / copper converter as necessary.

The digital recorder shall be capable of recording from all cameras whilst simultaneously replaying selected images from archive with no loss of performance and all high quality images shall be stored for a minimum of 31 days.

The off-site monitoring of CCTV images is to be confirmed but is not currently anticipated.

The installed system shall be capable of accommodating an additional 20% uplift in device quantities which may be reasonably expected during the construction or for future expansion of the facility.

The information contained on the Security layout drawings is initial design intent for costing purposes only. The final detail design is to be completed by a security specialist.

Contractor is to ensure the system meets the specification highlighted within the clients CCTV Specification document.

3.16 Disabled Toilet Alarm System

Employ a specialist to design, supply, install, test and commission a disabled alarm system in accordance with the requirements of BS 8300, Part M of the Building Regulations.

The disabled alarm system shall generally comprise of an overdoor indicator, pull cord and local reset at each accessible facility i.e. the accessible WCs / Shower. Each three-part alarm system shall be linked to the disabled alarm panel located in the security office.

The disabled alarm system shall be supplied with integral batteries to support 72-hour operation of the system.

3.17 Disabled Refuge Alarm System

The Contractor is to employ a specialist to design, supply, install, test and commission a complete disabled refuge alarm system in all refuge points. The system to comply with all relevant Statutory Regulations and appropriate standards, including but not limited to:

- BS 7671 – IET Wiring Regulations (18th Edition)
- Equality Act (2010)
- Building Regulations Approved Document Part M
- Health and Safety Work Act 1972
- IEC 60849
- BS 8300-2: 2018 Design of an accessible and inclusive built environment. Buildings – Code of Practice
- BS EN IEC 60118-4 – Electroacoustics. Hearing Aids. Induction-Loop Systems for Hearing Aid Purposes. System performance requirements.
- BS 7594 – Code of Practice for Audio-Frequency Induction-Loop Systems (AFILS)
- Fire Strategy

The system is to comprise a number of individual call points installed in refuge areas and connectivity to life services in accordance with BS EN 81. A disabled refuge alarm system is to be provided within the stairwells, for use by persons less able, for emergency evacuation purposes.

The system is to be installed in positions in accordance with the fire strategy and building control requirements.

The main disabled refuge panel to be located within the security office, with an additional panel placed at the base of the staircases that has the disabled refuge point on the floor above.

Allow for an unswitched fused connection unit for each of the panels.

At the disabled refuge point on the floors above ground, there will be a disabled refuge outstations, which will be linked and powered from the main panel placed on the ground floor, within the staircase.

The refuge station to sound locally whilst providing lamp indication and a reset push button.

The refuge is to be provided with a call button to facilitate a full two-way communication system with corresponding communication points to the main disabled refuge panel.

The indicator to be of the flush mounting type with a stainless steel face plate engraved 'DISABLED ALARM INDICATOR PANEL'.

The disabled refuge alarm system cabling to be installed on a dedicated ELV galvanised steel wire cable basket for Data.

Cabling to be soft skin enhanced type in accordance with BS5839 Part 1. Cables to be fixed on the containment with metal cable ties.

The system to be supplied with integral batteries to support 72-hour operation of the system

3.18 Intercom System

Employ a NACOSS Gold approved specialist to design, supply, install, test and commission an intercom system.

The barrier and pedestrian entrance intercom system shall comprise of an intercom receiver (audio and video) within the security office. The intercom receiver within the security office shall have the capability to release the vehicle barriers as and when required in order to provide access to authorised persons.

As per the CCTV a future provision security duct is to be terminated within a manhole chamber at the boundary of the Phase 2 site. During phase 2 the intercom system for the barriers is to be reconfigured to the security office located on the ground floor of the Hub building.

The intercom system shall be supplied with integral batteries to support 72-hour operation of the system.

3.19 Hearing Aid/Induction Loop System

The Contractor is to employ a specialist to design, supply, install, test and commission a complete induction loop system in the reception area. The system to comply with all relevant Statutory Regulations and appropriate standards, including but not limited to:

- BS 7671 – IET Wiring Regulations (18th Edition)
- Equality Act (2010)
- Building Regulations Approved Document Part M
- BS 8300-2: 2018 Design of an accessible and inclusive built environment. Buildings – Code of Practice
- BS EN IEC 60118-4 – Electroacoustics. Hearing Aids. Induction-Loop Systems for Hearing Aid Purposes. System performance requirements.
- BS 7594 – Code of Practice for Audio-Frequency Induction-Loop Systems (AFILS)

The hearing aid / induction loop system is to be utilised by the hard of hearing using their personal hearing aids when switching to the "T" position.

Provide a hard-wired fixed induction loop system at the reception desk position on the ground floor, powered via an unswitched fused connection unit each.

The induction loop system to comprise the following:

- Induction loop amplifier
- Desktop microphone
- Single core loop cable
- 'Loop fitted' sign

The loop amplifier to be desk mounted and the loop cable to be concealed in order to create the loop.

A dedicated power supply to be derived from a local distribution board and served via a local unswitched fused connection unit.

The system to be provided complete with portable desk top induction loop sign and self-adhesive sign.

The system to incorporate integral cut-off timer, remote microphone socket for optional tie/desk microphone, power on, input level, charging required and charging in progress indicators.

The hearing aid / induction loop cabling to be installed on the dedicated ELV galvanised steel wire cable basket for Data.

All cabling is to be Cu / Low Smoke Zero Halogen (Cu/LS0H) and as recommended by the system manufacturer.

3.20 Earthing and Bonding

Employ a specialist to design, supply, install, test and commission an earthing arrangement in accordance with all the appropriate standards:

- BS 7671 – IET Wiring Regulations (18th Edition)
- BS 7430 – Code of Practice for Protective Earthing of Electrical Installations

The earthing installation is to comprise of all conductors, conduits, trunking, cross bonds and separate individual circuit protective conductors to form the complete system. The earthing installation is to protect personnel, the building, the structure, plant and equipment in the case of an electrical fault within the supply system.

The building is to utilise the supply authority incoming earth connection. The earthing system within the building to be connected to the transformer and to the main LV panels via an earth bar.

Provide dedicated earthing installation for the standby generator. Liaise with ENW for the ENW substation earthing requirements.

A main earth bar to be provided in the electrical switchoom adjacent to the main LV panel. Provide the earth bar with appropriate test links for isolation of the external earth connection and fix it securely to the wall using insulated fixings.

Use the main earth bar for all main equipotential bonding conductors. The main earth bar is to be sized to have 25% spare capacity earth terminals.

Bond all exposed conductive parts of the electrical installation. Provide equipotential and supplementary bonding conductors throughout the building as required. The main earthing network is to be connected to the lightning protection earthing system in such a way as to keep to a minimum the number of parallel paths to earth.

All metalwork, structural steelwork, gas pipes, water pipes, ductwork, drainage, cable containment, etc. are to be bonded to earth and provided with equipotential cross bonds, as required by the associated standards (IET Wiring Regulations 18th Edition and BS 7430). All extraneous conductive parts are to be bonded so that in the event of a fault of negligible impedance, disconnection is to take place in a manner and in such time as to ensure no danger arises.

Supplementary bonding conductors to be provided as a minimum to:

- All extraneous conductive parts, e.g., pipes at sinks, stainless steel sink tops, exposed water pipes and the like from adjacent socket outlets, extraneous metalwork

- All exposed conductive parts through the circuit protective conductor
- Across all flexible joints in ductwork and pipework (as part of mechanical works package)
- Raised floor systems
- Metallic false ceiling grid
- Simultaneously accessible parts
- Metal handrails bonded to structure
- Lift rails
- Metal conduits, trays, trunking, etc. All trays and baskets to be bonded to the earth terminals via copper cable.
- Structure steel
- Concrete steel reinforcement
- Dry riser installations
- Roof structure
- Exposed frame
- Mechanical plant
- Kitchen equipment
- Metallic cable sheaths of all cables except Openreach
- Lightning protection system

Main earthing conductors are to be sized in accordance with BS7671 and the supply authority requirements.

Main equipotential conductors are to be bonded back to the earth bar using separate Protective Conductors for each main bond and labelled individually using permanently fixed and printed labels at each end.

In addition to main bonding conductors, separate earth conductors are to be installed with all sub main cabling from 35mm upwards.

Secondary earthing bars are to be installed to main items of plant and sub main distribution. This is to include server rooms, external plant, Mechanical Control Panels (MCP's), rising busbar trunking, etc where the items of electrical equipment are supplying loads in excess of 150A TP. The secondary earthing bar to be wired directly back to the main earthing bar within the switch room.

A dedicated earthing system to be provided for the ICT system with earth bars located in the main communication / server rooms.

The Contractor to label the new sub main cables at each end by means of propriety manufactured cable marker tags. Colour of the cable markers to be yellow with black lettering and to be fixed to the cable exterior with cable ties.

Provide circuit protective conductors (CPCs) and protective bonding conductors in accordance with the recommendations of BS 7671: 2018 18th Edition. All protective conductors to be appropriately sized to provide the required disconnection times under fault conditions.

All final circuit and sub-main circuit protective conductors are to be installed in accordance with BS7671, to provide high integrity final circuit earthing facilities within the final circuit distribution boards.

All final sub-circuiting is to have full sized CPC's. Where these are separate cables, they are to have to be low smoke zero halogen insulated green/ yellow single core copper conductors and run in the same containment system as the phase and neutral conductors.

Electrical continuity across electrical systems and containment is to be provided via 'earth tags' to ensure electrical continuity is maintained across junctions and joins. Metallic containment is to be treated as exposed conductive parts and therefore to be bonded back to the main earthing system.

Earthing of sub-main distribution equipment is to be achieved by bonding all the extraneous panel metalwork to the panel earthing bars, including armour of the incoming cables.

Earthing of the final circuits' containment is to be provided to metal wire ways carrying the cabling i.e. metal conduit, trunking, trays, basket, ladder racks etc.

All bonding in toilet areas and stairway handrail are to be concealed.

Verify and test the earthing arrangement including all main equipotential bonding installations to ensure satisfactory bonding is provided between the main earth bar, the incoming services and the building structure.

The complete system is to be certified before handover is accepted.

3.21 Lightning Protection

Employ a lightning protection specialist to design, supply, install, test and commission a new lightning protection system for the new building and any other site wide ancillary building structures such as the generator enclosure/bike shed, based on the Architect's drawings, to protect the new buildings construction and buildings contents, in accordance with all the appropriate standards, including but not limited to:

- Requirements for Electrical Installations – IET Wiring Regulations BS7671 (including amendments)
- BS EN/IEC 62305 – Lightning Protection Standard
- Local Electricity Supply company requirements

The specialist Contractor is to be an approved installer and member of the National Federation of Master Steeplejacks and Lightning Conductor Engineers.

An initial risk assessment to be carried out in accordance with British Standard BS EN 62305-2:2006. The building is to be classified a lightning protection level in accordance with BS EN 62305 – 3. Ground resistivity tests to be conducted, to determine ground conditions and size / quantity of earth electrode test pits required.

The system is to comprise air termination network(s), down conductors and earth reference electrodes driven into the sub soil at low level. The air termination network to comprise a grid of PVC covered 25x3mm aluminium or copper tapes fixed to the roof via proprietary fixings, with finals distributed along the roof ridge.

All equipment located externally requires bonding. All extraneous metalwork on the roof and façade is to be bonded to the lightning protection system. Rooftop plant and ductwork may be used to form part of the air termination network wherever practicable. Any protruding plant elevations shall be protected by means of air spikes.

All cables run externally are to make as much use as possible of natural shielding from fully bonded conducting materials.

Down conductors are to be provided by one of the following methods:

- Bonding to steel reinforcing bars within structural columns and slabs
- Bonding to structural steel columns
- Bonding to conducting tape running down the exterior of the building

The top of each column to be bonded to the air termination network at roof level.

Structural steel elements within the foundation piles are also to be used as earth conductors wherever practicable. Where these are not available conventional earthing rods are to be used. Test joints are to be provided for all down and earthing conductors and are to be located in inspection pits adjacent to the building foundations.

Reinforcement bars within the concrete structural frame are to be bonded using 3mm x 25mm aluminium or copper insulated tapes at discrete locations at: change in levels, intersection of floor slabs and columns and at the lowest level for connection to earth electrodes. Suitable sized copper ground tapes are to be used to bond the structure to the earth electrode via inspection pits.

Termination from the building down conductor (whether re-bar or external tapes) is to be connected via earth test links to each earth electrode.

Allow for all exposed connections and test connection points so that the lightning protection system can be appropriately tested throughout its design life.

Ensure electrolytic compatibility of dissimilar metals before bonding. Any adhesive products used for bond earthing/ aluminium tapes at roof level/ exposed metal work, to be fit for purpose and carry a lifetime guarantee.

Connections of down tapes to earth electrodes to be made in purpose concrete made inspection pits. The connection to be made with a purpose made bronze connector. Protect joints against corrosion by wrapping with PVC or Denso tape.

Surge protection devices to be installed at the main LV switchgears and at all downstream external, roof mounted distribution boards, or boards that serve major IT equipment, to comply with BS EN 63205. The surge protection devices are to be situated as close as practicable to the inside boundary of the new lightning protection system and are to be accessible. Provide Surge Suppression devices of Types 1 and 2 at the main LV panels and Surge Suppression of Type 2 at all boards serving IT equipment, to comply with BS EN 63205.

Transient over voltage protection devices to be installed at the following locations, to protect electronic equipment from the secondary effects of lightning:

- Incoming supply connection points to the building
- Primary LV switchgears
- External panels/ distribution boards
- Electrical boards serving major items of IT/ Telecoms hardware e.g. servers
- TV aerials/ dishes, if applicable

The system is to be bonded to the main building earth bar with testing facilities provided as required.

Allow for all final connections using earth tapes and/or solid copper conductors to all exposed and/or extraneous metalwork throughout the building and to parts of the main earthing system as described elsewhere.

A connection from the lightning protection system to the main earth terminal is to be provided, as well as a connection to the separate HV earth network of the substation and the separate earth network of the standby generator.

Liaise with the ICT / door access / CCTV etc. specialist Contractors to ensure coverage for radio transmission and wireless access throughout the building as described elsewhere in the specification.

Liaise with the architect to develop the lightning protection system and to minimise the visual impact that the system has on the building. Conceal all lightning protection system tapes as far as reasonably practicable without compromising requirements for visual inspection and routine testing.

Agree the colour of PVC sheaths with the architect.

Allow for all interfacing with the architectural and structural details including any connections required to the building façade and structure. Liaise with the architect and relevant subcontractors to agree suitable fixing methods to each building element.

The whole lightning protection system to be tested for compliance with BS 62305.

3.22 PV Solar Panels System

Employ a PV solar specialist to design, supply, install, test and commission a complete solar panel system installation that is to extend over a minimum area of 200m² on the roof, and is to comply with all the associated standards.

Ensure that the power generation system complies with all local authority, Building Control and Fire Officer requirements, and all the appropriate associated standards, including compliance with G98 and G99 engineering recommendations, where applicable.

The performance of the PV panel' s to satisfy the following requirements, as outlined within the Cundall Energy Performance analysis to achieve the associated EPC rating:

- Peak Power 43kWp

- Module nominal efficiency: $\geq 20.10\%$
- Array area: 217m²
- Array orientation: South
- Array inclination: 30° from horizontal
- Azimuth 160°
- Module array type Monocrystalline

Each PV installation to include an array of PV panels, inverters, isolation switches and synchronising equipment together with all required ancillary components.

At roof level, an IP rated isolator is to be connected to a suitably rated cable installed through the building and terminated into to a suitably rated isolator adjacent to the incoming supply position.

For general requirements and metering requirements, refer to the LV Distribution section of this specification.

The output of the PV solar panel installation is to be metered by a Schneider PM5000 series electrical meter or equal and approved.

3.23 Temporary Site Power Supply

The contractor is required to provide their own temporary site power as there is no availability of connection from the current client's buildings.

4.0

Regulatory Criteria and Environmental Requirements

4.0 Regulatory Criteria and Environmental Requirements

4.1 Planning Conditions

Refer to the latest Planning conditions report/tracker from the Planning Consultant. All conditions to be fully discharged by the Client, with the assistance of the Contractor, unless Main Contract Preliminaries state otherwise.

4.2 Mechanical and Public Health

The editions of the below documents are correct at the time of writing however the installation must be undertaken in accordance with the document edition current at the time of installation.

Where requirements differ between any of the below documents then this is to be brought to the attention of the PM who shall adjudicate.

In the event that legislation standards or industry guides referred to in this document are found to be out of date or superseded by a new document, the most recent revision or latest replacement document is to be utilised.

4.2.1 Natural Gas and Water Utilities

The installation is to be designed & installed in accordance with the recommendations of (where applicable):

- Institute of Gas Engineers and Managers (IGEM).
- Water Regulations Advisory Scheme (WRAS).
- The Water Supply (Water Fittings) Regulations 1999.
- National Joint Utilities Group (NJUG).
- Utility Network (DNO, iDNO etc.) workmanship standards.
- Guidance on Self-Lay Design, Permissible Materials, and Construction Arrangement.
- Design Guides e.g. CIBSE, BSRIA, CIPHE (formerly IoP), etc., incl. Technical Memoranda (HVCA & BSRIA).
- BSRIA BG37/2011 Utility Connections & Diversions.
- BSRIA BG2/1010 Commissioning Water Systems.
- BSRIA BG 29/2011 Pre-Commissioning Cleaning of Pipework.
- CIBSE Guide G.
- Commissioning Codes (CIBSE and BSRIA).
- The Association of Meter Operators.
- Gas Safety Regulations.
- Cadent / National Grid standards (T/SP/SSW/22 and T/SP/CE/12 National Grid guidance documents).
- HSE guidance
- The Construction Design and Management Regulations (CDM)
- BCO Guide to Specification

4.2.2 Mechanical HVAC Systems

The installation is to be designed & installed in accordance with the recommendations of:

- British Standards and BS Code of Practice.
- Building Regulations (latest versions).
- Local and Statutory Authority Requirements.
- Supply Authority Regulations.

- Institute of Gas Engineers and Managers (IGEM).
- Gas Safety Regulations.
- Water Regulations Advisory Scheme (WRAS).
- Design Guides e.g. CIBSE, BSRIA, CIPHE (formerly IoP), etc., incl. Technical Memoranda (HVCA & BSRIA).
- Commissioning Codes (CIBSE and BSRIA).
- DW 144 & 172
- TR19
- Clean Air Act
- HSE guidance
- The Construction Design and Management Regulations (CDM)
- BCO Guide to Specification

4.2.3 Above Ground Drainage Systems

The Building Regulations and all relevant local and statutory authorities' requirements especially the following British and European Standards:

- BS 416 – Discharge and ventilating pipes and fittings, sand-cast or spun in cast iron
- BS 476 – Fire tests on building materials and structures
- BS 1710 – Specification for identification of pipelines and services
- BS 6100 – Building and Civil Engineering. Vocabulary
- BS 7671 – Requirements for electrical installations. The IEE Wiring Regulations: latest edition
- BS EN 598 – Ductile iron pipes, fittings, accessories, and their joints for sewerage applications. Requirements and test methods
- BS EN 752 – Drain and sewer systems outside buildings
- BS EN 877 - Cast iron pipes and fittings, their joints and accessories for the evacuation of water from buildings. Requirements, test methods and quality assurance
- BS EN 12056-1:2000 - Gravity drainage systems inside buildings. General and performance requirements
- BS EN 12056-2:2000 - Gravity drainage systems inside buildings. Sanitary pipework, layout and calculation
- BS EN 12056-5:2000 - Gravity drainage systems inside buildings. Installation and testing
- BS 8000-13:1989 - Workmanship on Building Sites. Code of Practice for Above Ground Drainage and Sanitary Appliances.
- The Building Regulations - Part H (April 2002) of the Building Regulations 2000.
- BS EN 12354-1:2000 - Building Acoustics. Estimation of acoustic performance in buildings from the performance of elements
- BBA British Board of Agreement Certificate, as appropriate
- British Kitemarked, as necessary
- CIBSE Guide G – Public Health Engineering
- CIPHE (formerly IoP) – Institute of Plumbing Design Guide

4.2.4 Rainwater Drainage Above Ground

The Building Regulations and all relevant local and statutory authorities' requirements especially the following British and European Standards:

- BS 416 – Discharge and ventilating pipes and fittings, sand-cast or spun in cast iron
- BS 476 – Fire tests on building materials and structures

- BS 1710 – Specification for identification of pipelines and services
- BS 6100 – Building and Civil Engineering. Vocabulary
- BS 7671 – Requirements for electrical installations. The IEE Wiring Regulations: latest edition
- BS EN 598 – Ductile iron pipes, fittings, accessories, and their joints for sewerage applications. Requirements and test methods
- BS EN 752 – Drain and sewer systems outside buildings
- BS EN 877 - Cast iron pipes and fittings, their joints and accessories for the evacuation of water from buildings. Requirements, test methods and quality assurance
- BS EN 12056-1:2000 - Gravity drainage systems inside buildings. General and performance requirements
- BS EN 12056-3:2000 – Gravity drainage systems within buildings. Roof drainage, layout and calculation
- BS EN 12056-5:2000 - Gravity drainage systems inside buildings. Installation and testing
- BS 8000-13:1989 - Workmanship on Building Sites. Code of Practice for Above Ground Drainage and Sanitary Appliances
- BS EN 12354-1:2000 - Building Acoustics. Estimation of acoustic performance in buildings from the performance of elements
- BBA British Board of Agreement Certificate, as appropriate
- British Kitemarked, as necessary
- CIBSE Guide G – Public Health Engineering
- CIPHE (formerly IoP) – Institute of Plumbing Design Guide

4.2.5 Domestic Hot and Cold-Water Supply Systems

The installation is to be designed & installed in accordance with the recommendations of:

- Building Regulations
- British Standards
- The Water Supply (Water Fittings) Regulations 1999.
- BS EN 806-2:2005 – Specification for installations inside buildings conveying water for human consumption (design).
- BS EN 806-3:2006 – Specifications for installations inside buildings conveying water for human consumption (pipe sizing – simplified method).
- BS EN 806-4:2010 – Specifications for installations inside buildings conveying water for human consumption (installation).
- BS 8558:2015 – Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – complementary guidance to BS EN 806.
- Relevant Local and Statutory Authority Regulations and Byelaws.
- CIBSE Guides & Technical Memorandum
- HSE: Legionnaires' disease: The Control of Legionella Bacteria in Water Systems. Approved Code of Practice and guidance on regulations – L8 (fourth edition) published 2013.
- HSE: Legionnaires' disease: Part 2 The control of legionella bacteria in hot & cold-water systems. HSG274 Part 2 published 2014.
- BSRIA BG2/1010 Commissioning Water Systems.
- BSRIA BG 29/2011 Pre-Commissioning Cleaning of Pipework.

The following parameters are to be adhered to (but not limited to):

- Fixed water flow devices to be provided on all sanitaryware to control water usage.

- Provision to be made for suitable backflow prevention measures through devices in accordance with the fluid category risk to each mains water appliance as required by WRAS and WRC guidelines (including break tanks, RPZ valves, etc.).
- All supplies to basins and showers to be blended to prevent scalding via TMV3 blending valves. TMV's are to incorporate a means by which full thermal pasteurization flush through can be achieved.
- All sanitary ware fittings are to be provided with an isolating valve to allow for servicing and maintenance of the fitting.
- Where pipework runs within sub-floor voids, leak detection tape is to be provided linked to solenoid valves to shut off domestic water supplies.
- Self-regulating temperature maintenance tape to be provided on hot water supply pipework on all dead legs downstream of return pipework connections greater than two meters. The heat cycle shall be capable of raising the temperature above the hot water delivery set point to sanitize the water in the pipe.

Pipework identification to be specific to each type of water service to ensure that no cross-connections occur between potable and non-potable supplies. Identification between each type of water service shall be provided by a distinctive colour and label referencing the water conveyed i.e. Non-Potable Water Service – WC Flushing.

4.3 Electrical Services

The complete works, installation, and final system(s), testing and commissioning to conform fully with the latest editions of the relevant specifications, British Standards and Statutory Instruments, including but not being limited to:

- British Standards and Building Services Applications, Codes of Practice and Building Regulations
- CIBSE Guides and Technical memoranda
- BSRIA Guidelines
- Electricity at Work Act 1989
- CE Marked (all equipment)
- Health and Safety at Work Act 1974
- Equality Act 2010, including Part M
- Building Regulations
- Construction Design and Management (CDM) Regulations (2015)
- The IET Wiring Regulations BS 7671 Requirements for Electrical Installations latest edition
- Code of Practice for fire safety in design BS 9999
- NACOSS Code of Practice
- Local and Statutory Authority Requirements, including the Local Authority Fire Officer, the Local Fire Brigade and the Local Police Force Policies.
- Supply Authority Regulations.
- Commissioning Codes (CIBSE and BSRIA)
- The Fire Strategy
- CIBSE SLL Code for Lighting (2022)
- BS EN 12464-2: Light & Lighting: Lighting of Workplaces, Outdoor workplaces
- BS EN 12464-1: Light and Lighting – lighting of workplaces. Indoor Workplaces
- CIBSE SLL LG6: The Exterior Environment
- CIBSE SLL LG7: Offices
- CIBSE SLL LG14: Control of Electric Lighting
- CIBSE SLL LG16: Lighting for Stairs
- CIBSE SLL LG12: Emergency Lighting

- BS EN 1838: Lighting applications – Emergency lighting
- BS EN 5266: Emergency Lighting
- BRE Digest 498 – Lighting Control.
- Part L of the latest Building Regulations.
- NICEIC guidelines
- BS7835 Electric cables. Armoured cables with thermosetting insulation for rated voltages from 3.8/6.6 kV to 19/33 kV having low emission of smoke and corrosive gases when affected by fire. Requirements and test methods
- NSI Standards
- BS EN 50133 - Access control systems for use in security applications. General requirements for components
- BS EN 501327 - CCTV System Application Guidelines
- BS EN 61439 Low-voltage switchgear and control gear assemblies
- BS EN 6049 Electrical cables, installation. Protection sleeve in meta-aramid fibres. Technical specification
- BS 60529 Degrees of protection provided by enclosures (IP code)
- CIBSE TM39 Building Energy Monitoring
- BS 7430 Code of practice for protective earthing of electrical installations

5.0

Standard Installation Details

5.0 Standard Installation Details

5.1 Standard Details

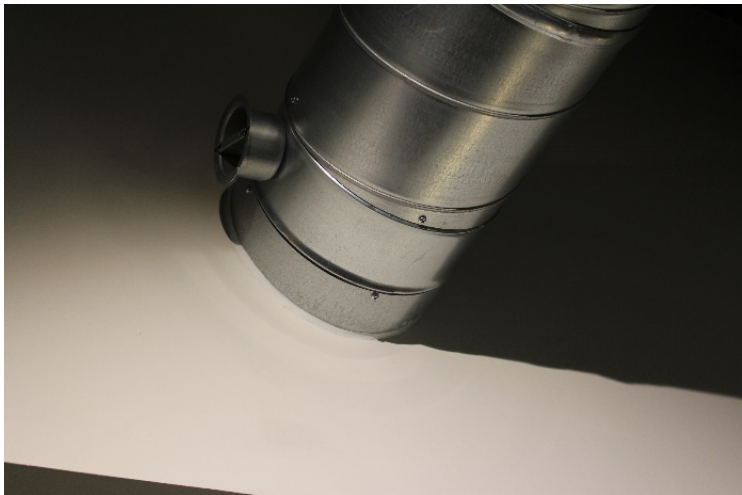
Any standard detail drawings applicable to this project are as detailed on the drawings and as per NJUG, M&W NBS Spec.

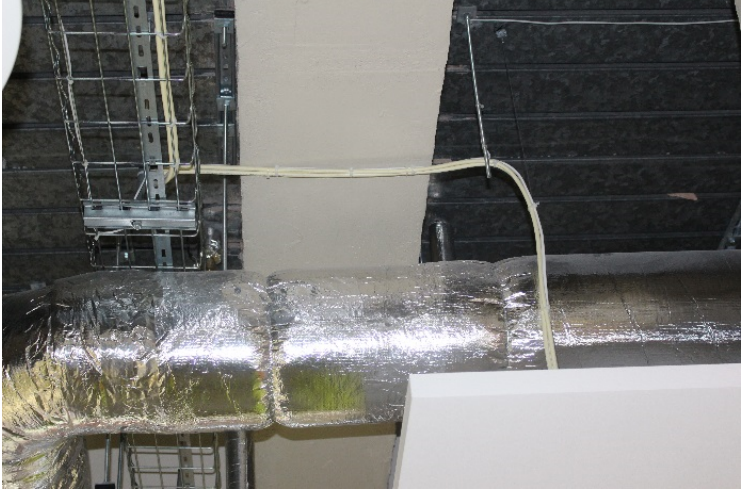
5.2 Installation Standards

All systems and equipment are to be selected and installed to comply and be in accordance with all current and appropriate legislation. Refer to the Regulatory Criteria and Environmental Standards section for further details.

Ensure that all items of equipment and methods of installation comply with the requirements of all relevant local and national authorities and ensure that they are invited to witness any such test that they may desire.

Refer to the table below for examples and details of service installation standards and quality required for the project where appropriate:

Ref	Description	Photograph Example
1	All exposed duct and service penetrations to be neatly matched in with silicone with colour to architect's specification. Services sprayed to an agreed RAL colour in key areas. All exposed ductwork to be internally lined/insulated (rather than externally) to leave a clean, galv finish.	
2	All cables to be clipped in separate groups with any fire alarms, ELV, security and data separated as per specification, wiring regulations and manufactures instructions.	To be contained within multi-compartment galvanised steel trunking with earthed dividers.

Ref	Description	Photograph Example
3	All drop rods to be trimmed off to 40mm and be complete with rubber end caps. All Unistrut to be provided with plastic end caps.	
4	Any statutory signage and emergency lighting to be neatly clipped and suspended similar to the photograph.	
5	Lighting power and control cabling where possible to be routed at 90° angles wherever possible when routing from cable management to lighting control modules.	
7	All fused spurs at high level and any other devices that may need to be reached shall be positioned as such to maintain good access when working at high level.	

Ref	Description	Photograph Example
8	All light fittings shall be set out by laser and lined up in all planes.	
9	Final service runs shall be set out with laser measurements with filter positions located such that easy safe filter access can be afforded. All distribution services including ductwork joints shall be cleaned with any mastic trimmed off as necessary.	

Table 5-1: Installation Standards

6.0

Standard Manufacturers Listing

6.0 Standard Manufacturers Listing

The design intent included within this package has been completed using the named plant and equipment manufacturers detailed within this package and listed in the 'Manufacturer Schedule' below.

Any alternative should be accompanied with a full technical submission for review/comment by the Client team. All alternatives to be fully inclusive of all changes required to accommodate the alternative plant etc. The Client team reserves the right to choose which alternatives are adopted if any.

6.1 Mechanical & Public Health

Equipment (as applicable to the project)	Manufacturer	Model/Range	Contact Details
Air Source Heat Pumps (LTHW)	Daikin	BLUEVOLUTION	Dimitri Votskis 07747 845162
VRF Condensers	Daikin	REYA-A (VRV 5 Heat Recovery)/R32	Dimitri Votskis 07747 845162
Air Source Heat Pumps & Cylinders (DHW)	Mitsubishi Heavy Industries Mitsubishi Electric (Kooltech)	QTon QAHV	Chris Matthews <u>07773 004 325</u> Simon Savin 07747 845162
Booster Sets	Duty Point Aquatech Pressmain Grundfos Calpeda	Various	
Water Storage Tanks	Dewey Waters Braithwaite Balmoral	Various	
Circulating Pumps	Grundfos Wilo DAB Calpeda	Various	01525 850000 01283 523000 0333 7775010 01869 241441
Buffers	Remeha Flamco Calpeda Ormandy Rycroft	Various	0330 678 0140 01744 744744 01869 241441 01274 490911

Equipment (as applicable to the project)	Manufacturer	Model/Range	Contact Details
Air / Dirt / Dosing	Spirotech	Spirocombi	0208 451 3344
	Vexo	Spiroplus X-pot	01767 500150
Electric Heaters	Dimplex	Various	0344 879 35 88
Fan Coil Units (un-ducted)	Daikin	FXSA Series (R32 Compatible) FCUs	Dimitri Votskis 07747 845162
DX / VRF	Toshiba - <i>JD corporate discount</i>	Various	Gavin Horner / Nathan Duce 07584040189 / 07767160879
	Daikin	Various	Dimitri Votskis 07747 845162
Underfloor Heating	Underfloor Solution Ltd	Various	Geoff Dean 0161 449 0005
Valves	Crane	Various	Steve Clarke 07791116283
AHUs	AHN	Bespoke	David South 0161 745 2018
	Air-source		0161 425 8553
	Systemair		Les Murphy 07557733348
	CIAT		Nathan Duce 07767160879
Fans	Nuaire	Various	Warren Wright 07767298210
	Systemair		Les Murphy 07557733348
Grilles / Diffusers	Complete Air Supplies	Various	Les Murphy 07557733348
	Gilberts	Various	01253 766911

Equipment (as applicable to the project)	Manufacturer	Model/Range	Contact Details
Attenuators	Caice Aimatic	Various	Frazer Robinson 07585 441669 Ian Stones 0161 764 4004
VAVs	Trox Complete Air Supplies	Various	01842 754545 Les Murphy 07557733348
Water Heaters	Billi	XT	020 7456 6789
Trace Heating	Excel 2002	-	01708 867770
Leak Detection	TTUK	FG-NET	02077296002
Sub-Meters (water / gas)	UK Metering	Multi-jet / ultrasonic	01623 655 000
BMS	JBC Controls Eco-i	Open protocol Trend, Tridium	Graham Taylor 07591 384596 David Hodges 07532188800
Natural Ventilation	Window Master	Actuators, controls	Tom Dyson 01536 614081

Table 6-1

6.2 Electrical

Equipment	Manufacturer	Contact Details
Air Circuit Breakers and Moulded Case Circuit Breakers	Schneider Electric Ltd	www.schneider.co.uk
Cables	Pirelli Cables now Prysmian	www.uk.QIYsmian.com
	AEI Cables Ltd	www.aeicables.co.uk
	BICC Cables now Prysmian Cables & Systems UK Ltd	www.uk.QIYsmian.com

Equipment	Manufacturer	Contact Details
	Draka	www.drakauk.com
Containment	Legrand	www.legrand.co.uk
	Cableduct	www.cableduct.ltd.uk
Disabled Alarm	Wandsworth Group Ltd	www.wandsworthgrouQ.com
	Static Systems Group pic	www.staticsystems.co.uk
Distribution Panels & Distribution Boards	Schneider Electric Ltd	www.schneider.co.uk
Electrical Accessories	MK Electric now Honeywell UK	www.mkelectric.co.uk
Fire Alarm System	Notifier by Honeywell (Morley panels are open protocol, Notifier panels closed protocol)	www.notifierfiresystems.co.uk
	Protec Fire Detection pic (managed protocol)	www.Qrofire.co.uk
Floor Boxes	Power Plan Systems Ltd	www.powerplan.co.uk
	Electrak International Ltd	www.electrak.co.uk
Lighting	Prolight Design - <i>JD corporate discount</i>	www.prolightdesign.com
Lighting Control	GE	www.gelighting.com/
Lightning Protection	Furse	www.furse.com
Low Voltage Protection Relays (integral with ACB or MCCB)	Schneider Electric Ltd	www.schneider.co.uk
Low Voltage Switchgear	ABB Ltd	www.abb.co.uk
Metering for Electrical Distribution (Building Regulations Part L)	C-Matic Systems Ltd	www.cmatic.co.uk
	Schneider Electric Ltd	www.schneider.co.uk
Miniature Circuit Breakers	Schneider Electric Ltd	www.schneider.co.uk
Power Factor Correction	Schneider Electric Ltd	www.schneider.co.uk
Surge Suppression	MEM now Eaton MEM	www.memonline.com
	Furse	www.furse.com
Transfer Switches	Asco Power Technologies Ltd	www.asco.com

Table 6-2

For individual lighting fittings refer to the luminaire schedule.

For the security equipment please refer to the clients CCTV, Access control and Intruder alarm specification

7.0

Tender Summary

7.0 Tender Summary

The below summary breakdown of the tender is to be completed by the tendering Contractor.

Item	Description	£ exc. VAT
1	Preliminaries	
2	Part L, BRUKL, TM52 and EPC	
3	MEP Design	
4	Rainwater Drainage	
5	Above Ground Drainage	
6	Domestic Cold Water Services inc site wide	
7	Domestic Hot Water Services	
8	Wet Heating Systems	
9	Refrigeration Heating & Cooling Systems (See cost options)	
10	Natural & Mechanical Ventilation Systems	
11	Services Insulation	
12	Trace Heating / Frost Protection	
13	BMS Controls	
14	Local Leak Detection (Comms)	
15	General LV power systems	
16	General Small Power	
17	Containment systems	
18	EV Charging	
19	General lighting systems	
20	Emergency Lighting	
21	External Lighting systems	
22	Data / Comms	
23	Security	
24	Fire alarm / detection	
25	Disabled toilet alarm	
26	Refuge System	
27	Induction Loop	
28	Earthing and bonding	
29	Lighting protection systems	

Item	Description	£ exc. VAT
30	Metering	
31	PV	
32	Builderswork	
33	Testing, commissioning and handover	
34	Working and Record drawings	
35	O&M manuals	
36	All other items not included above	

TOTAL £

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Total in Words

7.1 Separate Cost Options

Below is a list of separate costs options and provisional sums the contractor is to provide.

		Costed Options	
Item	Description	£ exc. VAT	£ exc. VAT
1	Separate cost saving for the de-specification of the lighting controls		
2	Separate cost saving for the de-specification of emergency lighting automatic testing and reporting to manual key switches only		
3	Separate cost saving for the replacement of single LSF cables to twin & Earth		
4	Separate cost option for chiller / heat pump Option 1		
5	Separate cost option for chiller / heat pump Option 2		

TOTAL £

Total in Words

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