R01

Building Services Scope of Works

UCL Institute of Education – Phase 2 Works

Issue Register

Ref	Issue	Date	Issued By	Checked by
0	Stage 3 Issue	16/12/2019	AJ/SN/MB/NH/TH	WF
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(Senior Associate Director)	(Director)

Contents

1.0 Introduction

The Institute of Education (IEO) at 20 Bedford Way is an existing Grade 2 listed Building comprising of a central block and several Wings.

This document provides the design concepts associate with the refurbishment of 20 Bedford Way, Phase 2 works for UCL Institute of Education (IOE). The project defines the operating parameters and the scope of works and indicates the full extent of the works and our understanding of design concepts associated with the services to be provided.

The Building comprises of 3 No large vertical cores with building services plant rooms at top and bottom. The building has multiple lecture halls on Level 1 and variable teaching and work spaces from Level 2 to 9.

The site is a satellite to the Bloomsbury Campus. Heating Plant is located within the adjacent SOAS assets and within the London University precinct. This is supplied with both MTHW and High Voltage power from SOAS.

A design assessment has been completed under BREEAM 2014 for the Refurbishment and Fit-out of non-domestic buildings, under BREEAM 2014to achieve a BREEAM Excellent rating.

2.0 Mechanical Services Design

2.1 Design Criteria

2.1.1 External Design Criteria

Summer	30.1°C db	20.5°C wb
Winter	-4°C db -4°C wb	
Heat rejection plant ambient Temperature selection and fresh Air ventilation, the ambient Summer conditions will be Taken as	35°C db	23°Cwb

Refrigeration plant will be capable of operating up to a maximum temperature of 40°C at reduced capacity.

2.1.2 Internal Temperature and Humidity

Teaching Spaces/Collaboration Spaces

Temperature

Summer	24°Cdb +/- 2°C
Winter	22°Cdb +/- 2°C

Humidity

Summer	Not controlled
Winter	30% RH min

2.1.3 Internal Temperature and Humidity

Social/ Break out/ Learning Spaces

Temperature

Summer	24
Winter	22°Cdb +/- 2°C

Humidity

Summer	Not controlled
Winter	30% RH min

Kitchen

Temperature

Summer	Not Controlled
Winter	15°Cdb +/- 2°C

Social Café

Temperature

Summer	24°Cdb +/- 2°C
Winter	22°Cdb +/- 2°C

Humidity

Summer	Not controlled
Winter	30% RH min

Offices/Open Plan Offices (Where Air Conditioned)

Temperature

Summer	24°Cdb +/- 2°C
Winter	22°Cdb +/- 2°C

Humidity

Summer	Not controlled
Winter	30% RH min

Offices/Open Plan Offices (Where Non Air Condi tioned)

Temperature

Summer	Temperature not to exceed 28°Cdb for a pre-determined period of time
Winter	22°Cdb +/- 4°C

Humidity

Summer	Not controlled
Winter	30% RH min

Comms Room

Temperature

Summer	22°Cdb +/- 2°C
Winter	22°Cdb +/- 2°C

Non air-conditioned user areas

Summer	Not Controlled
Winter	18°C ± 2°C

Toilet Areas

Winter	18°Cdb +/- 2°C
Summer	Not Controlled

Humidity not controlled

Tea point

Winter	22°Cdb +/- 2°C
Summer	Not Controlled

Reception

Summer	24°Cdb +/- 2°C
Winter	20°Cdb +/- 2°C

Corridors (to unconditioned areas)

18°C

Mechanical Plant Rooms

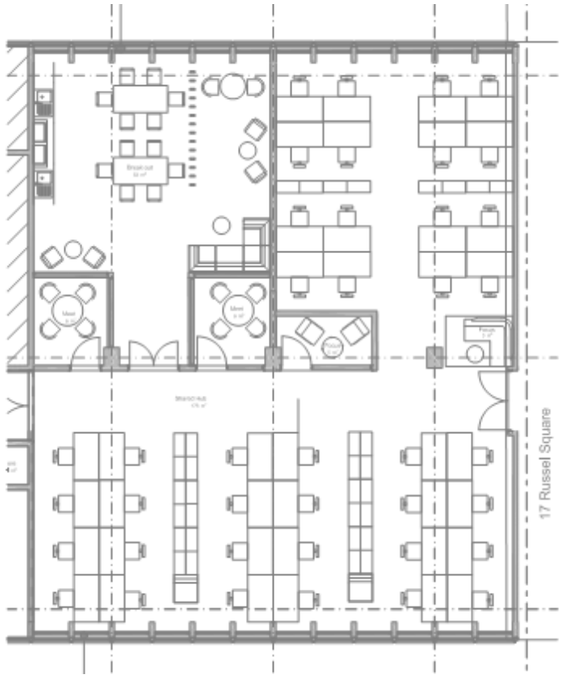
Summer	24°Cdb +/- 2°C
Winter	20°Cdb +/- 2°C

Mechanical Plant Rooms

Summer	24°Cdb +/- 2°C
Winter	20°Cdb +/- 2°C

2.1.4 Occupancy

As per furniture layouts on architectural general arrangement layouts where available



In the absence of this information the following will apply

Occupancy

Area	m²/person
Teaching Spaces	3
Circulation Spaces	5
Meeting Rooms	1
Tea Points	2
Kitchen	10
Computer Room	2.5
Social Café	1

2.1.5 Fresh Air and Ventilation Rates

Primary fresh air supply ductwork onto the office floor plate:

OfficesOpenplan	12 l/s per person
Teaching Spaces/ Breaking Out/Learning	10 l/s per person
Toilets	8 ac/h (extract)
Tea point	50 l/s

2.1.6 Infiltration Rates

Above Ground Floors 0.25 ac/hr to perimeter zone for terminal unit heating and cooling selection(Keith to advise)

Air leakage for the completed building envelope should not exceed 10m^3/hr/m^2 at 50 pascal differential test pressure. Building to be pressure tested in accordance with Building Regulations Part L requirements.

2.1.6.1 Internal Heat Gains (Infrastructure)

	Load Allowances	
Areas	Occupants:	90 W/m^2 (sensible) 50 W/m^2 (latent)
	Lighting:	
	Teaching Spaces	12 W/m^2
	Circulation Spaces	10 W/m^2
	Meeting Rooms	10 W/m^2
	Offfices / Open Plan Office	10 W/m^2
	Tea points	5 W/m^2
	Toilets	5 W/m^2
	Mechanical Plant Rooms	5 W/m^2
	Small Power :	
	Teaching Spaces	10 W/m^2
	Circulation Spaces	0 W/m^2
	Meeting Rooms	5 W/m^2
	Offices / Open Plan Office	25 W/m^2
	Tea points	15 W/m^2
	Toilets	25 W/ m²
	Mechanical Plant Rooms	(*) W/m^2
Server Rooms	Loads	To be confirmed

(*) Dependent on equipment installed

2.1.7 Occupancy Period

Plant noise emissions designed not for night time operation as per BuroHappold Engineering Acoustic Specification.

2.1.8 Filtration Standard

Specification	
▪ Pre – Filters	IAQ2 and EU3 Pre- Filters
▪ Bag Filters	EU6

2.1.9 Noise Criteria – Internal

Refer to BuroHappold Acoustic report.

NR ratings for Building Services

Teaching Spaces	NR 30
Offices	NR 35
Cellular Offices	NR 35
Open Plan Office	NR 40
Kitchen/ Breakout	NR 45
Toilet	NR 45

Internal noise levels as defined by IS0 R 1996, will apply at a distance of 1.5m from any grille/diffuser (at an angle of 45°C) or any wall surface.

2.1.10 Noise Criteria – External

Noise criteria as specified at 1.0m outside the nearest openable window.
The proposed scheme does not include for night time operation of main plant

2.1.11 System Operating Parameters

- Primary Fresh Air from AHU's 18° C when ambient temperatures > 28 °C
- Primary Fresh Air from AHU's 20° C when ambient temperatures < 20 °C
- Primary Fresh Air from AHU's 24° C when ambient temperatures > 20 °C

2.1.12 Refrigerant

Zero ozone depletion potential

2.1.13 Fire Rated Ductwork

All ductwork crossing escape routes but not serving these areas will be fire rated throughout from point of entry to point of exit.

2.1.14 Comms Rooms

The development will also house new dedicated Comms Rooms in both Cores A & B, these will be used to locate the data racks and technology currently stored solely in the ISD area on level 3 & various satellite rooms spread around the site.

The Comms rooms will be served by cooling only, this wil be provided by 2no. Split Direct Expansion (DX) Units in each room which will run on refrigerant and power fed from outdoor units.

In total there will be 20no indoor DX units, 10no in each core, A & B. The outdoor units will be located at the service road which runs through the development on level 2 with 5no units to serve Core A & 5no tto serve Core B.

3.0 Existing Services to be removed

3.1 General Works

The existing building contains multiple plant rooms as listed below. Each plant room forms part of the overall operation of the services design site and will be modified as described for the current phase of works.

Provisions for new or modified services for future provisions past the current project have been accounted for within the scope of works and will encompass the removal of the following services to facilitate the new installations.

3.2 PLANTROOM 1 (Located on the top of Core B from levels 10 to 12)

- Toilet extract fan serving both male and female toilets through the Core B from Level 1 to level 9.
- Laboratory extract fan, centrifugal fan.
- Domestic Cold Water tank.
- Existing steel pipework within the plant room (nominally 150 Dia.) connecting the new 2011 chilled water system to the crca 1975 equipment in the lower levels.
- Remove associated Trend BMS components and modify the software & head-end graphics.

3.3 PLANT ROOM 2 (Located at the top of Core A from levels 10 to 12)

- Existing Air Handling unit and associated components:
  - Supply air fan
  - Filter bank
  - Supply air fan
  - Filter bank
  - Existing built up mixing box
  - Return air fan
  - Mixing air dampers and control dampers
  - Attenuators
  - Associated heater batteries (MTHW)
  - Associated ductwork connections to and from the riser.
  - Associated pipework, valving and fittings
- Toilet exhausts fan systems and associated ductwork.
- Kitchen Exhaust fan system and associated ductwork.
- Remove associated Trend BMS components and modify the software & head-end graphics.

3.4 PLANT ROOM 3 (Located at level 1 on the southern side of core A)

- LTHW North and South Pump sets and associated pipework
- Existing AHU for outside air and associated components:
  - Supply air fan
  - Filter bank
  - Existing built up mixing box
  - Return air fan
  - Mixing air dampers and control dampers
  - Attenuators
  - Associated heater batteries (MTHW)
  - Associated ductwork connections to and from the riser.
  - Associated pipework, valving and fittings
- Toilet supply fans and associated ductwork
- Work shop supply and exhaust fan and associated heating coil.
- Remove associated Trend BMS components and modify the software & head-end graphics, including MTHW heating coil valve actuator and any associated sensors.

3.5 PLANT ROOM 4 (Located behind the small hall concourse)

- Heating coil MTHW connections and associated MTHW pipework and valving.

3.6 Plant Room 5/8 (Level 1 between Cores B and C)

- Toilet supply fans and associated ductwork for Core B
- MTHW branches to any and all equipment that is not a plate heat exchanger
- Remove associated Trend BMS components and modify the software & head-end graphics, including MTHW heating coil valve actuator and any associated sensors.

3.7 Plant Room 6 (Back of Logan Hall Auditorium on Level 2 under the Wing)

- Heating coil MTHW connections and associated MTHW pipework and valving.
- Remove associated Trend BMS components and modify the software & head-end graphics, including remove MTHW control components.

3.8 Plant Room 6A (Library Plantroom)

- Removal of the existing MTHW branch connections to the heating battery within the AHU.
- Remove associated Trend BMS components and modify the software & head-end graphics

3.9 Core A (The southernmost core of the building and shares vertical transport with the areas A, B and the Wing)

- All ductwork within the mechanical risers
- All ductwork within the toilet risers
- All LTHW North and South VT circuits.
- All LTHW CT pipework

3.10 Core B (The central core of the building and shares vertical transport with the areas B and C)

- All return air dampers and fire dampers entering the riser.
- Remove associated Trend BMS components and modify the software & head-end graphics, such as radiator zone control valves.
- All ductwork within the mechanical risers
- All ductwork within the toilet risers
- All steel CHW pipework (2 x 150 Dia. Pipes from level 2 to level 11, both would have asbestos in the insulation)

4.0 Enabling Works

4.1 Scope of Works

As part for the provisions of new and modified services installations the scope of works will encompass the following enabling works to facilitate the new services installation:

4.2 Plant Room 6A - Enabling Works

- Installation of duty standby LTHW pumps for the sole purpose of serving the library AHU heating battery in a header arrangement with the VT radiator circuit.
- Validate existing plate heat exchanger and modify to accept new loading of AHU combined with the existing radiator loading.
- Associated BMS upgrades for the new systems (new Smart Struxure BMS).
- New plate heat exchangers to be provided with all required pipe fittings required by Bloomsbury heat & power network.
- Associated BMS upgrades for the new systems (new Smart Struxure BMS).

4.3 Core A - Enabling Works

- Provide new LTHW CT circuit riser pipework from plant room 3 to plant room 2 complete with localised blanked isolation valves for future on floor connection of FCU circuits.
- Modify the existing LTHW Core VT circuit riser pipework from plant room 3 to level 9 to have localised connection to the existing north and south radiator circuits from Zone B and Zone a levels 2 to 4. During the horizontal level change over these will be used for reconnection to the new 2 pipe radiators sequentially as the North and South Circuits become redundant.
- Modify the existing wing VT rising LTHW pipework to supply connections to all new radiators on the floors of the Wing level 6-9 and Zone A levels 5-9.
- Provide new CHW connections from the top and bottom of the existing Core A 150 Dia. CHW riser headers to the plant rooms 2 and 3.
- Provide new supply air ductwork for ventilation of the levels 6-9 from the new plant room 2 AHU.
- Provide new supply air ductwork for ventilation of the levels 1-5 from the new plant room 3 AHU.
- Provide new CHW 2 port mortised isolation control valves (PICV) at the level 5 connection

5.0 Cooling Services and Heat Rejection

5.1 Chilled Water System (New and Existing)

The existing system will be modified and split to cater for the phase 2 and phase 3 future loading of the building.
The current cooling systems encompass of the following:

- 2 No. existing 450 kW chilled water chillers

This system will be supplemented by the following;

- 2 no. new 500 kW air cooled package chillers

The existing chilled water circuits with run and standby pumps will no longer cater for the Wing and Core A chilled water requirements and will only cater for the Core C and Core B chilled water requirements.

The newly formed chilled water circuit in Core A plant room 2 will be served by 2no. new chillers and cater for the Wing and Core A chilled water demand.

The temperatures of operation will stay the same throughout the building to allow for the ongoing service of existing AHU and FCU coil operations.

The primary chilled water temperatures are as follows:

- Flow Temperature: 7ºC
- Return Temperature: 13ºC

The installed chilled water system capacity, and system design is to be designed so as to allow the existing Daikin VRV cooling capacity currently served by the existing VRV units to be replaced by chilled water from the new chillers at the end of the VRV system life cycle.

The facility to connect additional circuits to thechilled water central plant is to be future proofed via appropriate isolation valving.

The contractor will validate all connected branches to the CHW distribution in order to carry out design and properly re-commission the system.

Where existing pipe system is to be extended, prior to connecting/open the new to the existing section of the pipework, the contractor will ensure the adequate water quality has been achieved in the new pipework and the existing system's water quality sample has been taken in order to prove that neither the new nor the existing pipework water causes damage / poor water quality issue in the system. Liaison with the building's facility management will be required.

MainCHW network uses the Core B to distribute CHW pipework throughout the building.

5.2 Existing VRV system

Existing variable refrigerant volume systems exist throughout the building to augment the chilled water distribution over the life of the building.

These system are in varying levels of lifespan and maintenance.

Each VRF or VRV system within the building envelope of the phase 2 works will be removed and replaced with CHW FCU's.

Where VRF or VRV systems are to be removed a full decommissioning and removal of equipment from site will be carried out by the contractor. This is inclusive of and not limited to all redundant pipework, power cabling, insulation, equipment, sensors, and inertia bases.

When removal of VRF /VRV system occurs, it is required to carry out the existing Trend BMS modification

5.3 Cold Storage Refrigeration

Any commercial scale refrigeration systems, controls and components will be designed, installed and commissioned as follows:

- In accordance with the Code of Conduct for carbon reduction and BS EN 378-2 Refrigeration systems and heat pumps - Safety and environmental requirements.
- Using robust and tested refrigeration systems/components, normally defined as those included on the Enhanced Capital Allowance (ECA) Energy Technology Product List (ETPL)
- The refrigeration plant will be commissioned to comply with the criteria for commissioning outlined in BREEAM issue Man 04 Commissioning and handover.
- The installed refrigeration system demonstrates a saving in indirect greenhouse gas emissions (CO2 eq.) over the course of its operational life.

5.4 Refrigerants

All systems (with electric compressors) must comply with the requirements of BS EN 378:2008 (parts 2 and 3) and where refrigeration systems containing ammonia are installed, the Institute of Refrigeration Ammonia Refrigeration Systems Code of Practice.

Systems using refrigerants will have Direct Effect Life Cycle CO2 equivalent emissions (DELC CO2e) of ≤ 1000 kgCO2e/kW cooling/heating capacity.

Verify this figure the following information will be confirmed through the submission of product data sheets / technical submissions:

- The volume of refrigerant charge for each individual cooling unit
- The system capacity (kW) for each unit
- The refrigerant type for each unit

5.5 Refrigerant Leak Detection

All refrigerant plant above 6kg refrigerant charge will have a permanent automated refrigerant leak detection system installed.

In all instances a robust and tested refrigerant leak detection system must be installed and must be capable of continuously monitoring for leaks.

6.0 Heating Plant Network and New Heating Systems

Heating is provided in the IOE through district heating. Two main district heating plantroom are located in plantroom PR5/8 & PR3 and serve heating and domestic hot water to the majority of the IOE. The plantroom are equipped with plate heat exchangers segregating primary (district) and secondary (building) networks.

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The secondary network serving the AHUs, radiators and domestic hot water has had several modification works in the past.

The contractor will validate all LTHW distribution in order to carry out design and properly re-commission the systems. Where existing pipe systems are to be extended, prior to connecting/open the new to the existing section of the pipework, the contractor will ensure the adequate water quality has been achieved in the new pipework and the existing system's water quality sample has been taken in order to prove that neither the new nor the existing pipework water causes damage / poor water quality issue in the system. Liaison with the building's facility management will be required.

Zone A and Wing A levels with new radiator circuits will be serviced by new LTHW pipework throughout and connected to the existing Wing VT LTHW circuit.

All redundant LTHW pipework will be decommissioned and removed from the project.

LTHW circuits serving new radiators will be provided with sufficiently sized Differential Pressure Control Valves (DPCV).This in order to maintain the differential pressures for the existing radiator throughout the building. This is in order to keep the pressure difference across Thermostatic Radiator Valves within the acceptable ranges.

It is currently anticipated that the Plantroom 3 LTHW temperature will be 75/55°C for Phase 2. Further design consideration required by the contractor to determine the appropriate temperature range.

The Heating System operates at the following existing and proposed new temperatures:

6.1.1 Current District Heating System:

Flow Temperature: 95ºC
Return temperature: 75ºC

6.1.2 Intermediate District Heating System - Future:

Flow Temperature: 80ºC
Return temperature: 60 ºC

6.1.3 District Heating - Final Future:

Flow Temperature: 75ºC
Return temperature: 45 ºC

6.1.4 Plant Room 3 PHX – Existing:

Flow Temperature: 82ºC
Return temperature: 62 ºC

6.1.5 Plant Room 3 PHX – Phase 2 Change:

Flow Temperature: 75ºC
Return temperature: 55 ºC

6.1.6 Plant Room 5/8 PHX – Existing:

Flow Temperature: 82ºC
Return temperature: 62 ºC

6.1.7 Plant Room 6a PHX – 2 Existing:

Flow Temperature: 82ºC
Return temperature: 62 ºC

6.2 Phase2 Wing Connection to Secondary Heating Network

The radiators on levels 6 to 9 will be on the two – pipe radiator VT circuit Wing A. The network is currently connected to the plantroom PR3 with a dedicated pump.

Energy sub-metering will be provided to the LTHW branches at each level.

The pumps P2A/B will be recommissioned with new designed flowrates including the phase 1 Wing connection.

The level 6 to 9 of the wing for phase 2 will be equipped with FCUs with LTHW connection at high level to provide space heating to the spaces to achieve thermal comfort The pipework will be connected to the pumps P3A/B system. The contractor will validate the systems as part of the design process.

New Zoning within each level of the wing will be required to match the architectural intent and the mechanical control strategy.

Radiator zones will be provided with zone control valves, minimum as below:

6.3 Phase2 Core A Level 6 to 9 Connection to Secondary Heating Network

The level 5 to 9 of the IoE for phase 2 will be equipped with new radiators with a new two-pipe radiator pipework system. The pipework will be connected to the Wing VT system via connection from the cleaners cupboard Wing VT rising location. The contractor will validate the systems as part of the design process.

VT LTHW North and South circuits within the Core A distribution will be removed within the core. The existing Zone B and Zone A. Radiator circuits will be connected to the Core A VT circuit within Core A complete with isolation and zone control valving. Isolation points will be accessible from the floor being served by each radiator circuit for future change over.

The level 5 to 9 of the Zone A for phase 2 will be equipped with FCUs (where applicable) with LTHW connection at high level to provide space heating to the spaces. The pipework will be connected to the Core A CT circuit system. The contractor will validate the systems as part of the design process.

Energy sub-metering will be provided to the new LTHW branches.

New Zoning within each level of the Zone A will be required to match the architectural intent and the mechanical control strategy.

Radiator zone will be provided with zone control valves, minimum as below:

The pumps P3A/B will be recommissioned with new designed flowrates for all connections. Inclusive of all new Air handling Coils.

6.4 Phase2 Core A Level 6 to 9 Connection to Secondary Heating Network

Plant room 4, 6,and 6a contain AHUs that will continue to operate during and after phase 2. These units are currently connected to the district heating network MTHW supply. Each plant room will be modified accordingly:

- Plant room 4 will be connected to the plant room 3 CT LTHW circuit.
- Plant room 6 will have a localised dedicated plate heat exchanger and pump set.
- Plant room 6a has a localised dedicated plate heat exchanger that will be reviewed for suitability for reconnection or preplacement and will have a dedicated pump set servicing the existing air handling coil.

All systems will be validated for energy consumption and flow prior to disconnection and removal of the MTHW connections.

Coils will be reconnected to achieve the maximum output possible from each coil based on the existing and new SOAS BHP district heating temperatures.

All redundant pipework and valving is to be decommissioned and removed.

6.5 Heating/DHW Sub-metering

Energy metering systems will be installed to 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.

The CISBE TM39 methodology will be followed, together with the UCL Sustainable Building Standard.

The end energy consuming uses will be identifiable to the building users, for example through labelling or data outputs.

The following energy end uses by functional area will be sub-metered:

- Space heating
- Domestic Hot Water Heating

The following functional areas will be sub-metered where applicable:

- Kitchens (excluding small staff kitchens and food technology rooms)
- Computer suites
- Workshops
- Lecture halls
- Conference rooms
- Process areas
- Data centres
- IT work and study rooms, including IT-equipped library space and any space with provision of more than one computer terminal per 5m².
- Individual sub-metering of standard classrooms/seminar rooms is not required.

6.6 NOX EMISSIONS

Where any heating/DHW plant not served by the SOAS energy centre is installed it will have a NOx emission level (measured on a dry basis at 0% excessO2) of less than 40 mg/kWh.

The Contractor willcalculate total NOx emissions for the refurbishment including heat / DHW from the energy centre.

7.0 Environmental Control Systems

7.1 Environmental Control System

Environmental control of the various areas will be based on the use of the following HVAC systems:

Fresh air will be provided into the building in accordance with the relevant standard for ventilation from Building Bulletin 101 Ventilation of School Buildings, April 2014.

Areas of the building subject to large and unpredictable or variable occupancy patterns will have carbon dioxide (CO2) sensors specified :

- Mechanical ventilated spaces will be fitted with sensors and inked to the mechanical ventilation Systems to provide demand-controlled ventilation to the space.
- Space sensors will have the ability to alert the building owner or managerwhen CO2 levels exceed the recommended set point, and will be inked to controls with the ability to adjust the quantity of fresh air, i.e. automatic opening windows/roof vents.
- The ventilation systems for each area served will generally incorporate energy recovery in the form of run around coils or thermal wheels. Refer to AHU schedule within the schedule of equipment

.

Zones 3 Wing Levels 6 to 9:

Each room is treated as an individual zone with fresh air supply VAV/CAV box and extract air.

Fresh air VAV Box linked (upon CO2 levels) or CAV will be supplied into each room.

Extract VAV/CAV volumes will be interlinked to the supply VAV/CAV that serve the floors and back the same proportion of supply to exhaust air ratio to the AHU located in Wing level 4 plantroom.

CO2 sensors will be installed in an occupied space at 1600mm FFL in each room with VAV terminals and linked to VAV systems to modulate the fresh air provision into each room.

Allowance will be made to provide and install minimum 2No. CO2 sensors for multi-function rooms and 1No.CO2 sensor for cellular office space.

One new AHU will be allocated to the Levels 6 to 9 of the Wing The AHU will be connected to new intake louvre for fresh air intake and exhaust louvre air discharge.

The AHU will be provided with a thermal wheel. Heating & Cooling coils connected to the CT and CHW systems, will be provided and linked to the BMS to heat/cool the fresh air supply.

The unit will be provided withvariable speed fans and modulate the fan speed according to the need of fresh air.

The fresh air ductwork will run at high level into the spaces, with branches connections with VAV/CAV boxes.

All supply ductwork will be insulated.

All VAV / CAV will be complete with appropriately sized attenuation

Consideration is currently been given to replace CO2 sensors in small cellular offices with PIR's.
This to be agreed with BH.

Zones A Levels 5 to 9:

Each room is treated as an individual zone with fresh air VAV/CAV. The fresh air VAV (upon CO2 levels) or CAV will be supplied into each room as a separate zone, surrounding the corridor central space.

The fresh-air will be transferred via cross talk attenuator at high level into the central corridor. The air will be extracted at high level adjacent to the core A.

Return air grilles will be provided in the ceiling of the central corridor to ensure ventilation is provided into the space.

One new AHU will be allocated to the Zone A and B of the Levels 6 to 9. The AHU will be connected to the existing intake and discharge louvres.

The AHU will be provided with heat recovery.

In-duct coils, connected to the CT and CHW systems, will be provided and linked to the BMS to heat/cool the fresh air supply. The unit will be provided with variable speed fans and modulate the fan speed according to the need of fresh air.

CO2 sensors will be installed in all occupied spaces at 1600mm FFL in each room with VAV terminals and linked to VAV systems to modulate the fresh air provision into each room.

Allowance will be made to provide and install minimum of 2No. CO2 sensors for combined rooms.

Consideration is currently been given to replace CO2 sensors in small cellular offices with PIR's.
This to be agreed with BH.

One new AHU will be allocated to the Level 1 Plant room 3. It will be connected to the existing fresh air intake and exhaust air discharge arrangement in Plantroom 3.

The AHU will be provided with a method of heat recovery. The AHU will be connected to the CHW and LTHW to provide sufficient heating & cooling to the fresh air to be supplied into the spaces.

The AHU will be provided with variable speed fans and modulate the fan speed according to meet the fresh air requirement of each room.

Fire dampers will be installed as required to form a complete fire strategy for the building.

Reception level 3 and 4

The reception space is connected to an atrium beginning on level 1. The continuous atrium will utilise the same type of passive cooling and heating from adjacent spaces post completion of the phase 2 works.

The existing western boundary fan convectors will be replaced with 2 pipe heating only fan coil units that are serviced via the Core A CT pumps.

The new reception area of the level 3 on the Bedford Way entrance will be conditioned locally with4 pipe fan coil units serviced with CHW and CT LTHW from the plant room 4 below.

The new entrance on the level 3 will utilise a hot air curtain to prevent ingress of un-temperedoutside air. The hot air curtain will be heated from the CT LTHW circuit serving the localised FCU's

7.2 HVAC ZONE DESCRIPTIONS

ALL CONDITIONED SPACES

A Two-pipe radiators system will be provided in these spaces at the bottom of the windows.

Secondaryglazing will be positioned in front of the existing glazing in order to improve the energy efficiency of the building. The radiators will be located in between the concrete ribs, and will be limited to 1000mm long by 400mm high.

There appear to be adequate perimeter heating to address heat loss from the space and this negate the requirement to provide LTHW to fan coil units. This will be verified once final thermal modelling exercise have been concluded by L&P. All radiators will be complete with TRVs

Where it is not practical to provide all heating via radiators , LTHW will be provided to FCU's

Radiator LTHW circuits for this area will be provided with energy sub-meter.

FCU LTHW circuits for these areas will be provided with energy sub-meter.

FCU CHW circuits for these areas will be provided with energy sub-meter (Also refer to section B12 of this document.)

Each space will be provided with a wall mounted user controller, with the user capable to adjust the room temperature within the +- 1.5°C from the design room temperatures.

Indication of set point changes on the wall unit will take the form of 'warmer/cooler or + / -', and not indicate specific temperature values.

FCU with CHW cooling will be provided into spaces where there is a risk of summertime overheating. These FCU's will be provided with CHW coils. Where there is a risk and all heating cannot be off-set by LTHW radiators, FCU's will be provided with LTHW heating coils.

The FCU will generally be of the chassis type and ducted. The FCU's will be located at high level, above suspended fabric acoustic rafts and baffles panels. The FCU will be ducted to linear slot diffusers and integrated with the acoustics rafts to supply air-conditioned air into the space.

In small meeting rooms it will not be practical to fit chassis type FCU's due to the size of these units. In these rooms high wall mounted FCU's will be utilised.

The FCU will be selected at low/medium velocities to reduce the noise impact of the unit to the room. The unit will be provided with acoustic enclosure if required to guarantee the noise level requirements.

FCU's will be fitted with integral condensate pumps and these will be interfaced with the FCU's. In the event of a pump failure the valves serving the FCU will be isolated to negate risk of water damage.

7.3 OFFICE OPEN PLAN AREAS

Each room will be provided with VAV box linked to space CO2 sensor monitoring the CO2 levels. The VAV box will be acoustically treated, with outside acoustic protection to reduce the breakout noise, and embedded with acoustic attenuator to reduce the inlet noise in the supply side.

The VAV box type will be TROX TZ Silencio or TVZ or equivalent in term of air flow and noise levels. The supply ducts will run at high level with branches to serve the spaces with VAV with acoustic attenuation and diffusers connections.

Return air paths will be through adjacent central corridors. The return air will be connected with a bell mouth to the corridor return areas.

7.4 OFFICE DECANT SPACES AREAS

The existing Level 4 and 5 Computer cluster within the Core B will be used as a decant space for the current UCL IoE Staff.

The space will be converted into a work space for these employees as a form of short term relocation. The HVAC systems for the space will continue to run as they are with minor allowances for redistribution of air terminals and throws.

The existing ISD spaces on Level 3 will also be used for UCL IoE Staff temporary relocation space. These spaces will be completely upgraded for HVAC services inclusive of:

- 1 New 4 pipe FCU's and controls.
- 2 MVHR supplying tempered outside air from the adjacent

7.5 OFFICE / MEETING ROOMS / TEACHING (SEMINAR) AREAS WING

The tempered outside air will be supplied to the space from the appropriate riser location. The ducts will run at high level with branches to serve the spaces with VAV with acoustic attenuation and linear slot diffusers connections.

The diffusers will be TROX VSD 35 linear slot diffusers or high induction swirl diffusers.

Active diffusers will be positioned to supply air within the room in the adequate location according to the throw, the acoustic considerations and any potential obstructing element or services.

The linear slot diffusers should be TROX VCD35 and facilitate external blade washing the perimeter façade whilst the remainder of the air is directed through the remainder of the blades to serve internal areas.

In small cellular meeting rooms high induction swirl diffusers will be utilised in lieu of linear slot diffusers .

FCU will be provided into office spaces where there is a risk of summertime overheating. The FCU will be ducted type, located at high level, above a suspended fabric acoustic rafts and baffles panels. The FCU will be ducted to linear slot diffusers or high induction swirl diffusers.

The FCU will be selected at low/medium velocities to reduce the noise impact of the unit to the room. The unit will be provided with acoustic enclosure if required to guarantee the noise level requirements.

7.6 TEACHING SPACE

The areas will be provided with fresh air from the appropriate AHU. Each room will be provided with VAV box linked to space CO2 sensor monitoring the CO2 levels. The VAV box will be acoustically treated, with outside acoustic protection to reduce the breakout noise, and embedded with acoustic attenuator to reduce the inlet noise in the supply side.

The VAV box type will be TROX TZ Silencio or TVZ or equivalent in term of air flow and noise levels.

The outside air ducts will run at high level to reach the spaces, and will run within the space close to partition wall with the social and learning space within a bulkhead. The bulkhead will contain the main supply air duct, the branches to the spaces, the VAV and acoustic attenuation and the final branches to the diffusers.

The diffusers should be TROX VCD and facilitate external blade washing the perimeter façade whilst the remainder of the air is directed internally.

Secondary ductwork from FCU to linear slot diffusers to be insulated. The Slot diffuser plenums all to be internally lagged with 15mm barafoam.

7.7 LOBBIES, CORRIDORS, CIRCULATION

Conditioned air will be provided into those spaces from fresh air AHUs, connected with CAV boxes to provide sufficient air change rate to the spaces.

Where applicable, two-pipe system radiators will be to guarantee internal temperature range.

The spaces will be designed to provide sufficient air circulation. Upon architectural and/or structural constraints, the spaces can be supply only, extract only or supply & extract. If pressure regime is applied, acoustic considerations will be undertaken to prevent noise diffusion between spaces.

7.8 STORES

Conditioned air will be provided into those spaces from fresh air AHUs, connected with CAV boxes to provide sufficient air change rate to the spaces.

Where applicable, two-pipe system radiators will be installed (where double glazed façade) and/or FCU to guarantee internal temperature range.

The spaces will be designed to provide sufficient air circulation. Upon architectural and/or structural constraints, the spaces can be supply only, extract only or supply & extract. If pressure regime is applied, acoustic considerations will be undertaken to prevent noise diffusion between spaces.

7.9 TEA POINTS

A Conditioned air will be provided into those spaces from fresh air AHUs, connected with CAV boxes to provide sufficient air change rate to the spaces. Where applicable, two-pipe system radiators will be installed (where double glazed façade) and/or FCU to guarantee internal temperature range

7.10 TOILETS

Fresh air will be provided into those spaces from dedicated fans complete with heat reclaim. These fans will be connected with CAV boxes to provide sufficient air change rate to the spaces.

Dedicated extract air from new toilet extract fans located within high and low level plant rooms will be provided into each WCs. Each cubicle will be equipped with extract duct connection, with VCD and extract grille at high level.

The toilets will be negatively pressurised to prevent odour diffusion into adjacent spaces, with make-up air coming from adjacent space.

Where applicable, two-pipe system radiators will be installed (where double glazed façade) and/or FCU to

7.11 EXISTING KITCHEN

This area is served by a dedicated kitchen extract hood. The supply air will be delivered into the kitchen via the Plant Room 2 AHU distribution and a new kitchen extract duct will be taken through to high level Plant Room 12 to discharge away from the AHU intake. .

The fresh air intake and exhaust will be via penthouse type louvres located in the roof.

Kitchen gas ventilation & interlock system to be provided.

7.12 EXISTING DX INSTALLATIONS SERVING THE RETAINED AREAS TO REMAIN

A The existing DX condensers serving the retained areas are to be protected and maintained in an operational condition.

The pipework between the condensers and the room units are to be traced, protected and retained, so that the condensers and room units remain functional throughout the project.

The contractor will validate and locate all the locations of the condensers to be retained, and the existing pipework and record for future replacement at end of life cycle.

7.13 ISD DATA CENTRE

The existing data centre will have a reduction of capacity as part of the ISD scope of works. The existing CRAC units supplying the southern server room will be decommissioned and removed from site.

The remaining servers will be amalgamated into the northern server room that is to remain operational.

All chilled water services to this space are to remain continuously operational throughout the duration of phase 2 works.

7.14 BMS/Automatic Controls.

The existing BMS system is TREND controls. New Structureware system to be installed to monitor / control all new equipment metering / sub-metering to be connected back to UCL campus wider metering system, EMON system.

The Contractor will modify the existing TREND system associated with the scope of the phase 2 works, including modifications to software & head-end graphics and District Heating MTHW system, reflecting the works.

8.0 Electrical Services

8.1 Electrical Services

8.2 Electrical Design Criteria

The following allowances have been used to calculate the electrical services power distribution:

Offices	Maximum Demand (Based on Nett Office Area)
Office area lighting	12w/m² @ 400 lux
Core areas lighting	8w/m² @ 400 lux
Small Power	25w/m²
Core Power	5w/m²
Future SER loads	500w/m^2 over 20m^2 per tenancy 1 No Tenancy per floor
Future MER load	No allowance
Mechanical services	80w/m²
Spare capacity	25%

All final sub circuits other than ring sub-circuits will be sized to accommodate their connected loads. Ring final sub circuits will be 32A rated to BS 7671 with a minimum allowance of 200 watts per socket outlet.

8.2.1 Artificial illumination criteria

Lighting will be designed generally in accordance with the requirements of CIBSE code for interior lighting to allow tenants to comply with the CIBSE Lighting Guide LG5 – Lighting for Education and BS:5266 and BS: EN1838 for emergency lighting.

Emergency lighting within common parts and net lettable area will be provided with emergency lighting and escape signage lighting in accordance with BS 5266pt 1 & 7.

The following criteria will be achieved at the relevant working plane

Open Plan Offices	-	400 lux (at working plane)
Cellular offices/Meeting Rooms	-	400 to 500lux (at working plane)
Teaching Rooms	-	500lux (at working plane)
CIBSE LG7 Category (All offices)		
Limiting glare factor	-	19
Classrooms	-	300lux (at working plane)
Circulation areas	-	200 lux at finished floor level (min)
Reception	-	Contrasting levels (200 lux min FFL)
Reception desk	-	500 lux (at working phase)
Corridor / Stairs	-	150 lux (at tread level)
Cafe	-	200lux (at floor level)
Kitchen	-	500lux (at floor level)
W.C's	-	200 lux (at floor level)
Disabled W.C's	-	250 lux (at floor level)
Staircase	-	150 lux (at floor level)
Plantrooms	-	250 lux (at floor level)
Loading Bay	-	100 lux at floor level
All other areas / BSEN standards	-	In accordance with CIBSE lighting code
Uniformity ratio minimum / average over task areas	-	0.8
Emergency Lighting	-	BS EN 1838 (BS 5266 Part 7 1999)
Defined Escape Route routes)	-	1 lux (minimum on defined escape
Electrical Panels LV, Distribution Boards and MCCP's	-	15 lux (min) on vertical surface

8.3 Incoming Services

The building is served by two UCL Network HV electrical supplies that enter the building individually supplying two substations via two transformers in each substation rated at 1000kVA each, that are located on level 2 of the service road.

The three cores A, B and C general lighting and power distribution to all the floors supplied through rising main busbar system within the electrical risers located in central core lift lobbies of each core.

Each floor on core A and wing is fed via local combined Lighting and Small Power distribution boards which are fed via generally 100A TP&N MCCB tap-off rising main busbar.

Each floor on core B and core C is fed via local combined Lighting and power distribution board which are fed via generally 160A TP&N MCCB tap-off rising main busbar.

8.4 Scope of Works

The electrical services will include but not limited to the following systems supplied, off loaded, installed tested and commissioned and set to work to the satisfaction of the services engineers.

The contractor will be responsible for the co-ordination of the services outlines within this document together with the preparation and submission of working drawings for approval.

- Installation of a new main and sub main distribution and switchgear
- Metering
- Lighting installation
- Lighting control system
- Emergency lighting
- Small power installation
- External lighting installation
- Fire alarm system
- Disabled Refuge Intercom System
- Mechanical services supplies
- Life Safety Generator
- Access control and door entry systems
- Disabled WC alarms
- Earthing and equipotential bonding
- Data and communication cable containment provisions

The works shall include as follows;

8.4.1 Early works & Decant works;

Prior to Phase 2 works proceeding within the habitable areas of the building the following areas shall be targeted as early works for the project. These areas are required to enable for future decant spaces within the building.

Core B Level 12 - Plant Room 1

- Demolition of DCW tank to make way for new standby diesel generator set
- New standby Diesel Generator Set for Fire service power backup

Zone B Level 3

- IT room conversion to work space (exact details to be confirmed by Architects)

Core B level 4 and 5

- Computer room conversion to work space

Core C levels 2 and 3

- Conversion of archive spaces to teaching spaces
- Conversion of childhood observation spaces to workspaces

8.4.2 Enabling Works;

In order to prepare the horizontal floor plates for new work and teaching spaces, base building infrastructures upgrades required. These upgrades shall be carried out within the enabling works stage of the Phase 2 works.

These works shall include the following;

- MEP Core upgrades within Cores A and B bottom to level 9
- Life safety enabling works from level 2 to level 9 of Core C
- Plant Room 2 MEP Upgrades (Chiller Included) (Core A roof)
- Plant Room 3 Upgrades (Core A Basement)
- New plant room W.8 associated with Wing level 8 AHU plant. (Level 8 Wing)
- Toilet Exhaust in Plant room 1 upgrade for new Core B toilets
- Substation upgrade works (by UCL) to facilitate the Phase 2 works. This includes transformer and main switchboard replacement.

8.4.3 Floor Plate Works;

Once the Phase 2 enabling works have been completed the horizontal floor plates shall be unlocked for the phase refurbishment works.

The works proposed within the Phase 2 shall include the following:

- Floor Plate Wing Level 6 to 9
- Floor Plates Zone A Levels 3 to 9
- Zone B level 3 and 4 reception facilities
- Lawton room, level 6, will have a light refurbishment.
- Miscellaneous floors as possible within budget.
- Additionally MTHW to LTHW upgrades will occur in plant room 4, 6, 6a and 5/8 in order to allow for future Bloomsbury Heating and power central heating plant upgrade that will change the MTHW temperatures and pressure.

The main Phase 2 Electrical Services works shall include the following;

a. Installation of new core electrical infrastructure, this includes but not limited to the following:

- New Rising Mains Busbar
- New Lighting and Small Power Distribution boards
- New electrical services containment rising vertically in the core risers – Core A,B &C (core C fire services only)
- New Sub-Mains board for mechanical services supplies

b. Installation of the following services to all refurbished areas;

- Lighting & emergency lighting
- Lighting control
- Small power
- Data communications and AV system
- Fire Detection and Alarm
- PAVA
- Security System (access control, CCTV etc)
- Disabled Persons refuge and WC Alarm system
- Related system containment

c. Replacement of existing fire alarm system (per Osborn Associates design)

d. Installation of new combine disabled persons WC alarm and disable refuge alarm system (per Osborn Associates design)

e. Installation of new 500KVA standby diesel generator as backup supply to the fire service lifts, Evacuation lifts and smoke extract system.

f. Removal of DCW tank to accommodate new diesel generator. Conversion of some areas within the IOE building into decant spaces.

g. Relocation of the existing server room however a timeline for this has not been agreed and will require further investigation, suitable new location and approval from UCL ISD

h. New containment from the existing distribution boards and risers - generally located within the lift lobby electrical risers

i. New containment for life safety systems i.e. emergency lighting, Fire Detection and Alarm as well as PAVA from existing distribution points

j. New cable trays for new data services from the new comms rooms subject to UCL ISD design approval.

k. New lighting and emergency lighting at the Wing rear escape stairs from level 3 to level 9 this includes emergency lighting at escape stairs from level 4 bar terrace to level 3 escape routes and also to level 4 escape stairs leading to service road side.

l. New lighting and emergency lighting to all Wing terraces from level 6 to level 9.

m. New lighting and small power at level 3 and level 4 new reception and café area.

n. Allow for abortive works and re-configuration of WCs at level 3 core B to create new electrical riser.

o. Allow for modifying electrical services to the rooms, which are located, adjacent to the proposed comms room in core B areas.

p. Allow for modifying electrical services to the existing library entrance area, which will be reconfigured to allow for an opening in the core B area.

The following systems (existing and new) installed by others as part of the masterplan works are also affected and will require adjustment to enable the Phase 2 works:

- LV distribution and Switchgear
- Submains distribution
- Lighting and small power Installation
- Lighting Control Systems
- Emergency Lighting Systems
- Induction loop system
- CCTV systems
- Access Control systems
- Disabled Persons Alarm Systems
- Fire Detection and Alarm Systems
- Public Address and Alarm Systems
- Disabled Refuge Alarm Systems
- Data and Telephone wire ways
- Earthing and Bonding
- Testing and Commissioning of the Electrical Services
- Vertical Transportation (by Others)

The contractor shall allow for alterations to the above systems to allow for correct functioning of the phase 2 works.

F Electrical supplies to Mechanical plant equipment.

G Electrical supplies to Plumbing/Public Health plant equipment

8.5 LV Distribution

New floor standing BS:EN 61439-1:2009 Form 4a Type 6 main LV switchboard shall be installed.
These shall have incoming MCCB protection for the primary mains incoming supply.

The switchboards shall include outgoing MCCB's complete with inter tripping devices for each load centre within the building.

The sub-mains cabling shall be sized to supply normal lighting, cooling loads, general power loads and SER loads, identified under the design criteria.

The following provisions shall be made for each load Centre in positions identified on the drawings:

- Small power and Lighting Distribution board to detail with metering to meet the requirements of the areas served and to provide 25% spare capacity.
- An Arc Fault Detection enclosure shall be installed next to the small power distribution board. The size of the Arc Fault Detection enclosure shall be 30% of the small power distribution board.

The LV distribution system shall be provided to the following services:-

- Three phase sub-mains cable to each floor riser for lighting and small power.
- Mechanical services supplies MCC panels
- Lift Supplies
- Chillers and AHU's

The switchboard will incorporate sub-meters to suit the UCL Metering Requirements.

Life Safety supplies will derive their (LV) supplies direct from the main Life Safety Switchpanel located in Level 12 generator room.

All distribution boards will be of the metal clad miniature circuit breaker type.

Armouring will be used as the principal earth path, supplemented with additional conductors as required.

Sub-main cables shall be primarily XLPE/SWA/LSF. All sub-mains cable shall be cleated to the containment systems throughout.

8.6 Lighting

Strip Out Works

- The existing lighting services serving within the core A, B and proposed refurbished floor plates areas shall be stripped out back to the existing distribution board.
- The existing emergency lighting and related lighting control system serving core A, B and proposed
- refurbished areas shall be stripped out.
- Survey works shall be carried out to identify any circuits feeding the adjacent spaces which are part of future phases of works at no additional cost to the contract
- All refurbished floor plate spaces included in phase 2 works , Zone B Level 3 and Level 4 new reception facilities, , all core areas including WCs and all plant rooms area which are part of the refurbishment works shall be provided with new LED lighting..

Interior lighting will be provided, in accordance with the CIBSE Code for Lighting LG5 and all relevant Building Bulletins.

Luminaires will be of the suspended/recessed LED linear type located to afford best use of daylight control and can be switched or dimmed in conjunction with appropriate sensors within the room.

The luminaires will be selected to utilise LED lamps to keep energy use to a minimum.

8.7 Emergency Lighting

An addressable emergency lighting testing system will be provided as from a UCL approved manufacturer's UCL's policy.

8.8 Lighting Control

Lighting Control System will be provided for the internal lighting installation, capable of remote interrogation and manipulation via an IP protocol.

Lighting will be automatically controlled and dimmed through a DALI protocol to regulate the lux levels of the various spaces in line with BS EN 12464 Light and Lighting. The final operation and control matrix will be determined with Employer during the commissioning stage.

The systems will provide a pre-set scenario's and have daylight linking throughout the buildings wherever appropriate.

The system will also interface with the fire alarm, turning the lighting to 100% in all areas in the event of an alarm.

When the building is unoccupied and is beyond the predetermined time, all lighting will be extinguished.

Lighting control to all areas will be as follows:-

- Plantrooms and services risers - Local switching
- Classrooms – Wall dimming switch and absence detector
- Store rooms – Presence Detector
- W.C's – Presence detector
- Corridors and Lift lobbies – Presence detector

Luminaires within WC areas will be PIR controlled with an appropriate run on timer whilst lighting to staircases will be provided for ease of movement and statutory levels for means of egress or escape.

Internal lighting will be zoned to allow for occupant control in accordance with the criteria for relevant areas present within the building.

8.9 Small Power

Strip Out Works

- The existing small power installation serving within the core A, B and proposed refurbished floor plates areas shall be stripped out back to the existing distribution board.
- Survey works shall be carried out to identify any circuits feeding the adjacent spaces which are part of future phases of works at no additional cost to the contract

Small power will be provided throughout the floor for the following services:

- Small power outlets
- Supplies to fixed items of equipment
- Supplies to mechanical services
- Supplies to Fire Alarm and PAVA racks

Small power to the various areas shall be served as described in the following sections and shall generally comply with BS7671, 18th edition IET Wiring Regulations and amendment 2015.

Final user sockets shall be standard BS1363 socket outlets with RCD protection provided within the distribution cupboards or directly within desk arrangements where so specified. Dedicated circuits utilising fused spur outlets shall be provided with MCB protection only or RCD protection as further coordinated under the scheme.

BS 1363 socket outlets or industrial pattern sockets to BS EN 60304 Part 1 shall be employed for connection of specialist equipment.

Mechanical service plant shall be fed via lockable rotary isolator switches and protected to suit from the distribution boards or respective BEMS MCCP's as appropriate.

Emphasis shall be given to ensure all containment is fully re-wireable with a spare space factor exceeding 25%.

Small Power generally comprises socket outlets as indicated on the drawings.

These shall be fed via high level containment or from within the floor via steel trunking containment routes wherever possible. Dado socket outlets shall be wired via ring or radial circuits and shall be protected by 30mA RCD DB-mounted protective devices. In all instances the contractor shall manage detail proposals for the setting out of these services and shall allow for a mockup to agree the positioning with the relevant Engineers and end users.

Dado Trunking shall be of white PVC type and of MK 3 compartment manufacture unless differently stated on the drawings.

In addition flush wall mounted socket outlets will be provided throughout the works, high level sockets and spurs will be provided surface mounted where feeding equipment.

Classroom/Office space shall have in addition to the above arrangement of vertical trunking serving small power, data and AV arrangements.

All wiring shall comprise multi core LSF insulated cables in cable trays / steel conduit arrangement with final LV Circuit and Data drop down connections or flexible conduit connections from either high level or within the floor areas situated floor screed trunking systems.

All 13A 30mA RCD protected sockets and non-standard socket outlets shall be compliant socket outlets and all circuit cabling shall fully comply with the necessary requirements of BS7671 IET 18th Edition Wiring Regulations.

Supply to each individual PAVA rack shall be via a 16 A BS EN 60309-2 ('Commando type') plug and socket outlet, mounted on high-level cable basket.

Supply the BS EN 60309-2 outlet from an integral 16 A type C single-pole MCB.

All mounting heights shall be as DDA and UCL guidance requirements.

8.10 Containment Systems

Primary containment will be provided throughout the building to accommodate all systems as indicated on the containment drawings.

Containment will generally comprise of cable trays, cable baskets and trunking.

The horizontal routes will generally follow the main corridor runs and circulation spaces where possible.

Containment will be provided as follows for the following distribution networks:

- Sub-main LV: cable tray
- Telecoms and Data: cable tray/basket
- Fire Alarms, BMS and security: 2 compartment galvanized trunking
- Small Power and Lighting: galvanised trunking
- Mid and Low Level Power inc data: dado trunking

8.11 Induction Loop System

An induction loop systems will be provided to the following areas:

- Seminar Rooms
- Teaching Spaces
- Lecture Theatres

The system will be designed and installed to conform with BS 7594 BS 6083 IEC 118 Part 4.

8.12 Fire Alarm System

A new fire alarm installation with enhanced voice alarm sounders will be installed in the new refurbished space. The complete system will be designed by fire alarm specialist, Osborn Associates.

New main fire alarm panels will be installed as indicated on drawings with loops covering all of the refurbished areas and any adjacent spaces impacted by the fit-out.

Fire alarm interfaces will be provided to mechanical plants, access control doors and lighting control systems.

The fire alarm category will be L1 subject to an agreement with UCL Fire Officer.

Wiring willbe a Hard skinned "enhanced" cable as Prysmian FP Plus (Sheath colour red) as manufactured by Prysmian Cables & Systems.

8.13 Voice Alarm System

The following voice sounders conforming to BS 5839 will be installed. Combination of voice and tone sounders will be used in all areas where the public or large numbers of students use the space, where phased evacuation or the need to differentiate buildings is to be considered.

PAVA rack and associated power supplies will be provided where indicated on drawings.

8.14 Disabled Refuge Intercom/Disabled W.C. Alarm System

A digital addressable, fully monitored disabled refuge system for emergency services/building management use shall be provided at designated disable refuge and shall include signals from the accessible WC's call system equipment.

The complete system shall comply with BS 5839 (part 9), and BS 9999 legislation and "assist compliance to the disability discrimination act (DDA) for safe and efficient emergency evacuation within any structure".

Multiple loops shall be provided and loop powered boosters where necessary shall be incorporated.

The main control/indicator panel complete with master handset shall be located within in Ground Floor Entrance.

Cabling to remote units shall employ "enhanced" fire rated cables.

The complete system shall be battery backed for 24 hours quiescent and 3 hours use plus battery charging facilities.

8.15 Standby Life Safety Generator

A standby generator shall be provided for life safety systems including:

- Fire Fighting Lift
- Evacuation Lifts
- Smoke damper panel

The life safety generator shall be located at Level 12 Roof generator room.

The generator shall be sized so as to allow life safety equipment to start simultaneously to meet Insurer's requirements.

A life safety generator fuel storage tank shall be provided to allow generator operation over at full load.

A fuel fill point shall be provided, position to be agreed with the Architect.

The fuel tank shall be protected by a foam system from a foam inlet and piped to a set of discharge heads over the tank.

Facilities shall be provided on the generator switchboard to allow connection of a generator load bank via a terminal connection box located at Ground floor level.

All life safety systems shall be provided with a secondary supply directly derived from a life safety switch panel within the Roof. Cable routing shall be via diverse routes to a dedicated life safety secondary riser in the main core and from this riser to the points of supply. This riser is integrated in the riser due to space restrictions and shall be separated by construction to meet BS 8519 and BS9999 requirements. Where diverse routing to the riser is not possible (e.g. from the LS-Switch room to the riser in the basement) separation by construction in line with BS9999 and BS8519 shall be provided.

All life safety cables shall be fully fire rated to BS8519.

All life safety systems shall be provided with two sources of supply via automatic transfer switches (ATS) directly adjacent to the points of supply and within the same location/ fire compartment. Each ATS shall include a phase failure relay and maintenance by-pass arrangement.

A Statutory Remote Indicator shall be provided at the Ground Floor Fire Fighting Entrance / Lift to satisfy BS EN 9999.

An indication of the status of any of the following shall be provided adjacent to the fire-fighting lift switch and duplicated in any fire control panel:
i) the primary and secondary power supplies;
ii) any powered ventilation or pressurization systems;
iii) any pumps feeding fire mains.

The indicators for power supplies shall identify which system is supplying the fire-fighting shaft. The indicators for powered ventilation systems, pressurization systems and fire main pumps shall indicate whether the equipment is in operation, and not merely whether it is energized."

The Approved Inspector shall need to determine the exact position of the indicator.

8.16 Data Transmission and Communication Systems

The data installation will be provided from the dedicated Comms rooms and will be distributed horizontally within a dedicated cable containment system. Details of the commsroom's requirements, including server room sizes, cooling requirements and electrical loads, will be provided by UCL ISD.

The system will comprise a network of outlets located around the refurbished building for the connection of Voice, Ethernet Data, Video Communications and CCTV.

8.17 Access and Security Systems

The system will be designed to conform to all latest relevant standards and UCL's "Specification for the Installation of turnstiles and their integration with UCL's Cardax access control system"

8.18 Earthing and Bonding

Earthing and bonding system will be provided to protect the building and their integral equipment.

The provision will include the earthing and bonding of all metalwork associated with the electrical installations including:

- All metal cable sheaths
- Cable armouring
- Metal conduit
- Trunking and similar equipment

8.19 Testing and Commissioning

The complete electrical installation shall be tested, inspected and fully commissioned by an NICEIC approved contractor. Specialist systems testing and commissioning shall be carried out by accredited Engineers with the respective governing bodies.

It shall be empahsised that all commission and testing procedures have to meet the phased approach of the construction work and due allowances shall be made to ensure that the requirement for duplicated commissioning is provided where required. Under all circumstances it is required to provide a complete commissioning package on completion of each phase. No omissions shall be allowed in this respect.

9.0 Public Health Services

9.1 New Mains water supply

- A new metered MWS to Plantroom 3: Core A (63ø) to include major leak detection (BREEAM). Branch to be taken from the incoming main supply to serve the Café area at level 3
- A new metered MWS to Plantroom 5/8 Core B and C (63ø:) to include major leak detection (BREEAM)

9.1.1 Cold water storage

- Existing cold water storage tanks located in Plantroom 3 and Plantroom 5/8 to be refurbished and have new internal central divisions fitted. The tanks shall have new pipework connections as required.

9.1.2 Domestic hot and cold water services pipework design critea

- Maximum pressure at draw off point 500kPa
- Flow pressure at draw off point: 100kPa minimum
- Supply system via booster pump set
- Flow velocity: Risers and plantrooms 2.0 m/s max
- Floor distribution 1.5 m/s max
- Domestic hot water generation Existing plate heat exchanger plants
- Domestic hot water distribution temperature 60/55°C

9.1.3 Sanitary drainage services scope of works

- · Design Standard: BS EN 12056 to System 3
- · Calculation Method: Discharge Unit

9.1.4 Rainwater drainage services scope of work

- Replace existing pipework
- Replace rainwater goods in accordance to Architectural Specification as required
- Rainwater system is to be separated from the sanitary drainage

9.1.5 Core B Plantroom - Level 1 scope of works

- Provide new circulation pump and 1 spare
- Retain Existing 800 L DHW Storage Vessel
- Install a new CWS, HWSF and HWSR pipework installation
- Install new tank overflow pipes
- Inspection, cleaning and disinfection of the existing cold water tank, to include new internal central division panel.
- Commissioning of retained booster pump set and the domestic hot water PHX plant and equipment.
- New distribution of domestic Hot and Cold Water pipework to Core B & Core C
- Replace and install new drainage pipework
- Provide a new Cat5 break tank and booster pump to serve the mechanical plant

9.2 Core A Plantroom Level 1 scope of works

- Provide new circulation pump and 1 spare
- Retain Existing 800 L DHW Storage Vessel
- Install a new CWS, HWSF and HWSR pipework installation
- Install new tank overflow pipes
- Inspection, cleaning and disinfection of the existing cold water tank, to include new internal central division panel.
- Commissioning of retained booster pump set and the domestic hot water PHX plant and equipment.
- New distribution of domestic Hot and Cold Water pipework to Core B & Core C
- Replace and install new drainage pipework
- Provide a new Cat5 break tank and booster pump to serve the mechanical plant

9.3 Typical Toilet Cores

- Install new drainage system
- Install new water supply system comprising domestic cold and hot water circulation supply systems
- Install PIR operated solenoid valves to each toilet core, (cold water supplies only).

9.4 Sanitary Pipework Installation

A two-pipe soil system shall be designed to remove the effluent from the various sanitary appliances throughout the building toilet cores. A HDPE piping system using fusion weld joints shall be used for the main soil and ventilating stacks. The branch, waste, soil and ventilating piping shall be installed using UPVC.

The foul drainage above ground system will be installed to meet the performance requirements stated in BS EN 12056(Part 2), the Building Regulations and all other technical manuals and guides applicable. The system will be installed using the minimum pipework, fittings and accessories necessary to carry away all discharges from the sanitary appliances etc quickly, quietly and with freedom from nuisance or risk to health. It is essential that air from the foul drainage system is prevented from entering the building. All pipelines will be identifiable in accordance with BS 1710.

All drainage pipework will be installed to convey discharges without cross flow, back fall, leakage or blockage and it is essential that the system is adequately tested, cleaned and maintained at all times and throughout the construction process.

Main soil vent pipes will terminate to atmosphere at roof level. Sanitary fittings including showers and taps will be selected by the Architect.

9.5 Rainwater Installation

In general, the rainwater pipework system will carry rainwater from roof levels via gravity. The surface water discharge will be conveyed to the Thames Water sewer via an existing sewer connection.

All internal rainwater pipes will be designed for installation within designated services ducts or ceiling voids. Removable access panels will be co-ordinated with drainage access points to enable maintenance to rainwater pipework. Where rainwater pipes are to be exposed, they will be installed true to a high standard, true to line and level and supported in accordance with BS EN 12056 (Part 3) and the manufacturer’s recommendations.

A HDPE piping system using fusion weld joints shall be used

All rainwater services in ceiling voids and within the risers will be insulated. All pipelines will be identifiable in accordance with BS 1710.

9.6 Potable Water Installation

New metered incoming mains water services will supply the existing potable cold water storage tanks serving cores A and B/C sited within Level 1 plant areas. It is proposed to fit central division within each of the storage tanks. Confirmation is required from the tank manufacturer as to whether the central panels can be retro fitted or whether installed tanks have to be dismantled to fix the panels.

The systems pressure serving Core A and B will be generated with by the use of the existing packaged variable speed potable cold water pump sets. The pump sets operate on a duty/ standby basis for ease of maintenance and protection in the event of pump failure.. Note further investigations are required to determine as to whether the existing booster sets have the capacity to meet the new installations

A major leak detection system will be installed to comply with BREEAM requirements

The boosted potable cold water supply will be distributed through dedicated risers to provide water to sanitary fittings within each of the toilet cores.

The discharge pipework from the potable booster set will pass through a filter before being treated with a UV filter to ensure microbiological fouling of the system does not occur providing protection to the entire domestic water system.

The site is within a hard water area therefore water treatment will be required to protect the entire domestic cold water system. This will be achieved using an electro-magnetic physical water conditioner installed on the pump discharge.

The water supplies to mechanical plant in the Level 1 and Roof Plantrooms are identified as category 5 risk therefore a dedicated break tank and pump set will be required for each area.

The cold water systems will be pressure controlled with the use of pressure reducing valves to ensure excessive pressures are not experienced throughout the building, in particular to the lower floors.

To comply with BREEAM requirements a water supply solenoid valve shall be installed on the cold water supply to each office WC area. Solenoid valves shall be controlled via infra red movement detectors within each toilet facility.

Drain valves will be provided at all system low points and isolation valves on all appliances connections.

Surge arrestors shall be fitted at the top of each riser

The whole of the new cold water systems after the local authority mains will be chlorinated, all necessary injection points will be provided as may be required to facilitate such works.

Insulation will be provided for frost protection and to guard against the build up of temperature to all cold water pipes and storage cisterns. Where exposed to external ambient temperatures pipework and vessels will be trace heated.

The whole system will comply with BS: 6700, HSE ACOPS L8 and the Water Regulations 1999 second edition. All fittings, appliances, valves and materials to be water research council approved. (WRAS)

All pipelines will be identifiable in accordance with BS 1710.

9.7 Hot Water Installation

Hot water shall be provided from the retained plate heat exchangers and buffer vessels located with the respective L 1 plantrooms. Note further investigations are required to determine as to whether the existing hot water generators have the capacity to meet the new installations

The hot water shall be distributed through the dedicated risers using a two pipe circulation system, providing hot water to each toilet core. The circulating system shall be controlled by the use of thermostatic balancing valves.

The hot water system shall be pressure controlled with the use of pressure reducing valves, where applicable, to ensure excessive pressures are not experienced throughout the building, in particular to the lower floors.

The whole system shall comply with BS: 6700, HSC ACOPS L8, CIBSE TM13, and Water Regulations 1999 second edition. All fittings, appliances, valves and materials to be Water Research Council listed.

Insulation will be provided on all of the pipework installation to minimise the heat loss from the system

All pipelines will be identifiable in accordance with BS 1710.

9.8 Fire Systems

The entire existing hosereel installation in both Cores A and Core B is to be stripped out and removed.

The existing dry riser installation in both Cores A and Core B is to be made compliant with the current British Standards.

A dry riser outlet is to be installed on each floor level. All landing valves and the inlet breeching pieces are to be inspected for defects and tested. The dry riser sy