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37 Langrove Street, Everton, Liverpool, L5 3PE

Job No: VBS-0126 L5 3PE

Doc Ref: VBS-0126 L5 3PE 2.1 Electrical Performance Specification

Latest Revision: A

Date: 21/05/2026

Electrical Performance specification

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Revision Schedule

Document Control			
Revision	Description	Document Reference	Date of Issue
A	Issue 1	VBS-0126 L5 3PE 2.1 Electrical Performance Specification	21/05/2026

1.	INTRODUCTION	4
2.	PROJECT DESCRIPTION	7
3.	SCOPE OF WORKS	8
4.	DESIGN BASIS	11
5.	PROVISION OF INFORMATION	14
6.	ENABLING, STRIP OUT AND BUILDERS' WORKS	16
7.	MAINS AND SUB MAIN INSTALLATION	18
8.	INTERNAL LIGHTING INSTALLATION	21
9.	EMERGENCY LIGHTING INSTALLATION	23
10.	EXTERNAL LIGHTING INSTALLATION	25
11.	POWER SUPPLIES TO MECHANICAL PLANT	26
12.	FIRE ALARM INSTALLATION	26
13.	DATA INSTALLATION	29
14.	CONTAINMENT INSTALLATION	30
15.	EARTHING AND BONDING INSTALLATION	31
16.	TESTING AND COMMISSIONING	33
17.	OPERATING & MAINTENANCE MANUAL AND BUILDING USER GUIDE	34
18.	ACCESSORY MOUNTING HEIGHTS	35
	APPENDIX A – SCHEDULE OF MANUFACTURERS	36
	APPENDIX B – BENCHMARK STANDARDS	37
	APPENDIX C – LIST OF REGULATIONS AND STANDARDS	41
	APPENDIX D – DEFINITIONS	42
	APPENDIX E – SCHEDULE OF TENDER DRAWINGS	44
	APPENDIX F – ELECTRICAL ENGINEERING SERVICES SUMMARY OF TENDER	45

1. INTRODUCTION

1.1. General

- 1.1.1. This document details the works for the electrical Services installation for the undertaking of carrying out the plant room refurbishment, subsequent distribution pipework and electrical installation and modifications at Shrewsbury House Youth Centre 37 Langrove Street, Everton, Liverpool, L5 3PE on behalf of Jon France & Vicki Parker.
- 1.1.2. This specification establishes the Stage 3 design intent, minimum technical standards, performance criteria, system interfaces and contractor responsibilities associated with the electrical installation. The Electrical Services Contractor, hereafter referred to as the Contractor, shall undertake and complete the final detailed design necessary to deliver a fully coordinated, compliant and operational installation.
- 1.1.3. The Contractor, shall provide a fully coordinated, operational and compliant installation necessary to deliver a complete working system, including:
 - Electrical design calculations.
 - Containment sizing.
 - Builder's work coordination.
 - Labour.
 - Materials.
 - Containment.
 - controls interfaces.
 - Testing.
 - As-installed documentation.
 - Commissioning documentation.
- 1.1.4. The Contractor shall modify or divert existing services as necessary and install, design, co-ordinate, supply, test, commission, and set-to-work the new Mechanical and Electrical services installation including all enabling works as described in the main contract documentation, this document, and as are shown on the drawings.

This document shall be read in conjunction with the following:

- VBS Doc A Electrical Workmanship Specification.
 - VBS Doc B Mech & PH Workmanship Specification.
 - VBS-0126 L5 3PE BMS Specification
 - VBS-0126 L5 3PE 2.1 Mechanical Performance Specification
 - **Electrical services drawings**
 - L5 3PE-ZZ-SC-E-5001-Plant Room Electrical Strip Out
 - L5 3PE-ZZ-SC-E-5002-Plant Room Electrical Installation
 - **Mechanical services drawings**
 - P2-L5 3PE-ZZ-PL-M-001-LTHW Layout
 - P2-L5 3PE-ZZ-SC-M-002-LTHW Schematic
 - P2-L5 3PE-ZZ-SC-M-003-Strip out 1/2
 - P2-L5 3PE-ZZ-SC-M-004-Strip out 2/2
 - P2-L5 3PE-ZZ-PL-M-005-Domestic water services
 - All installation drawings and associated Information.
- 1.1.5. This Specification shall be read in conjunction with all other documentation produced by all relevant parties, inclusive of the contract conditions and preliminaries.
 - 1.1.6. The Electrical Contractor shall undertake full detailed design responsibility for the electrical services installation based upon the design intent contained within this specification and associated drawings.
 - 1.1.7. The Contractor shall verify all equipment selections, cable sizing, containment sizing, discrimination, fault levels, builders' work requirements and coordination with all other disciplines prior to manufacture or installation.
 - 1.1.8. The specification and the associated information used for the project do not relieve the Contractor of his responsibilities for the detailed design and provision of any part of the installation not specifically detailed, but as would be necessary to achieve a full and complete working installation or which will require specialist final design portions or co-ordination.

- 1.1.9. The Contractor shall employ and include within the contract price the services of the relevant specialists for the design and construction.
- 1.1.10. The Contractor shall produce fully coordinated installation drawings prior to commencement of works on site. Drawings shall be coordinated with architectural, structural, mechanical, public health, fire alarm, BMS and specialist contractor installations to ensure adequate access, segregation, maintenance clearances and installation compliance.
- 1.1.11. The Contractor shall cooperate with the Principal Designer and Principal Contractor in accordance with the Construction (Design and Management) Regulations 2015 and shall provide all information necessary for residual risk identification, construction coordination and Health & Safety File compilation.
- 1.1.12. Where commodities are specified to conform to British Standards shall be clearly indelibly marked with the reference specified. Where this is impractical the relevant advice and delivery notes shall include the BS reference with which they comply.
- 1.1.13. Where commodities are specified as manufactured by a BSI Kitemark Licensee or where commodities/services are specified to be by Registered Firms (under BSI Assessment Schemes) the manufacturer/firm must be a current participant in the relevant scheme.
- 1.1.14. The installation shall be complete in every respect and shall include all labour, materials, supports, fixings, containment, interfaces, controls wiring, identification, testing, commissioning and ancillary items necessary to provide a fully operational installation whether specifically detailed within this specification or not.
- 1.1.15. All installations shall be designed and coordinated to permit safe access for inspection, testing, maintenance, isolation, replacement and removal of equipment, including adequate maintenance and replacement zones, without requiring removal of unrelated services.
- 1.1.16. This performance specification, and the associated drawings detail the principal requirements of the installation but do not relieve the Contractor of his responsibilities for the detailed design and provision of any part of the installation not specifically detailed, but as would be necessary to achieve a full and working installation, or which will require specialist final design portions or co-ordination.
- 1.1.17. The documents comprising this Specification and associated drawings have been prepared on the basis of the Architects design drawings. These indicate the scope of work and materials required, together with methods and standards for the installation, etc.
- 1.1.18. Any items which are required to ensure the installation complies with Statutory Authority requirements and delivers fully functional systems shall be included in the contractors' design and proposals.
- 1.1.19. Where trade names, manufacturers or proprietary products are referenced within this Specification, such references are intended to establish the minimum required standard of quality, performance, durability, functionality, compatibility and maintainability. Equivalent products may be proposed by the Contractor, provided that full technical submissions are provided to the Contract Administrator and Building Services Consultant for review. Such submissions shall include, as a minimum, manufacturers' data sheets, performance data, dimensional information, electrical characteristics, compliance certification and confirmation of compatibility and interoperability with associated systems and existing installations. No alternative product shall be ordered, installed or commissioned without prior written approval from the Client.
- 1.1.20. If any discrepancies or anomalies are discovered between any of the specification documents or between the specification documentation and any room data sheets or drawings, the Contractor shall immediately seek guidance from the Consultant.
- 1.1.21. The specification does not absolve the Contractor from his/her responsibility to visit the site and make reference to all governing factors which may affect the content and programme of works, and method of construction. No claim for additional costs or extension of time will be entertained resulting from lack, or misinterpretation, of information.
- 1.1.22. The sequence of the works shall be agreed with the Main Contractor and may necessitate the installation being carried out in multiple areas simultaneously. Any major shutdown of the site supply shall be agreed with the Client, the Main Contractor and Contract Administrator.
- 1.1.23. It is the responsibility of the Contractor to ensure that the electrical installation is designed and installed in an efficient manner and that energy efficiency and conservation are a priority. The Contractor is expected to be proactive with regards the electrical installation and is invited to offer proposals for alternatives which will result in a cost saving for the Client whilst maintaining the level of performance and quality detailed in this specification. These proposals must be presented for explicit and written approval prior to adoption/incorporation into the scheme. Failure to obtain approval may result in the Contractor having to rectify works at his own cost.

- 1.1.24. The electrical installation shall comply in all ways with the edition current at the time of construction, of all relevant Codes of Practice, Regulations, Local Authority Requirements, Byelaws, Utility Company requirements, British Standards, European Norm documents and Building Regulations.
- 1.1.25. All fixed wiring cables installed as part of the Works shall comply with the Construction Products Regulation (CPR) and shall be UKCA and/or CE marked as applicable. Cables shall be selected and installed in accordance with the required reaction-to-fire classification appropriate to the building use, occupancy risk and installation environment.
Unless noted otherwise, all fixed wiring cables shall achieve a minimum reaction-to-fire classification of Cca-s1b,d1,a1 in accordance with BS EN 13501-6 and BS EN 50575. Higher classifications may be required in designated escape routes or higher-risk areas subject to fire strategy requirements.
- 1.1.26. Enhanced fire-resistant cabling for life safety systems including fire alarm systems, emergency lighting systems, gas safety systems and critical shutdown interfaces shall comply with the relevant British Standards applicable to the system served.
- 1.1.27. The final cable classification shall be determined by the Contractor and confirmed with the Architect and Clients Team during detailed design, based upon building occupancy, fire strategy, means of escape and installation environment. Ratings shall generally be as follows:

Euroclass Level	Description	Example Environment
B _{2ca}	Very high fire protection, self-extinguishing	Above fire exits and in designated escape routes.
C _{ca}	High fire protection, self-extinguishing	General areas within commercial buildings, leisure facilities, administration and office buildings.

- 1.1.28. Cables shall be manufactured under an approved third-party certification scheme such as BASEC or equivalent approved.
- 1.1.29. Fire resistant cabling serving life safety systems shall comply with the relevant British Standard applicable to the system served, including BS 5839-1, BS 5266 and BS 8519 where applicable, including, but not limited to:
- Fire alarm systems.
 - Emergency lighting systems.
 - Gas safety interlocks.
- 1.1.30. Life safety system cabling shall be segregated from general wiring systems in accordance with the relevant British Standards applicable to the system served.
- 1.1.31. The contractor shall include for providing a copy of the cable manufacturers Declaration of Performance (DOP) certificate on completion of the cable installation to ensure compliance, this shall be included in both paper and electronic format.
- 1.1.32. The contractor shall design and install containment systems which are suitable for their intended purpose and location.
- 1.1.33. Cables shall be supported using fire resistant clips, cleats or fixings such that wiring systems will not collapse prematurely in the event of fire.
- 1.1.34. The Contractor shall take account of the final room layouts and uses within his design.
- 1.1.35. Circuit references shall be identified on all accessories with clear plastic labels on brushed finish accessories and white self-adhesive labels with black text on all other accessories.
- 1.1.36. All fused connection units and isolators shall be provided with a permanently fixed engraved label to indicate the equipment or circuit controlled. Text will be engraved and coloured red or black and text characters will be of a height of 3.0mm minimum. The Contractor must agree the legends with the CA prior to engraving.
- 1.1.37. The Contractor at no additional cost, to the CA's requirements, will replace any accessory engraved without the prior approval of the CA.
- 1.1.38. All fuses installed in fused connection units are to be rated suitably for the load of the equipment or circuit served. The Contractor will be responsible for liaison with other Contractors to ensure that the correct type of supply for their equipment is provided.

2. PROJECT DESCRIPTION

2.1. General

- 2.1.1. Shrewsbury House Youth Centre is a building constructed in the 1970s, comprising a youth centre, church, hostel house and vicarage. The house and vicarage have been separated and are no longer connected to the building services installation.
- The youth centre comprises a sports hall, cellular office spaces to the north and east elevations, together with larger open-plan areas and a small kitchen, arranged over two floors. The church area consists of a large meeting space and double-height congregational area, with a glazed corridor connecting to the central courtyard. The hostel comprises multiple single-occupancy bedrooms over two floors, with a central common area and catering facilities.
- 2.1.2. The project comprises replacement of the existing heating boilers and associated modifications to plant room pipework, controls and electrical installations.
- 2.1.3. Prior to commencement of the Works, the Contractor shall inspect, test and verify the existing electrical supply arrangements to confirm suitability for the new plant room distribution board.
- 2.1.4. The Contractor shall strip out and remove all redundant LV electrical services and distribution equipment within the plant room. Where existing services cannot be removed due to utilised installation methods (e.g. embedded direct in masonry / direct in ground), they shall be suitably isolated, labelled and made safe at the point of entry to the plant room.
- 2.1.5. The Contractor shall install a suitable containment system within the boiler room to facilitate installation of all mechanical & BMS services field wiring.
- 2.1.6. The Contractor shall design, supply, install, test and commission a new plant room distribution board supplying all LV circuits associated with the plant room installations.
- 2.1.7. The Contractor shall undertake a full assessment of all existing electrical cabling serving the LTHW plant and associated equipment, confirming suitability, capacity, and compliance with current regulations. Any cabling identified as inadequate, undersized, damaged, or non-compliant shall be replaced in full.
- 2.1.8. Working in coordination with the BMS contractor, The Contractor shall design, supply, install, test, and commission all electrical supplies to the BMS control system and final equipment (including pump sets and associated plant). This shall include all controls cabling, containment, and integration of safety interlocks, including but not limited to emergency stop circuits, thermal protection devices, and any relevant fail-safe mechanisms. The Contractor shall, in coordination with the BMS Contractor and Fire Alarm Contractor, design, install, test and commission all field power supplies, control cabling and associated containment from the BMS control panel to final equipment locations, including but not limited to:
- 1 No. New BMS system installation.
 - 1 No. New gas safety system, including control panel, gas detection, shut-off valves and all required interfaces.
 - 1 No. Fire alarm shutdown interface.
 - 2 No. Existing Rinnai gas fired water heaters to be integrated into the new system (external courtyard & rooftop)
 - 2 No. Vaillant ecoTEC plus boilers (boiler room).
 - 2 No. Constant temperature (CT) heating pumps (boiler room).
 - 2 No. Variable temperature (VT) heating pumps (boiler room).
 - 4 No. Motorised 2-port zone control valves (boiler room – CT heating circuits).
 - 2 No. automatic pressurisation units (APUs) including ancillary equipment (boiler room).
 - 1 No. Plate heat exchanger (PHE) and associated equipment (boiler room).
 - 4 No. Internal space temperature sensors complete with control wiring and BMS integration (sports hall, offices, church and hostel).
 - 3 No. MID-approved Class 2 heat meters (MI-004 compliant) serving the church and hostel heating systems.
 - 1 No. MID-approved electricity meter (MI-003), Class B accuracy, installed at the landlord distribution board incoming supply for energy monitoring and/or billing purposes.
- 2.1.9. The Contractor shall work with the BMS Contractor to design, supply, install, test and commission a BMS control system in its entirety, to control all LTHW plant and associated equipment. The system shall include

provision for remote monitoring via the client's local network and shall interface with the fire alarm system, gas safety system and water heaters.

- 2.1.10. The Contractor's design shall include provision for MID-compliant metering. Heat meters shall be Class 2 accuracy (MI-004), and electricity meters shall be Class B accuracy (MI-003). All meters shall be provided as complete approved assemblies and installed in accordance with manufacturer requirements.

3. SCOPE OF WORKS

3.1. General

- 3.1.1. The Electrical Contractor, working in coordination with the Mechanical Contractor, BMS Contractor and Fire Alarm Contractor, shall be responsible for the entire design, detailing, supply, installation, testing, commissioning and handover of the final electrical installation to the standards and regulations specified, together with all planning and management necessary to ensure the logical, efficient and satisfactory execution of the works.
- 3.1.2. The Contractor shall be responsible for the submission of all drawings and calculations to the engineer for approval prior to the installation of any services.
- 3.1.3. Unless with prior written agreement of the project manager, the Contractor shall ensure that works do not interfere with, or interrupt services to, the other occupants, areas or services within the building without prior permission.
- 3.1.4. The Contractor shall be responsible for all alterations, disconnections, making safe, stripping out and proper disposal of existing electrical services as required to accommodate the new electrical installation.
- 3.1.5. The Electrical Contractor shall ensure the existing electrical installation being replaced is stripped out in its entirety as the project progresses.
- 3.1.6. The Contractor shall be responsible for submitting all relevant information to the statutory authorities and obtaining their approval. Copies of all approvals shall be submitted to the project manager and Building Services Consulting Engineer.
- 3.1.7. The installation shall be conducted in a neat and workmanlike manner by suitably skilled operatives experienced in commercial building services installations.
- 3.1.8. The project shall include the installation of, but not limited to, the following new services, the detail of which is provided within the later respective sections:

- Undertake enabling works (including provision of temporary supplies and disconnecting and removing of all existing equipment no longer required).
- Strip out and removal of redundant plant room electrical services.
- New plant room electrical distribution arrangement.
- Provision of new general & emergency lighting installation.
- Provision of new external lighting.
- Provision of new general small power installation.
- Provision of new supplies for Mechanical Services (E for M).
- New BMS power supplies, control wiring and controls interfaces.
- Fire alarm alterations and gas interlock interfaces.
- Provision of new data installation.
- Provision of new containment systems as required.
- Provision of earthing and bonding.
- Testing, commissioning and certification of all installations.
- Demonstration and user training to the end user/client of the installed services.
- Provision of working and co-ordination drawings.
- Provision of as installed drawings.
- Provision of operating & maintenance manuals.
- Provision of recommended statutory servicing schedule for all installations.
- Provision of 12-month defects liability period.

- 3.1.9. The above summary is intended for the general guidance of the Contractor, no omission from this description shall relieve the Contractor of his obligation to carry out the whole of the works required and as hereinafter described.

- 3.1.10. The Contractor shall include for all equipment deliveries and storage (off and on site), access equipment, specialist equipment, staff welfare, test equipment and tools as necessary to undertake the works described.
- 3.1.11. Where project equipment has been procured directly or indirectly on behalf of the Client and is delivered to site, the Contractor shall label all items clearly identify the equipment as Client property and shall include wording such as: "Property of Shrewsbury House Youth Centre – Not for Removal"
- 3.1.12. The Contractor shall fully liaise and coordinate the electrical installation with:
 - Mechanical services installations.
 - Public health services.
 - BMS installations.
 - Fire alarm systems.
 - Architectural requirements.
 - Structural requirements.
 - Existing retained services.
 - All other specialist contractor installations.
- 3.1.13. The Contractor shall ensure all installations are coordinated and installed to permit safe operation, inspection, testing, maintenance and replacement without requiring removal of adjacent services.
- 3.1.14. As part of the works, the Contractor shall assist the Client and Principal Contractor in obtaining Building Regulations approval, which shall include compliance with Part L.
- 3.1.15. The Contractor shall ensure that the Electrical Services installations shall fully comply with the current agreed versions of all regulations in force at the time of tender, including but not be limited to the recommended standards within the appendix.
- 3.1.16. The Contractor shall ensure that the works shall comply in all respects with the current editions (including all amendments) of all relevant legislation, statutory instruments, Approved Codes of Practice, British Standards, European and International standards adopted as British Standards, and the requirements of all statutory authorities and enforcing bodies applicable at the time of design and installation. This shall include, but not be limited to, the following:

3.1.16.1. General Legislation

- Health and Safety at Work etc. Act 1974
- Construction (Design and Management) Regulations 2015
- Workplace (Health, Safety and Welfare) Regulations 1992
- Management of Health and Safety at Work Regulations 1999
- Control of Substances Hazardous to Health Regulations 2002 (as amended)
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR)

3.1.16.2. Electrical

- Electricity at Work Regulations 1989 (as amended)
- BS 7671 (IET Wiring Regulations), current edition including all amendments
- IET Guidance Notes as applicable
- BS EN 61439 (LV switchgear and control gear assemblies) where applicable

3.1.16.3. Building Regulations

Building Regulations 2010 (as amended) and all relevant Approved Documents, including but not limited to:

- Part B – Fire Safety
- Part F – Ventilation
- Part G – Sanitation, hot water safety and water efficiency
- Part L – Conservation of fuel and power
- Part M – Access to and use of buildings
- All works shall be to the satisfaction of the Building Control Body.

3.1.16.4. Mechanical, Gas and Water Installations

- Gas Safety (Installation and Use) Regulations 1998 (as amended)
- Water Supply (Water Fittings) Regulations 1999
- Pressure Systems Safety Regulations 2000 (where applicable)
- Clean Air Act 1993

3.1.16.5. Construction Products and Fire Performance

- Construction Products Regulations 2013 (as amended), including UKCA and/or CE marking requirements as applicable
- Reaction to fire classification in accordance with BS EN 13501 series
- Cables to achieve minimum Euroclass Cca.

3.1.16.6. Environmental and Pollution Control

- Environmental Protection Act 1990
- Control of Pollution Act 1974 (as amended)
- Control of Noise at Work Regulations 2005 (where applicable)

3.1.16.7. Standards

- All relevant current British Standards (BS), BS EN and BS EN ISO standards.
- Relevant IEC standards where no equivalent British Standard exists.
- CIBSE Guides and Technical Memoranda where applicable

3.1.16.8. Authorities and Insurers

- The Building Control Body
- The Fire and Rescue Authority
- Statutory Undertakers
- The Employer's insurers
- Any other relevant enforcing authority

3.1.17. The Contractor shall notify all authorities in accordance with their regulations and obtain any required approvals for the Installation.

3.1.18. Refer to Appendix B for a full list of standards and regulations.

3.1.19. Where no specific design, performance or installation standards are quoted the following shall apply to ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.

- All documentation, regulations, guides, technical memoranda etc. produced by the Chartered Institution of Building Services Engineers.
- Construction (Design and Management) Regulations 2015
- BS EN 50110 Operation of electrical installations. General requirements
- Provision and Use of Work Equipment Regulations
- Personal Protective Equipment at Work Regulations
- The Construction (General Provisions) Regulations
- The Construction (Lifting Operations) Regulations
- Other relevant Safety Regulations
- Public Utility Company and/or Statutory Authority regulations, specifications, and requirements
- British Standards and Codes of Practice
- Local Authority Regulations and approvals.
- BSRIA Commissioning Codes
- Manufacturer's stipulations and recommendations for installation, testing, commissioning and maintenance.
- Equality Act.
- Clean Air Act
- IET Wiring Regulations.
- Building & Engineering Services Associations Specifications
- All relevant IGEN – UP Guidance Documents and Associated Appendices

3.1.20. Where published documents are included in the above list the Contractor shall ensure that the installation of the works complies with the current edition of said document

- 3.1.21. The Contractor shall notify all authorities in accordance with their regulations and obtain any required approvals for the Installation.
- 3.1.22. Where no specific design, performance or installation standards are quoted the regulations and standards tabulated in the Appendix shall apply to ensure full installation and system compliance and that operational compatibility exists between the systems and any other system installed at the same location.
- 3.1.23. The client's representative (CA/PM) will give written notice of requirements for this instruction to commence. Training shall only be given once Practical Completion has been achieved but before the full occupation of the building takes place.
- 3.1.24. The contractor shall provide training for a minimum of 2 persons on each system and he is to obtain signatures from those that receive the training to confirm that it has been completed to their satisfaction. A copy of the training form is to be included in the building logbook and a copy be provided to the engineer and CA or PM
- 3.1.25. Provision of fully comprehensive Operation & Maintenance manuals complete with As-Installed drawings to cover all the installed, modified and existing Electrical Services systems.

4. DESIGN BASIS

4.1. General

- 4.1.1. This section defines the design intent parameters, engineering assumptions, and performance criteria upon which the electrical services design has been developed at Stage 3.
- 4.1.2. The Electrical Contractor shall adopt this Design Basis when undertaking the detailed design and shall notify the Contract Administrator of any deviations or incompatibilities prior to progressing the detailed design.

4.2. Electrical Load Assessment

- 4.2.1. The electrical installation has been developed based on the following preliminary load assessment for the plant room refurbishment works:

System	Estimated Connected Load (kW)
Mechanical Plant (boilers, pumps, PHE, APUs etc.)	7.5 – 8.5
BMS & Controls Systems (including gas safety system, metering and interfaces)	1.0 – 1.5
Lighting (internal and external)	0.5
Small Power & Ancillary Systems	1.0 – 1.5
Total Connected Load	10.0 – 12.0 kW

- 4.2.2. The anticipated maximum demand, after application of diversity, is estimated to be:
8.5 – 9.5 kW (approximately 9.0 – 10.0 kVA)
- 4.2.3. Allowing for future capacity and system expansion, the electrical installation shall be designed for a minimum diversified load of:
 - 11.0 – 12.0 kW (approximately 11.5 – 12.5 kVA)
 This equates to a design current in the order of:
 - 16 – 20 A per phase (400V, 3-phase system)
- 4.2.4. The plant room distribution system, including sub-main cabling and distribution board, shall therefore be sized on the basis of a minimum:
 - 32A three-phase supply
- 4.2.5. These values are to be verified and refined by the Contractor during detailed design.

4.3. Diversity Assumptions

4.3.1. The following diversity factors have been assumed in establishing the design intent:

Load Type	Diversity Factor
Lighting	0.9 – 1.0
Small Power	0.4 – 0.6
Mechanical Plant	1.0 (unless duty/standby arrangement confirmed)
BMS / Controls	1

4.3.2. The Contractor shall review and refine diversity in accordance with:

- BS 7671
- IET Guidance Notes
- Actual plant duty/standby arrangements

4.4. Supply Characteristics and Earthing Arrangement

4.4.1. The electrical installation shall be derived from the existing landlord low voltage intake.

4.4.2. For the purposes of Stage 3 design, the following assumptions have been adopted:

- Nominal supply: 400/230V, 3 phase, 50Hz
- Earthing arrangement: TN-C-S (PME) – to be confirmed
- Maximum demand capacity at origin: to be verified during detailed design

4.4.3. The Contractor shall confirm:

- Earthing system type
- Available capacity
- Suitability of the existing intake

4.4.4. Any requirement for supply upgrade shall be notified immediately.

4.5. Fault Level Design Assumptions

4.5.1. The system has been conceptually designed based on the following fault level assumptions:

- Prospective fault level at intake (DB1): 16 kA – 25 kA
- Prospective fault level at plant room distribution board: 10 kA – 16 kA

4.5.2. Final fault level calculations, including cable impedance effects, shall be undertaken by the Contractor to confirm:

- Protective device ratings
- Distribution board fault withstand capacity
- Discrimination performance

4.6. Voltage Drop Criteria

4.6.1. Voltage drop across the installation shall comply with BS 7671:

- Lighting circuits: maximum 3%
- Other circuits: maximum 5%

4.6.2. The design intent allocation is as follows:

- Sub-main distribution: maximum 2%
- Final circuits:
 - Lighting: 1%
 - Power: 3%

4.6.3. The Contractor shall verify compliance across the fully coordinated installation.

4.7. Protection Philosophy

- 4.7.1. The electrical protection system shall be designed in accordance with the following principles:
- Full compliance with BS 7671
 - Coordination and discrimination between all protective devices
 - Minimisation of nuisance tripping
 - Protection of life safety systems
- 4.7.2. The following approach shall be adopted:
- Final circuits to be protected by RCBOs unless otherwise justified
 - Discrimination to be achieved between upstream and downstream devices
 - Selective or time-delayed devices to be utilised where required
 - AFDD provision to be risk assessed in accordance with BS 7671 and building risk profile
- 4.7.3. The Contractor shall provide a full discrimination study as part of the detailed design submission.

4.8. Environmental and Installation Conditions

- 4.8.1. The following design conditions shall be assumed unless confirmed otherwise:
- Plant room ambient temperature: 30–35°C
 - Cable grouping factor: to be assessed based on final routing (assume 0.8 minimum)
 - Installation method: containment-based (tray, trunking, conduit)
- 4.8.2. All cables and equipment shall be selected and rated accordingly.

4.9. Lighting Design Parameters

- 4.9.1. Lighting design shall be based on the following assumptions:
- Maintained illuminance levels as defined within this specification
 - Reflectance values:
 - Ceiling: 0.7
 - Walls: 0.6
 - Floor: 0.3
 - Maintenance factor: 0.8 (unless otherwise justified)
- 4.9.2. The Contractor shall verify all assumptions against final architectural finishes and submit full lighting calculations.

4.10. Metering Strategy

- 4.10.1. The installation shall incorporate energy metering in accordance with the following:
- Main incoming supply: MID-approved electricity meter (Class B)
 - Heat metering: MID-approved (Class 2) for heating systems
 - Sub-metering to be provided for major plant loads where indicated
- 4.10.2. All meters shall be:
- Connected to the BMS system
 - Capable of remote monitoring and data export

4.11. Future Capacity and Allowances

- 4.11.1. The installation shall allow for future expansion in accordance with the following principles:
- Distribution boards: **minimum 25% spare ways**
 - Containment systems: **minimum 25% spare capacity**
 - Allowance for future additional plant loads and system modifications
- 4.11.2. The Contractor shall size all systems accordingly.

4.12. Design Responsibility

- 4.12.1. The above Design Basis establishes the minimum requirements for the electrical installation at Stage 3.
- 4.12.2. The Electrical Contractor shall:
 - Validate all assumptions
 - Undertake full detailed design
 - Provide all necessary calculations to demonstrate compliance
- 4.12.3. Any deviation from the Design Basis shall be submitted to the Contract Administrator for approval prior to implementation.

5. PROVISION OF INFORMATION

5.1. Contractor Design Responsibility

- 5.1.1. The Electrical Contractor shall undertake full detailed design responsibility for the electrical services installation based upon the design intent contained within this specification and associated drawings.
- 5.1.2. The Contractor shall verify all equipment selections, cable sizing, containment sizing, discrimination, fault levels, builders' work requirements and coordination with all other disciplines prior to manufacture or installation.
- 5.1.3. The Contractor shall produce fully coordinated installation drawings prior to commencement of works on site. Drawings shall be coordinated with architectural, structural, mechanical, public health, fire alarm, BMS and specialist contractor installations to ensure adequate access, segregation, maintenance clearances and installation compliance.

In summary, the Contractor shall be responsible for:

- Electrical design calculations.
 - Schedule of connected and diversified loads.
 - Cable sizing calculations.
 - Voltage drop calculations.
 - Fault level verification.
 - Earth fault loop impedance calculations.
 - Protective conductor sizing calculations.
 - Earthing and bonding design.
 - Protective device coordination and discrimination studies.
 - Containment sizing and coordination.
 - Lighting calculations.
 - Emergency lighting calculations.
 - Builder's work requirements.
 - Equipment selections.
 - Coordination with all other trades and disciplines.
 - Production of coordinated installation drawings.
 - Production of commissioning documentation.
 - Production of as-installed documentation.
- 5.1.4. The design drawings shall be fully coordinated with the Mechanical drawings and consider the requirements of mechanical and BMS specifications. They shall fully detail the design intention of the drawing.
 - 5.1.5. The design drawings shall substantiate in all respects the design calculations carried out by the Electrical Contractor. Any drawings provided within this services performance package show indicative services requirements; it is the responsibility of the contractor to provide full calculations to demonstrate that all aspects of the installation comply with the requirements of this specification.
 - 5.1.6. The Contractor shall verify that sufficient access, maintenance, valve operation, equipment withdrawal and safe working clearances are maintained throughout the installation.
 - 5.1.7. All calculations are to be undertaken using industry recognised calculation software packages.
 - 5.1.8. Cable voltage drop design is to be in accordance with Table 12A (Appendix 4) of BS 7671 for installations supplied by a public low voltage system as follows;

5.1.8.1.	Lighting circuits	3%
5.1.8.2.	Other uses	5%

- 5.1.9. The contractor shall be responsible for ensuring that all protective devices in the system are correctly selected and is to produce a discrimination study to ensure full discrimination and coordination between all new distribution equipment and protective devices.
- 5.1.10. The Contractor shall assess the requirement for Arc Fault Detection Devices (AFDDs) in accordance with BS 7671, building occupancy risk profile and fire strategy requirements.
- 5.1.11. Calculation of lux levels to all areas of the building shall take into account the use of light absorbent finishes in areas. Reflectance's to be assumed 0.7 ceiling, 0.6 walls and 0.3 floors. These are to be confirmed with the Contract Administrator prior to completion of final design.
- 5.1.12. The contractor shall provide an efficacy calculation demonstrating that the lighting design to the building is in compliance with the requirements of Part L of the building regulations.
- 5.1.13. Copies of design calculations and drawings shall be submitted to the Building Services Consultant Supervising Engineers by the Electrical Contractor prior to ordering of materials and commencement of installation or related structure. Notwithstanding this, the Electrical Contractor shall be responsible for any error, discrepancy or omission in any calculation or design drawing prepared on their behalf, whether or not such calculation or design has been passed 'No Comment' by the supervising engineers.
- 5.1.14. Calculations shall comprise but not be limited to the following:
- Schedule of loads including diversity values (generally as BS 7671 and associated guidance notes).
 - Distribution supply capacity.
 - Detailed calculations to establish the sizes for all cables and equipment
 - Protective device discrimination graphs and calculations (maximum limiting earth loop impedance calculations shall not exceed whichever are the lower values stated in either BS 7671 or those in HTM 06-02 adjusted for 230V nominal voltage).
 - Protective and equipotential bonding conductor sizing calculations
 - Lighting design calculations, including provision of isolux drawings, photometric data and glare calculations
 - Emergency lighting calculations
 - Acoustic calculations to verify fire alarm sounder type and locations
- 5.1.15. Design drawings shall comprise, but not be limited to the following:
- External electrical services layout, including external lighting.
 - Coordinated reflected ceiling plans showing lighting and lighting controls
 - Coordinated small power layouts
 - Coordinated plans showing plant area and plant room layouts
 - LV distribution routes & schematic
 - Coordinated containment layouts for all electrical services
- 5.1.16. The Electrical Contractor shall comply with the manufacturer and equipment selection procedure detailed herein for all electrical systems and associated components. This shall apply to all major plant, equipment and ancillary electrical accessories, including but not limited to switches, socket outlets, control devices and wiring accessories.
- 5.1.16.1. Issue of a technical submission to the Building Services Consultant Supervising Engineers that shall fully describe the particular item of plant and equipment. This shall include written confirmation that the item is fully specification compliant together with clarifying any particular options that are proposed to be incorporated as part of the item of plant and equipment. The technical submission shall therefore also need to incorporate the full manufacturers' literature, selection details and relevant wiring diagrams.

- 5.1.16.2. The Contractors calculations and installation drawings will be reviewed by the engineer and returned with a review code as described below. Upon receipt of such calculations or drawings bearing the review code and signature, the Contractor shall immediately take such action as demanded by the code. The review codes as referred to herein shall be defined as:
Status A Information Submitted is of acceptable standard, work may proceed in accordance with the Contract and Specifications, no further review necessary.
Status B Information Submitted is of standard acceptable in principle, work may proceed in accordance with the Contract and Specifications provided that comments incorporated. Incorporate comments and resubmit for further review.
Status C Information Submitted not of acceptable standard, work may not proceed. Incorporate comments on calculation or drawing and resubmit.

- 5.1.17. The Building Services Consultant Supervising Engineers will comment upon the technical submission within 10-working days of receipt, if it is deemed that there is insufficient information submitted then the technical submission will be returned to the Electrical Contractor for re- submission with appropriate level of detail. The 10-working day period will then recommence when the technical submittal is re-submitted.
- 5.1.18. The building services installations shall be designed and installed to achieve a design life in accordance with the CIBSE Guide to Ownership and Maintenance of Building Services and CIBSE Guide M. The building services shall all have a minimum 20-year design life.
- 5.1.19. The Electrical Contractor shall have full design responsibility for all and every aspect of the electrical services installation.
- 5.1.20. The Electrical Contractor shall be responsible for the correct setting out of the works and shall provide fully detailed and coordinated working drawings. The working drawings shall be based on the design drawings and shall take into account other disciplines, trades and services, site constraints and all modifications which may have taken or take place during the construction process.
- 5.1.21.** Working drawings shall be fully dimensioned ready for installation, indicating the

6. ENABLING, STRIP OUT AND BUILDERS' WORKS

6.1. General

- 6.1.1. The Contractor shall allow for all necessary enabling and isolation works required to make the existing site ready for the commencement of construction works.
- 6.1.2. This work is to include for the safe phased stripping out of any existing services (power, small power, lighting, containment and specialist systems etc.) within the areas of work.
- 6.1.3. The Contractor shall allow for all necessary builders works required for the scheme as detailed below.
- 6.1.4. The Contractor shall be responsible for the provision of, or re-instatement of, all fire stopping to services penetrations.

6.2. Making Good

- 6.2.1. The Contractor shall, in consultation with the main contractor, ensure that all necessary work to make good any areas where fabric is affected by the removal of services is fully covered in the main contractor's works.

6.3. Existing Services Survey

- 6.3.1. Prior to commencement of works, the Contractor shall undertake detailed pre-construction survey / inspection and assessment of:
- 6.3.2. Historic inspection and testing certification.
- 6.3.3. Existing plant room distribution.
- 6.3.4. Existing containment systems.
- 6.3.5. Existing earthing and bonding.
- 6.3.6. Existing cable routes.
- 6.3.7. Existing fire alarm interfaces.

6.3.8. Existing supplies serving retained plant.

6.3.9. The contractor shall also be required to undertake the following:

6.3.10. Validation of retained sub-main cabling.

6.3.11. Validation of retained fire alarm interfaces.

6.3.12. Identification of any services requiring temporary supplies.

6.3.13. Existing upstream surge protection arrangements shall be verified during detailed design.

6.3.14. Verification of asbestos registers in addition to targeted asbestos survey results prior to work commencing.

6.3.15. The Contractor shall verify all existing site conditions prior to commencement of installation works and shall immediately notify the Contract Administrator of any discrepancies between the specification, drawings and site conditions.

6.3.16. No claim arising from failure to inspect or verify existing conditions shall be accepted.

6.4. Temporary Works and Shutdowns

6.4.1. The Contractor shall coordinate all shutdowns with the Client, Contract Administrator and all affected parties prior to commencement.

6.4.2. The Contractor shall allow for all temporary electrical supplies, temporary containment, temporary lighting, temporary controls arrangements and temporary interfaces required to maintain safe operation of the building during the works.

Particular attention shall be given to maintaining operation of:

- Fire alarm systems: The fire alarm system must remain operational throughout works.
- Emergency lighting systems.
- Existing retained plant.
- Existing BMS systems, where operational.
- Security and life safety systems.

6.5. Asbestos

6.5.1. The Contractor shall verify results of the Asbestos Register for the existing property (if one has been produced or retained as part of the original building construction records) in addition to targeted asbestos survey results for any recorded instances of Asbestos or ACM's.

6.5.2. Should the Contractor suspect the presence of asbestos, ACM's or any other hazardous materials in the vicinity of his workforce, he must immediately cease work and clear that area of labour and inform the Main Contractor, Contract Administrator and the Client.

6.5.3. Under no circumstances whatsoever must the Contractor attempt to remove or take samples of the suspected material or materials.

6.5.4. In the event the presence of asbestos, ACM's or other hazardous material is confirmed or otherwise by a specialist services laboratory, the Contract Administrator will instruct the Contractor of the necessary actions to be taken.

6.6. General Builders Work

6.6.1. The Contractor shall ensure that detailing and coordination of all builders' work associated with the Electrical services installation, including all holes, sleeves, trenches, etc. is provided. Such builders work shall be carried out by the Main Contractor, or as directed for the particular development.

6.6.2. Builders work details shall be indicated upon a dedicated drawing and shall be fully dimensioned and positioned to allow accurate fabrication and formation of the necessary openings by the Main Contractor. Care shall be taken to coordinate all Mechanical, Electrical and Public Health builders work requirements to avoid clashes and optimise the extent of openings and works required.

6.6.3. The Contractor shall be responsible for providing all builders work holes for the electrical services installation that are below 100mm in diameter or 100mm x 100mm in size.

6.6.4. The builders work by the Main Contractor shall not include primary or secondary supports for pipework, ductwork, cable trays, cables, etc. These shall be supplied and installed by the Contractor.

- 6.6.5. It is the Contractor's responsibility to undertake/provide or request all builders work required to complete the Contract.
- 6.6.6. Where necessary, the Contractor shall liaise with the Main Contractor and structural engineer to ensure that builders work holes will not adversely affect the structure.

6.7. Fire Stopping

- 6.7.1. The Contractor shall ensure that fire stopping is installed around every services penetration and to all ducts and risers where they pass through any type of fire rated construction.
- 6.7.2. Provide and install firestop products that limit the spread of fire, heat, smoke, and gasses through otherwise unprotected openings in fire rated assemblies, including walls, partitions, floors, roof/ceilings, and similar locations, restoring the integrity of the fire rated construction to its original fire rating.
- 6.7.3. All through-penetration firestop systems shall be installed with approved methods using materials that have been tested and classified to produce an approved assembly.
- 6.7.4. Products shall be manufactured in a facility that follows ISO 9001 best practices.
- 6.7.5. Products shall have undergone a formal life cycle assessment evaluating environmental impact.
- 6.7.6. Any recessed accessories installed within fire rated construction are to have intumescent fire barriers installed to limit the spread of fire through the structure via the accessory and box.

7. MAINS AND SUB MAIN INSTALLATION

7.1. System Objective

- 7.1.1. The Electrical Contractor shall design, install, test and commission a new mains distribution system to serve the plant room as detailed on the design intent drawings and schematics.
- 7.1.2. The Contractor shall ensure that a high-quality installation is provided and that all items are supplied and installed so that the system is complete in its entirety.

7.2. System Description

- 7.2.1. Within the scope of this project, the Contractor shall install a new plant room distribution board to serve all new and modified plant room electrical services.
- 7.2.2. The installation shall be designed such that safe isolation, maintenance and replacement of plant can be undertaken without disruption to adjacent systems.
- 7.2.3. Prior to commencement, the Contractor shall verify the available capacity, diversity assumptions and prospective fault level of the upstream distribution system against the proposed boiler room arrangement. Where the existing upstream capacity is insufficient, the Contractor shall design, size and install a new 5-core XLPE/SWA/LSZH sub-main cable in accordance with BS 7671 from DB1 located adjacent to the origin / DNO cut-out to the plant room.
- 7.2.4. The Contractor shall also provide a suitably sized containment system, including necessary fixings and supports, allowing for a minimum of 25% spare capacity for future expansion unless otherwise agreed.
- 7.2.5. The sub-main shall terminate at a new wall-mounted main distribution board located within the plant room as indicated on the drawings.
- 7.2.6. The distribution board shall comprise a minimum 6-way TP&N arrangement, such as the Schneider Electric Acti9 Isobar PB or equal approved manufacturer, including 25% spare ways.
- 7.2.7. Outgoing circuits requiring metering shall be provided with energy sub-metering as indicated on the drawings and schedules.
- 7.2.8. Local distribution boards shall serve final circuits as required and as shown on the drawings and within the distribution board schedules.
- 7.2.9. Final circuits shall incorporate RCBO protection unless equipment characteristics dictate otherwise.
- 7.2.10. The Contractor shall undertake and document a risk assessment of the requirement for Arc Fault Detection Devices (AFDDs) in accordance with BS 7671 Section 421, the building fire strategy, occupancy risk profile and sleeping risk areas.
- 7.2.11. Where AFDD protection is not incorporated, the Contractor shall provide written justification within the detailed design submission.

7.3. Supply & Intake Arrangement

- 7.3.1. The electrical installation shall be supplied from the existing landlord low voltage intake position adjacent to the office area. The incoming supply shall be verified during detailed design to confirm earthing arrangement (TN-S or TN-C-S), available capacity and prospective fault level.
- 7.3.2. A new sub-main distribution arrangement shall be derived from the existing origin of supply (DB1) to serve the plant room installation. The Contractor shall confirm available load capacity and notify the Contract Administrator where any upgrade to the incoming supply is required

7.4. Distribution Hierarchy

- 7.4.1. The electrical distribution system shall comprise the following hierarchy:
 - Existing building intake position and landlord distribution board (DB1)
 - New sub-main distribution circuit serving the plant room if required.
 - New plant room distribution board (DB-PR)
 - Final circuits serving mechanical plant, lighting, small power and controls equipment
- 7.4.2. The system shall be configured as a 400/230V, 3 phase, 4 wire + CPC installation.

7.5. Segregation

- 7.5.1. The electrical installation shall be segregated into the following system categories:
 - Life safety systems – including fire alarm, emergency lighting, and gas safety systems
 - Mechanical plant systems – including boiler plant, pumps, and associated controls
 - General services – including lighting, small power and ancillary systems
- 7.5.2. Life safety wiring systems shall be segregated from general power and control cabling in accordance with BS 7671, BS 5839-1 and BS 8519. Segregation shall be achieved through dedicated containment routes or physical barriers within shared containment systems.

7.6. General

- 7.6.1. The distribution board shall be wall-mounted and incorporate an incoming switch disconnect or protective device, with outgoing protective devices, metering, instrumentation and indication as detailed on the drawings and schedules. The board shall be arranged to allow top and/or bottom cable entry and shall be provided with perimeter trunking (nominally 100mm x 100mm), subject to coordination with access, segregation and cable routing requirements.
- 7.6.2. The distribution board shall be of sheet steel construction and manufactured and verified in accordance with BS EN 61439-2, providing a minimum Form 2 segregation.
- 7.6.3. The distribution board fault rating shall be verified against the prospective short-circuit current at the point of installation and shall not be less than 16kA unless calculations demonstrate otherwise.
- 7.6.4. Extension boxes, where required to accommodate the size of incoming & outgoing cables or ancillary equipment, are to be mounted directly onto the main enclosure in accordance with the manufacturer's recommendations.
- 7.6.5. Where required circuits shall be protected by appropriately sized 30mA residual current devices (RCBO's) as required to comply with BS 7671 Requirements for Electrical Installations IET Wiring Regulations - latest edition.
- 7.6.6. Outgoing ways are to be single or triple pole RCBO / MCBs
- 7.6.7. RCBOs shall have a minimum short-circuit breaking capacity of 16 kA, unless otherwise required to suit the calculated prospective fault current at the point of installation.
- 7.6.8. Where device ratings are lower than the fault level, verified cascading arrangements in accordance with manufacturer data shall be provided.
- 7.6.9. All devices shall be capable of being locked in the off position.
- 7.6.10. All spare ways shall be fitted with proprietary blanks or plates. Re-wirable fuses are not to be used. All outgoing way terminations are to be made off within the protective device.

- 7.6.11. Metering is to be multi-functional digital type display providing information on voltage, current KWh and kVA in real time and cumulatively. The meter is also to record the kVA maximum demand on the way/circuit.
- 7.6.12. The local distribution arrangement shall be interfaced with the BMS system, and the following information is to be reported to the system:
 - Energy meters
 - Phase status
 - Incoming device status (open/closed)
- 7.6.13. The main panel is to be fitted with an electronic type of surge protection device (SPD) to provide protection from transient overvoltage.
- 7.6.14. Surge Protection Devices (SPDs) and associated upstream overcurrent protective devices shall be selected and installed in accordance with BS 7671 Sections 443 and 534, BS EN 61643, manufacturer recommendations and the verified prospective fault current at the point of installation.
- 7.6.15. Type 2 SPDs shall be installed to all new distribution boards serving the plant installation. Additional Type 3 SPDs shall be provided where required by manufacturer recommendations for sensitive electronic equipment including the new BMS panel, metering system and gas safety panel and associated control equipment.
- 7.6.16. All sub main cables are to be XLPE/SWA/LSZH or XLPE multi core type. All sub mains are to be of a single unbroken length, with a dedicated copper CPC/earth cable. SWA alone shall not be utilised for the earth conductor.
- 7.6.17. The contractor shall include for providing a copy of the cable manufacturers Declaration of Performance (DOP) certificate on completion of the cable installation to ensure compliance, this shall be included in both paper and electronic format.
- 7.6.18. All sub mains are to be run on containment for the entirety of their length and where practicable are to be concealed within ceiling voids or risers.
- 7.6.19. All cables are to be continuous in length. No joints will be accepted. Terminations will be made using mechanical type compression gland kits complete with earthing rings/tags. Care shall be taken to select materials that will not cause adverse reaction between the gland and armour. Final connections for cables will be effective utilising mechanically compressed lugs.
- 7.6.20. All cables are to be clearly labelled at both ends of the cable route stating the cable identification number, source of supply and the load served.
- 7.6.21. Local small power and lighting final circuit distribution boards are to be proprietary wall mounted metal clad type and be fitted with protective devices conforming to BS EN 60898 / BS EN 61009.
- 7.6.22. Each board is to be provided so as to leave 25% spare ways.
- 7.6.23. RCBOs/MCBs shall have a minimum short-circuit breaking capacity of 10 kA or 16 kA as required to exceed the calculated prospective fault current at the point of installation.
- 7.6.24. All distribution boards are to be supplied in accordance with the schematic drawings and distribution board schedules issued as part of the electrical design package.
- 7.6.25. Upon completion the Contractor shall provide new full (typed) circuit charts for each distribution board. The distribution charts shall provide the following information for each outgoing way:
 - Circuit number.
 - Circuit description.
 - Wiring type.
 - Reference method.
 - Number of points served.
 - Cable size.
 - Protective device type & rating.
 - Protective device breaking capacity.
- 7.6.26. Voltage warning notices shall be securely fixed externally on all switchgear and equipment where low voltage is present including 230V equipment. These shall be manufactured from rigid PVC or flexible vinyl film with self-adhesive backing.
- 7.6.27. Isolation warning notices shall be provided in accordance with BS 7671. Requirements for Electrical Installations IET Wiring Regulations – latest edition.
- 7.6.28. All cabling shall be Harmonised as required in installations from April 2006. Colours L1 - Brown, L2 - Black, L3 - Grey and N – Blue.
- 7.6.29. All panel and distribution board covers are to be supplied complete with lockable covers and fitted with barrel locks and keys to allow the board to be installed so as to not be able to be tampered with.

- 7.6.30. Every distribution board where applicable shall be fitted with a warning label highlighting the use of the old and new wiring colour conventions within the installation as a whole. A typical example is shown below.

CAUTION
This installation has wiring colours to two versions of BS 7671. Great care should be taken before undertaking extension, alterations or repair that all conductors are correctly identified.

8. INTERNAL LIGHTING INSTALLATION

8.1. System Objective

- 8.1.1. The Electrical Contractor shall design, supply install, test and commission and set to work a completely new lighting installation to the plant room and external area, as detailed on the design drawings and within this document provide a high-quality installation providing correct levels of illumination to the designated areas.
- 8.1.2. The internal lighting installation shall be automatically control via presence detection sensors.

8.2. Design criteria

- 8.2.1. Lighting levels (where applicable) shall generally be:

Room Reference	LUX Level (AV maintained)	Uniformity	Notes
Plant rooms, switch gear rooms	300	0.4 U _o 25 UGR _L	Considers common context modifiers detailed in EN 12464-1: 5.3.3

- 8.2.2. Where a room type is not given in the above reference, illumination criteria shall be designed to be in accordance with the Society of Light and Lighting code for lighting.

8.3. System Description

- 8.3.1. The Contractor shall provide suitably IP rated LED luminaires within the boiler room to achieve a minimum maintained illuminance level of 300 lux at finished floor level in accordance with the recommendations of the SLL Code for Lighting and BS EN 12464.
- 8.3.2. The Electrical Contractor shall ensure that all luminaires and ancillary controls are suitably selected to be compatible with the environment in which they are installed. This will include:
- Suitable ingress protection
 - Impact protection
 - Operating temperature range
 - LED luminaires shall be provided with 5-year warranties.
- 8.3.3. Lighting controls associated with the installed luminaires shall comprise occupancy detection providing maintained illuminance.
- 8.3.4. Lighting design shall achieve:
- Minimum 300 lux at floor level.
 - Uniform illumination.
 - Suitable maintenance access lighting.
- 8.3.5. Final connection to luminaires shall be via a plug in ceiling rose arrangement to facilitate future maintenance.

8.4. General

- 8.4.1. Luminaires shall be of a good quality and soundly constructed, they shall comply fully with current edition of British Standards relative to the type of equipment supplied. Luminaires shall comply with the current fire-retardant materials to TP(a) standard where they form as part of the ceiling.
- 8.4.2. Lighting circuits shall be fed from local distribution boards in accordance with the distribution board schedules. Circuits shall be wired using PVC/LSOH twin and earth cables installed in trunking/conduit and on baskets.
- 8.4.3. The requirements shall be site and location specific and confirmed with the Architect and Clients Team prior to commencing design or installation.
- 8.4.4. The contractor shall include for providing a copy of the cable manufacturers Declaration of Performance (DOP) certificate on completion of the cable installation to ensure compliance, this shall be included in both paper and electronic format.
- 8.4.5. Minimum cross-sectional area of the cabling used for wiring of the lighting circuits is to be not less than 1.5mm².
- 8.4.6. Circuits shall be protected by 10A 30mA residual current devices (RCBO's) as required to comply with BS 7671.
- 8.4.7. All wiring other than in plant areas shall be concealed within floor voids, ceiling voids, ducts etc., or within wall chases. Specific areas, and only if indicated on the drawings may be surface mounted. Surface wiring within plant areas shall be run within galvanised conduit, trunking or cable tray.
- 8.4.8. Cabling shall be routed within the containment system. Where cables emanate from the trunking the cables shall be installed within white PVC conduit in the ceiling voids and flush mounted drops within the areas having new wall surface installed. All conduits shall be galvanised in plant areas.
- 8.4.9. Generally, accessories shall be manufactured by Clipsal, Wandsworth, MK or Delta.
- 8.4.10. Accessories shall generally be metal clad type in plant and back of house areas.
- 8.4.11. Sockets and accessories to certain areas and locations within the building may be designated as requiring a colour differential from the surrounding area by a minimum of 30-point LRV differential as described in Part M of the building regulations.
- 8.4.12. The contractor shall request a list of such areas from the architect prior to commencing second fix and then he shall install either accessories that satisfy this colour differential or surrounding equipment that meets the differential requirements (such as contrasting coloured dado trunking lid) to ensure compliance with part M is achieved.
- 8.4.13. Where a contrast is not required or not necessary (for items such as fused spur outlets to equipment) the accessories shall be white plastic or decorative as the area requires.
- 8.4.14. Generally, lighting accessories shall be manufactured by Clipsal, Wandsworth, MK or Delta, and be of plastic construction. The Contractor shall take account of the final room layouts within his design.
- 8.4.15. Local switches controlling lighting and equipment shall comply with BS 3676 and BS EN 60669-1 and shall be minimum 10A rated.
- 8.4.16. Switching for the lighting system shall be designed to be fully compliant with the requirements of Part L of the building regulations. If this necessitates additional light switching/control, then this shall be incorporated in the design.
- 8.4.17. Where more than one phase of the supply is present in one switchbox, phase barriers shall be installed to segregate the circuits on different phases. In addition, a label engraved "Danger 400 Volts", shall be attached to or engraved upon the front grid plate.
- 8.4.18. All boxes used for fixing switches shall be supplied with an earth terminal or screw in the base of the box.
- 8.4.19. Where metal or metal clad switches are utilised, a 1.5mm² earth continuity conductor shall be installed between the metal clad switch plate and its associated metal box and be linked with a separate insulated fly lead.

9. EMERGENCY LIGHTING INSTALLATION

9.1. System Objective

- 9.1.1. The Electrical Contractor shall design, supply install, test and commission and set to work a new emergency lighting installation to the plant room and adjoining external area in accordance with ICEL 1001, BS5266, BS EN 1838 and as detailed on the drawings and within this specification, to provide a high quality installation providing escape lighting from all areas to allow safe passage within and away from the building.
- 9.1.2. The emergency lighting shall be designed and installed in accordance with the requirements of BS EN 1838, BS EN 50172 and in accordance with BS 5266. Plant rooms containing operational or hazardous equipment shall be treated as high-risk task areas.
Emergency lighting to high-risk task areas shall provide a minimum illuminance of 15 lux, or 10% of the normal maintained lighting level, whichever is greater, at control panels, switchgear, plant access locations and safe isolation points.
- 9.1.3. To facilitate a safe working and maintenance environment, the Contractor shall install a standalone self-contained automatic test emergency lighting system, which shall be a separate standalone fitting and not integrated with the general lighting.
- 9.1.4. The installation shall include:
- Emergency escape lighting.
 - The emergency lighting duration shall be minimum 3 hours.
 - Photoluminescent exit signage where required (to be illuminated via the local emergency lighting arrangement).
 - Internal Auto-Test functionality.
 - Certification.

9.2. Design criteria

- 9.2.1. Emergency Lighting levels (where applicable) shall generally be:

Room Reference	Minimum LUX Level (AV maintained)	Uniformity	Notes
Escape routes	1 at floor (centre line)	No greater than 40:1	
High-risk task areas / hazardous plant	10% of normal lighting level or 15 lux minimum (whichever is greater)	No greater than 40:1	

- 9.2.2. Specific locations for siting of luminaires are to be noted and be in accordance with the guidance given in LG12.
- 9.2.3. Where a room type is not given in the above, the illumination criteria shall be designed to be in accordance with the requirements of BS5266.

9.3. System Description

- 9.3.1. The emergency lighting system shall generally comprise maintained luminaires of the same type as the local area lighting or dedicated self-contained recessed LED emergency luminaires as detailed on the drawings and given in this specification.
- 9.3.2. Illuminated exit signage is to be provided as detailed on the drawings and legends where shown are based on generic routes and are to be checked against the requirements of the fire escape plan prior to ordering and final installation.

- 9.3.3. Emergency lighting is to be provided outside the exit from the building by means of dedicated non-maintained emergency luminaire as shown on the drawings and given in this specification, to provide safe means of escape from the building to a safe location.
- 9.3.4. Emergency luminaires shall be only self-contained, 3-hour maintained type, complete with integral battery pack, led indicators, associated changeover gear to operate under mains failure conditions.
- 9.3.5. All emergency lighting shall be fed from local lighting circuit or from the local lighting control modules via a minimum of 4 core LSF flex.

9.4. General

- 9.4.1. The complete system including all luminaires, batteries, lamps, chargers, inverter units, enclosures and wiring is to be installed.
- 9.4.2. All integral emergency luminaires shall be connected direct to the mains supply and in the event of a failure the unit shall automatically connect to the battery housed within the unit. On restoration of the permanent supply, the unit shall revert automatically to mains operation and recharge the batteries. All units shall be supplied complete with rechargeable battery, changeover relay and silicone rubber covered cable interconnections.
- 9.4.3. Each unit shall derive its supply from the permanent un-switched circuit connected directly to the permanent unswitched supply serving the normal local mains lighting such that the battery is on automatic charge when the mains are healthy. Self-testing emergency fittings shall not interrupt the operation of general amenity lighting. An emergency luminaire with an emergency module shall not be connected to 2 different circuits. (Refer to BS 5266: 8.3.3 Test facility).
- 9.4.4. All integral inverter modules where a luminaire is an emergency type of the main luminaire type or to a self-contained non-maintained emergency luminaire shall be ICEL approved. All battery packs shall be vented high temperature nickel cadmium types. The Contractor shall be responsible for ensuring that the LED charging indicator is installed so it is visible from normal viewing angles to provide clear indication that emergency lighting batteries are on charge. In addition, the emergency lighting installation shall be complete with changeover gear/charger/inverter module. All LED's shall be green. Red LED's are not acceptable to indicate the supply to the luminaire is healthy. A red LED indicator may be presented to indicate a fault or failure of the mains supply (dependant on the manufacturer and specification of the particular luminaire utilised)
- 9.4.5. Each unit shall include solid state switching and the re-charge equipment shall enable a fully discharged battery to be fully re-charged within 14 hours. Facilities shall be included to prevent reverse polarity at low battery voltage.
- 9.4.6. Emergency lighting luminaires shall be provided with automatic self-test and central monitoring functionality. The system shall automatically undertake routine function and duration testing in accordance with BS EN 62034 and shall provide fault reporting for lamp, battery, charger and communication failures. Test results and fault status shall be capable of being viewed centrally and exported for statutory compliance reporting.
- 9.4.7. All Emergency lighting test switches shall be fully labelled detailing the location of the circuit being tested and the circuit reference. Where more than one key switch is located a multi-gang switch plate shall be installed. A framed schedule shall be installed adjacent the key switch detailing switching.
- 9.4.8. Escape/exit signage shall be provided at all doors and along escape routes and shall be of the illuminated 3-hour type.
- 9.4.9. If plug in ceiling roses are to be installed, they shall be clearly identified as such and be complete with labels stating the following (Emergency Lighting Supply – DO NOT LEAVE DISCONNECTED). Labels shall incorporate red lettering on a white background a minimum of 3mm in height. Emergency luminaires shall be wired via red 4 pin plug-in type rose using 4 core butyl flexible cables. It is not acceptable to feed an emergency luminaire from two ceiling roses.
- 9.4.10. A person deemed competent by the installer or the enforcing authority, shall test the whole system for operation and duration. A test certificate in accordance with BS 5266: Part 1: Appendix A, shall be issued to the Client.
- 9.4.11. Upon completion of the whole of the emergency lighting installation at the completion of the project, the Contractor shall provide Inspection and Test Certificates in accordance with BS 5266, Part 1. Luminaires for use on emergency lighting systems shall comply with BS 4533: Section 1023.22. Self-contained luminaires shall be ICEL approved.

10. EXTERNAL LIGHTING INSTALLATION

10.1. System Objective

- 10.1.1. The Electrical Contractor shall design, supply install, test, commission and set to work a complete new lighting installation to the external courtyard area of the building from the plant room as detailed on the drawings and within this specification, to provide a high-quality installation providing correct levels of illumination to each area according to its use or type.
- 10.1.2. External plant areas shall be illuminated in accordance with BS EN 12464-2. General circulation routes and plant compound areas shall achieve a minimum maintained illuminance of 20 lux. Local task illuminance shall be increased as necessary, with a minimum maintained illuminance of 50 lux provided at maintenance interfaces, access points, control panels, isolators and other plant requiring routine operation or maintenance.
- 10.1.3. The installation shall be complete with all automatic controls as detailed on the drawings

10.2. Design criteria

- 10.2.1. External Lighting levels (where applicable) shall generally be:

Room Reference	LUX Level (AV maintained)	Uniformity	Notes
Walkways	20	0.25	-
External plant maintenance areas	50 lux at maintenance interfaces	-	-

- 10.2.2. Where an area type is not given in the above table, the illumination criteria shall be designed to be in accordance with the Society of Light and Lighting code for lighting guide for the lighting to that area type.

10.3. System Description

- 10.3.1. The system shall generally comprise wall mounted luminaires to the plant room local circulation area, and shall utilise LED luminaires as detailed on the drawings.
- 10.3.2. External lighting shall be controlled by means of photocell for bringing the luminaires on at dusk and off at dawn in addition to PIR presence detection as detailed below.

Area	Time On	Time Off	Control
External circulation	Dusk	Dawn	Photocell & Presence Detection

10.4. General

- 10.4.1. All luminaires shall be of a type suitable for the environment and installation shall be such that the ingress protection and integrity of the luminaire when installed and in operation is not compromised.
- 10.4.2. The external lighting circuit is to be fed from the plant room lighting distribution board and shall incorporate general and emergency fittings.
- 10.4.3. Circuits to building mounted luminaires shall be wired using PVC/LSOH twin and earth cables installed in trunking/conduit and on baskets.
- 10.4.4. Minimum cross-sectional area of the cabling used for wiring of the lighting circuits is to be not less than 1.5mm² for building mounted lighting circuits.
- 10.4.5. Photocells are to be installed in locations so as to be effective in operation but remain safe from vandalism and damage.

11. POWER SUPPLIES TO MECHANICAL PLANT

11.1. System Objective

- 11.1.1. The Contractor shall design supply install, test and commission and set to work a new power installation to mechanical services in the plant room, to provide a high-quality installation of general power supplies for equipment to all areas of the building.
- 11.1.2. The Contractor shall install the small power installation as shown on the drawings including (but not limited to):
 - BMS / Mechanical Control Panel (MCP)
 - Supplies for ventilation fans
 - Fused connection units for local mechanical equipment
 - Rotary isolators for mechanical equipment
 - Isolators for plant items
 - Note, final connection from isolators and connection units, is to be provided by the Mechanical Contractor.

11.2. System Description

- 11.2.1. The Contractor shall verify the location for, and nature of, all supplies to all mechanical plant with the mechanical contractor or the suppliers of a specialist system or piece of equipment.
- 11.2.2. Wherever possible, the Contractor shall look to avoid installing equipment directly below water services, in particular where unions and fittings may pose an increased risk of leaks onto sensitive electrical equipment.
- 11.2.3. Power to the new BMS / mechanical control panel shall comprise a sub main terminating to a suitably rated isolator at the locations of the panel. The MCP / BMS control panel shall be supplied by the BMS contractor,
- 11.2.4. Safety panels and ancillary equipment will be provided by the Mechanical Contractor.
- 11.2.5. Power to fixed equipment is to be provided by circuits supplying a local isolator or fused connection outlet to each piece of mechanical equipment as shown on the associated drawings.

11.3. General

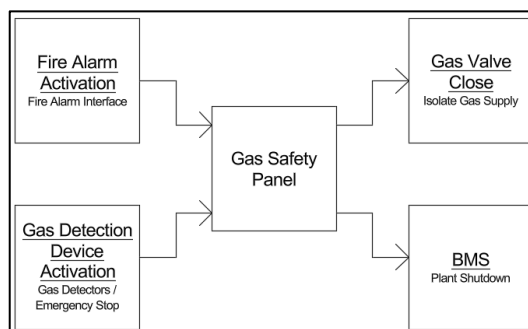
- 11.3.1. All accessories shall generally be the metal clad type or suitable alternative within plant and back of house areas.
- 11.3.2. The power supplies shall be fed from the local distribution boards and be installed using PVC/LSF twin and earth cables in containment.
- 11.3.3. Power for three phase and larger loads is to be fed from the MCP or local distribution board and be installed using PVC/SWA/XLPE cables on tray and in trunking.
- 11.3.4. Fan supplies shall either be controlled by the local lighting circuits & be fed via three pole isolators or be controlled by proprietary controllers which shall be supplied, installed and connected up by the Mechanical Contractor. The Contractor shall provide the containment to the fan via the triple pole isolator.
- 11.3.5. The Contractor shall ensure that all items are supplied and installed to ensure that the electrical supplies to the mechanical plant installation/point of isolation are complete in their entirety.
- 11.3.6. All exterior mounted isolators shall be rotary type units rated at IP54 and suitable for outdoor installation. All isolators shall be lockable in the 'Off' position. Cable entry to and from the units shall be bottom entry only.

12. FIRE ALARM INSTALLATION

12.1. System Objective

- 12.1.1. The Principal Contractor shall employ a specialist fire alarm subcontractor to undertake alterations to the fire alarm system.
- 12.1.2. Additions to the fire alarm system shall coordinate with the existing fire alarm system, the fire alarm subcontractor shall verify existing system capacity, loop loading, standby battery capacity and compatibility of all proposed interfaces prior to altering the system.

- 12.1.3. Attention is drawn to the existing fire alarm system, which will be required to remain in operation throughout the project. The Contractor working in coordination with the fire alarm contractor shall take measures to keep the system operational, whilst also minimising the potential for false alarm activations.
- 12.1.4. The fire alarm installation / alterations shall include renewed automatic detection within the plant room, incorporating combined beacon and provision of a new fire alarm interface which shall be utilised to action the following safety mechanisms:
- Gas supervision panel.
 - Incoming gas supply.
 - Boiler & Plant shutdown.
 - BMS monitoring.
- 12.1.5. A formal Controls Responsibility Matrix shall be issued to the Contract Administrator at the detailed design stage, identifying all I/O points, signal ownership and wiring responsibility between Electrical, Mechanical, BMS and Fire Alarm Contractors.
- 12.1.6. The interfacing / safety arrangement shall be installed and configured to operate as per the following interface hierarchy:



- 12.1.7. As detailed above, a number of factors shall influence the safe shutdown of the mechanical installation during a life safety event. The Contractor shall produce and agree a fully detailed Cause and Effect Matrix covering BMS, Fire Alarm and Gas Safety interactions prior to installation. No works shall proceed until this document has been reviewed and accepted by the Contract Administrator and Building Services Consultant.
- 12.1.8. The specialist fire alarm contractor shall allow to modify the existing fire alarm system to include a test/isolation facility to prevent safety mechanisms from activating during weekly fire alarm user tests. This shall be achieved via an integrated or surface mounted rotary key operated switch adjacent to the fire alarm panel.
- 12.1.9. Final connections shall be coordinated between fire alarm contractor and the BMS contractor. It shall be the fire alarm contractor's responsibility to install the fire alarm interface in close proximity to the new BMS & gas safety panels, leaving a coil of enhanced fire-resistant cable from the volt-free contacts, ready for connection to the gas safety panel by the BMS contractor.
- 12.1.10. Fire alarm and life safety wiring shall comply with BS 5839-1 and BS 8519 where applicable and shall comprise enhanced fire-resistant cable meeting the requirements of BS EN 50200 PH120 unless noted otherwise.
- 12.1.11. The Contractor shall ensure that a high-quality installation standard is achieved, and that all items are supplied and installed so that the system is complete in its entirety.

12.2. System Description

- 12.2.1. Automatic detection to the plant room is to be assessed and if required, renewed.
- 12.2.2. Break glass units are to be provided at each exit from the building or each exit from a floor or area within the building and as required by BS 5839-1 (latest version).

12.3. General

- 12.3.1. The alarm system shall be an open protocol system which affords the client the chance to utilise his/her own maintenance company and Contractor to undertake maintenance and alterations to the system

without being tied to using the manufacturer. Codes for all levels of system maintenance are to be provided to the client in the building manual information.

- 12.3.2. The Fire Alarm system shall be compatible with the existing system and shall be of the same type as presently installed.
- 12.3.3. The Contractor shall be responsible for employing the specialist fire alarm sub-contractor to program the system and make any necessary connections to the system.
- 12.3.4. The fire alarm specialist shall hold BAFE or UKAS accreditation to verify the design, installation, testing and commission the Fire Alarm system.
- 12.3.5. All wiring other than in plant areas shall be concealed within floor voids, ceiling voids, ducts etc., or within wall chases. Specific areas, and only if indicated on the drawings may be served via surface mounted. Surface wiring within plant areas shall be run within conduit, trunking or cable tray.
- 12.3.6. All metal clips securing plastic conduit shall be of the same colour or painted/sprayed the same colour as the plastic conduit used.
- 12.3.7. Cable shall be FP200 flexi or gold. Fire tough cable is not acceptable for any part of the installation. All cables shall be fixed using proprietary plastic-coated metal cable clips to the fabric of the building, in cable trunking or on a cable tray system, separate from other services.
- 12.3.8. Each detector shall be provided with a separate plug-in type of base connection unit housing the addressable module (where applicable), and similar detector types shall be interchangeable between bases without further modification to system configuration. The head and base shall be such as to require push-and-twist insertion or removal. Bases shall be compatible with each different type of detector.
- 12.3.9. Manual call points should be fitted with a hinged protective cover installed directly onto Type A call point(s); the hinged cover shall be required to be moved to gain access to the frangible element in line with the requirements of BS 5839-1 (latest version).
- 12.3.10. Beacons shall be installed to comply with British Standards and DDA requirements to provide visual indication of a fire condition. Beacons shall be initiated to operate simultaneously with the fire alarm sounders within the zone in which they are installed. Beacons shall comprise a high intensity flashing light in a red housing with red polycarbonate lens. Operating flash rate shall be between 30 and 120 cycles per minute. The location and intensity shall be sufficient to attract attention under all conditions of building occupancy and use.
- 12.3.11. Visual Alarm Devices (VAD's) are to be provided to all areas highlighted in the fire risk assessment as undertaken for the building. Where no FRA has been produced, they shall be allowed as a minimum to be provided to reception area, high risk areas, plant rooms with high ambient noise, toilets, showers and escape corridors with the remainder of VAD's to be indicators as indicated on the drawings.
- 12.3.12. The stroboscopic output of all VAD's is to be synchronised in order to reduce the possibility of adversely affecting epileptic users of the building.
- 12.3.13. The Contractor shall test and commission the fire alarm system following connection of the completed system and ensure all areas function correctly and are connected to the panel.
- 12.3.14. The Contractor shall check sound levels upon completion to ensure compliance with BS 5839-1 and as specified above. The Contractor shall issue a list of the levels taken to the engineer and for inclusion in the building manuals.
- 12.3.15. All sounders are to be tone compatible with every other type installed.
- 12.3.16. Where the existing fire alarm system is to be modified, the specialist/contractor shall survey the site prior to tender submission to verify that the system is in operational condition and able to incorporate the modifications and all items and equipment required to facilitate the alterations.
- 12.3.17. Where faults are observed these are to be reported to the Contract Administrator and Building Services Consultant.
- 12.3.18. Where system wiring integrates with the wiring of other systems this should not affect compliance with the relevant British Standard.
- 12.3.19. The minimum size of cable used throughout the system for detection circuits shall be 2.5mm², however due allowance shall be made due to the size of the area to ensure adequate performance of the devices is not detrimentally affected by volt drop.
- 12.3.20. The whole system shall be tested and commissioned by the system manufacturer or supplier and demonstrated to the Contract Administrator, Fire officer and any other party the Contract Administrator requires to be in attendance.
- 12.3.21. Alarm/Sounder circuits shall be wired in a minimum of 2.5mm² but allowance must be made due to the size of the area to ensure adequate audibility performance and provide an adequate supply to the audible units.
- 12.3.22. The specialist proposal shall be submitted to the consultant for approval and possible amendment prior to installation.

12.4. Testing

12.4.1. The fire alarm (upon completion or phased completion as appropriate) shall be commissioned and/or tested in accordance with the requirements of BS 5839-1 (latest version) section 4 and 5 and as follows:

- Verification of cable continuity and impedance within manufacturers limits
- Labelling and verification of all loop devices
- General operation of devices
- Cause and effect operations
- Cause and effect verification
- Functionality of interfaces
- Operation of dial out
- Returns to normal status upon full reset
- Demonstration of system

12.4.2. The testing of the system shall be undertaken by a competent person who is familiar with, and trained for, the commissioning of the type and make of system installed.

12.4.3. The testing and commissioning must be undertaken in line with the manufacturer's requirements and guidelines.

12.4.4. Upon completion of fire alarm testing and commissioning the following must be provided:

- Audibility to be proven and recorded on as built drawings
- Battery backup status/provision
- Proof of operation to the client
- Certification
- Logbooks
- Provision of as built drawing
- Provision of zone charts

12.4.5. The Contractor shall engage a competent fire alarm specialist contractor experienced with the Client's existing fire alarm infrastructure and monitoring arrangements. Where practicable, the Client's incumbent fire alarm specialist shall be utilised to maintain system continuity and compatibility.

13. DATA INSTALLATION**13.1. System Objective**

13.1.1. The Electrical Contractor shall design, supply, install, test and commission and set to work two new Cat 6A circuits from the site's local comms cabinet / patch panel to RJ45 outlets within the plant room (adjacent the MCP / BMS panel), to facilitate connection and remote access to the BMS system.

13.1.2. The Contractor shall ensure that a high-quality installation of system is provided and that all items are supplied and installed so that the system is complete in its entirety.

13.2. System Description

13.2.1. The Contractor shall provide only the parts of the network from the patch panel to the outlet on the wall. Any equipment to be installed to the data system at the feed end is by the Client's IT specialist.

13.2.2. The system shall comprise cabling emanating from the local patch panel to the data outlets as shown on the drawing to provide the data network to the BMS installation.

13.3. General

- 13.3.1. The Contractor shall supply, test and commission the data system as generally detailed on the drawings. The Contractor shall ensure that all items (including those not indicated on the drawings) are supplied and installed to ensure that the system is fully operational.
- 13.3.2. All accessories shall generally be metal clad in plant and back of house areas.
- 13.3.3. Throughout the installation, data cables shall be installed onto dedicated containment basket. Where data cables run with LV cabling, the data cables shall be a minimum of 50 mm away and shall run at 90° if crossing any LV cabling.
- 13.3.4. The data cabinet shall be connected with a 'clean earth' from local distribution board.
- 13.3.5. The Contractor shall supply and install any patching equipment as necessary.
- 13.3.6. All final connections shall be terminated into RJ45 sockets in locations shown on drawing. The data cables shall be terminated to the patching panels, one number cable per way on the racks. Patching numbering protocol shall be as per Client's requirements.
- 13.3.7. The labelling of the data cabling is specific for the Client and their system of labelling is to be adopted.

14. CONTAINMENT INSTALLATION

14.1. System Objective

- 14.1.1. The Electrical Contractor shall provide and install a complete containment system for the electrical and associated ancillary services within the plant room, including the sub-main supply arrangement where required and containment routes to the external Rinnai water heaters.
- 14.1.2. Within the plant room, the Contractor shall install 100mmx100mm galvanised steel trunking containment running the perimeter of the room at high level and dropping down to wrap new enclosures as detailed within the associated drawing.
- 14.1.3. Conduit drops shall be used to route cabling to final locations of equipment below and above the trunking as required.
- 14.1.4. Containment shall be installed to cater for all systems and shall include dividers to maintain segregation where required.
- 14.1.5. The Contractor shall ensure that a high-quality installation is provided and that all items are supplied and installed so that the system is complete in its entirety.

14.2. System Description

- 14.2.1. The Contractor shall supply and install all main and final containment required to provide fully contained cables systems. This shall include any required trunking, cable tray, cable basket etc.
- 14.2.2. Concealed conduit branches shall be extended as necessary between the main containment runs and the accessory/equipment locations, and complete conduit runs provided to areas where no other containment is installed.
- 14.2.3. Generally, containment shall be installed as shown on the drawings, the methodology employed is as follows:
 - Cable ladder for sub mains in large numbers
 - Cable tray for smaller numbers of sub mains
 - Trunking for final circuits
 - Cable basket for final circuits, SELV wiring and data cabling
 - Cable mat within the floor voids for data cabling
 - Metallic conduit for plant area final circuit wiring
 - High impact plastic conduit above ceilings and within structure or walls
 - Armoured flexible conduit from plant isolator/controller to item of plant

14.3. General

- 14.3.1. All cable containment systems where in public facing areas shall be concealed where possible, within floor voids, ceiling voids, wall chases etc.
- 14.3.2. Surface wiring within plant areas shall be run within galvanised metal conduit, trunking or cable tray.
- 14.3.3. Cabling shall be routed within the containment system. Where cables emanate from the trunking the cables shall be installed within conduit and flush mounted drops to accessory boxes. All conduits and accessories shall be galvanised metal in plant areas.

- 14.3.4. All final circuit cables shall be laid on tray/basket/ladder/conduit as appropriate or as detailed elsewhere.
- 14.3.5. The Contractor shall allow within the tender to extend from the main containment runs with smaller branch routes as required. Final wiring to points of use, and wiring concealed within wall chases shall be run within plastic conduits.
- 14.3.6. Fire alarm cables shall be secured to containment using fire resistant tie-wraps at correct intervals. All surface fire alarm cabling shall be secured using plastic coated metal clips/screw fixings.
- 14.3.7. All cables installed in escape routes shall be installed onto or within a fireproof type containment in order to ensure that they are not able to drop from the containment under the effect of fire in accordance with the requirement of BS 7671. All fixings shall be made using fully metallic anchors, fibre or a similar heat resistant insert types.
- 14.3.8. The Contractor shall co-ordinate with all other services all containment prior routes to installation.
- 14.3.9. All cables are to be run within containment for the entire length of their runs.
- 14.3.10. All drops to flush accessories are to be installed flush in the building in PVC conduits. Metal capping is not acceptable.
- 14.3.11. The Contractor shall bond all containment systems to the earthing system. 12mm x 1.5mm copper links or equivalent copper tape or cable shall be bolted against each joint or break by means of M6 brass nuts and bolts.
- 14.3.12. The Contractor shall liaise with all specialist Contractors to ascertain their exact containment requirements and allow for these within his tender.
- 14.3.13. All conduits are to be provided for new specialist systems and are to be installed provided with a draw wire.
- 14.3.14. Any cable trays shall minimum be medium duty pre-galvanised with 25mm return flange.
- 14.3.15. The Contractor shall ensure that any main runs of trunking, tray or basket has enough spare capacity to allow all the spare ways on the distribution boards to be cabled without the need to run additional containment.
- 14.3.16. All final connections for supplies to items of plant are to be run in flexible conduit. The Contractor shall supply final / interconnecting containment connections.
- 14.3.17. All containment is to have a minimum of 25% spare capacity for future use when calculated in accordance with BS 7671 guidance note 1.

15. EARTHING AND BONDING INSTALLATION

15.1. System Objective

- 15.1.1. The Electrical Contractor shall assess, verify, design, supply, install, test and commission the earthing and bonding installation associated with the plant room alterations and areas affected by the project, in accordance with BS 7671, Electricity at Work Regulations and all relevant statutory requirements.
- 15.1.2. The Contractor shall verify the characteristics and suitability of the existing earthing arrangement prior to commencement of the installation works, including confirmation of:
 - Earthing system type.
 - External earth fault loop impedance (Z_e).
 - Prospective fault current.
 - Main earthing conductor size.
 - Main protective bonding conductor sizes.
 - Suitability of Main Earthing Terminal (MET) arrangement.
 - Integrity and continuity of the existing earthing system.
- 15.1.3. For Stage 3 design purposes of this project, the existing installation is assumed to utilise a TN-C-S (PME) earthing arrangement. The Contractor shall verify the arrangement during detailed design and notify the Contract Administrator immediately should the arrangement differ from the design assumptions.
- 15.1.4. The Contractor shall assess the suitability of existing earthing and bonding connections to the plant room electrical installation, incoming gas supply within the adjacent gas cupboard and any further incoming services within the plant room. If the arrangement is found to be insufficient, the Contractor shall look to renew the arrangement.
- 15.1.5. The Contractor shall ensure that a high-quality installation is provided and that all items are supplied and installed so that the system is complete in its entirety.

15.2. DNO Earthing Arrangement

- 15.2.1. The Contractor shall inspect and verify the existing Distribution Network Operator (DNO) earthing arrangement serving the installation prior to commencement of the Works.
- 15.2.2. The Contractor shall confirm the suitability and adequacy of the existing DNO earthing arrangement for the modified installation.
- 15.2.3. Where the existing earthing arrangement is identified as unsuitable, non-compliant, damaged, unsafe, or insufficient for the proposed installation, the Contractor shall immediately notify the Contract Administrator and Client.
- 15.2.4. The Contractor shall liaise with the Distribution Network Operator where required regarding any defects, deviations, or proposed modification, upgrade, verification or alteration associated with the supply earthing arrangement.

15.3. Main Earthing and Bonding

- 15.3.1. The Contractor shall ensure that all new and modified electrical installation earthing and bonding conductors are connected to the electrical installation MET.
- 15.3.2. The Contractor shall verify the adequacy of the existing main earthing conductor and upgrade where required to suit the revised installation characteristics and fault current levels.
- 15.3.3. Main protective bonding conductors shall be installed in accordance with BS 7671 and shall be connected to all incoming metallic services including, but not limited to:
 - Gas services.
 - Water services.
 - Heating pipework.
 - Structural steelwork where applicable.
 - Other extraneous-conductive-parts.
- 15.3.4. Bonding conductors shall be installed using green/yellow insulated copper conductors sized in accordance with BS 7671 and terminated using suitable proprietary bonding clamps and labelled accordingly.
- 15.3.5. Labels stating "Safety Electrical Connection, Do Not Remove" shall be installed at all main bonding connections.

15.4. Supplementary Bonding

- 15.4.1. The Contractor shall assess the requirement for supplementary bonding in the plant area and install supplementary bonding where required to comply with BS 7671.
- 15.4.2. Within the plant room, all exposed-conductive-parts and extraneous-conductive-parts associated with the mechanical services installation shall be bonded, including but not limited to:
 - Boilers.
 - Pumps.
 - Pipework.
 - Pressurisation units.
 - Plate heat exchanger assemblies.
 - Gas pipework.
 - Cable containment systems where required.
- 15.4.3. Supplementary bonding conductors shall be coordinated to avoid conflict with maintenance access and shall be routed in a neat and workmanlike manner.

15.5. Containment and Mechanical Services Bonding

- 15.5.1. The Contractor shall ensure metallic containment systems are electrically continuous throughout their length and bonded in accordance with BS 7671.
- 15.5.2. Separate bonding conductors shall be installed across all flexible connections, and removable sections where electrical continuity cannot otherwise be guaranteed.
- 15.5.3.** All final connections to mechanical plant shall maintain earth continuity irrespective of installation arrangements.

15.6. General

- 15.6.1. Separate circuit protective conductors shall be installed for all sub-circuits and under no circumstances shall conduits or trunking be relied upon to provide a sole means of earthing or circuit protection. It shall be sized in accordance with the current edition of BS 7671 and shall be run in the form of a 'ring' for ring circuits.
- 15.6.2. The Contractor shall supply and install all main and potential bonding conductors which shall be connected to a main copper earth bar of not less than 25mm x 6mm, with individual connections and labels describing item earthed for each and every cable. The earth bar shall include a test link, which can be removed to isolate the main incoming earth from the remainder of the bonding conductors.
- 15.6.3. It will be expected that all water services pipe work, exposed or in ducts, will be cross-bonded, including bonding across all valves.
- 15.6.4. Earth bonds to the steelwork, pipe work and incoming water services shall be provided, sized as the main building bonding conductors.
- 15.6.5. All extraneous conductive parts, including incoming services to the building, suspended ceilings, flooring, pipework and the building structure, shall be effectively and separately bonded and connected to earth at the Main earth bars.
- 15.6.6. The resistance between any point on the bonded system and the main earth shall not exceed 0.02 ohms when tested in accordance with BS 7671. The Contractor shall verify all of the above and rectify any of these items, which have been found to not be in accordance.
- 15.6.7. The Contractor shall be deemed to have included within his tender for the supply and installation of all supplementary bonding conductors.
- 15.6.8. The minimum size for the supplementary bonding conductors shall be 4mm².

16. TESTING AND COMMISSIONING

16.1. System Objective

- 16.1.1. The Electrical Contractor shall undertake a full and comprehensive testing regime of the system in accordance with the requirements of BS 7671:2008 Requirements for Electrical Installations IET Wiring Regulations – latest edition in order to demonstrate that the system is in accordance with the Regulations.

16.2. System Description

- 16.2.1. All parts of the electrical installation shall be tested and commissioned to ensure safe and correct functioning throughout – together with demonstrating its compliancy with BS 7671.
- 16.2.2. The Contractor shall allow to return after 6 months to balance the phase loads to within 10%.
- 16.2.3. Testing shall be undertaken using calibrated equipment and copies of the calibration certificates shall be included in the building manuals.

16.3. General

- 16.3.1. A Completion Certificate in conformance with the ECA or NICEIC, record drawings, circuit charts and details of installed plant and equipment shall be incorporated into an Operating & Maintenance Manual (O & M).
- 16.3.2. The Contractor shall also allow for time to train the Client's representatives in the use of all the installed systems.
- 16.3.3. Testing, inspecting and commissioning shall be carried out in accordance with the requirements of the IET Regulations and this Specification. The testing, inspecting, commissioning shall be carried out upon completion of the installation, with witness tests being carried out by the checking Building Services Engineer where requested. In order for these tests to take place, the Contractor shall complete the installation and satisfy himself that the installation has been carried out in accordance with the requirements of the Specification and drawings, and only when he is satisfied that the installation is fully operational in accordance with these requirements shall he offer the installation to the checking Building Services Engineer for witnessing.

- 16.3.4. The Contractor shall satisfy himself of the full operational requirements of each and every system covered by the electrical services specification, and for each system shall prior to carrying out the testing and commissioning submit to the Checking Building Services Engineer a fully detailed method statement indicating in detail the sequence of testing to be undertaken. Each task identified in the method statement shall clearly indicate the required result or results, if more than one operation/output is applicable when the system is operating correctly.
- 16.3.5. The method statement shall clearly indicate all tasks that are to be undertaken to satisfactorily demonstrate the whole system is operating correctly in accordance with the specification and shall include the proving of all interlocks, remote signals, all inputs, outputs, etc.
- 16.3.6. The testing and commissioning shall include all items of equipment and systems and any defect found on any item of equipment or system shall be rectified by the Contractor at no cost to the contract.
- 16.3.7. Upon completion of the installation the Contractor shall issue completion and inspection certificates for the whole installation prior to project handover.
- 16.3.8. 3N^o copies of all record documentation shall be provided within the Operation and Maintenance manuals which shall be prepared by the Contractor shall therefore include a cost within the tender for the preparation of the related documents and drawings. Each copy of the O&M manual shall be complete with two USB sticks containing the complete O&M manual in digital format and include the Record Drawings in both .pdf and .dwg (AutoCAD 2019) format. Failure to provide this documentation will result in practical completion being denied.

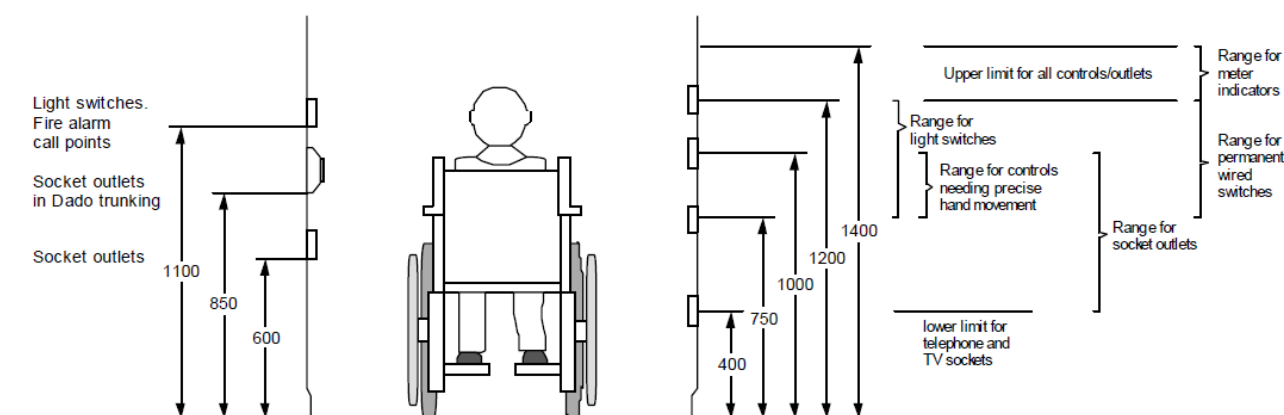
17. OPERATING & MAINTENANCE MANUAL AND BUILDING USER GUIDE

- 17.1.1. The Contractor shall prepare an Operating & Maintenance manual and a Building User Guide following the requirements of BSRIA BG26 and BG79. The building logbook should be in accordance with the requirements of CIBSE TM31.
- 17.1.2. Where applicable the requirements of BREEAM standard of Very Good standard are to be achieved.
- 17.1.3. Draft O&M Manuals shall be made available for review by the Building Services Supervising Engineer four weeks prior to practical completion and shall be complete in all respects. Failure to do so will defer the practical completion date with associated late completion attributed to the Electrical Contractor. The manuals shall be reviewed, and comments issued back to the Electrical Contractor for incorporation into a final edition to again be reviewed by the Building Services Supervising Engineer prior to issue to the client.
- 17.1.4. The Electrical Contractor shall include a cost within his tender for the preparation and issue of 3N^o final copies of the Operation and Maintenance manuals, all record documentation, related documents and drawings. Each copy of the O&M manual shall be complete with a CD / DVD containing the complete O&M manual in digital format and include the Record Drawings in both .pdf and .dwg (autocad 2014) format. Failure to provide this documentation will result in practical completion being denied.
- 17.1.5. The final version of the O&M's shall be issued at Practical Completion.
- 17.1.6. The Building User Guide shall be relevant to the non-technical building user, occupy a separate section in the O&M Manual and shall include the following content:
 - Building service information
 - Emergency information
 - Energy and environmental strategy
 - Water use
 - Transport facilities (by others)
 - Materials and waste policy
 - Re-fit /arrangement considerations
 - Reporting provision
 - Training
 - Links and references

18. ACCESSORY MOUNTING HEIGHTS

- 18.1.1. The approximate position of distribution board, control equipment, fittings and accessories shall be as indicated on the drawings. Actual positions shall be determined and approved on site before the work commences.
- 18.1.2. The right is reserved, prior to the work commencing, to make minor alterations to accessory positions of up to two metres in either direction, without incurring any cost variation to the Contract.
- 18.1.3. Unless reference is given on Drawings or directed in writing, the following mounting heights to the centre of all accessories above finished floor level shall be adhered to (however prior to installation actual heights shall be agreed with the architects/Interior Designer's setting out details):
- 18.1.4. In addition to the above, the below shall apply

Heights of Switches, Socket outlets and Controls



British Standard 8300 recommendations

- Wall Mounted Luminaires – 1800mm
 - Lighting and Override Switches – 1200mm to top of switch
 - Socket Outlets above worktops – 150mm to bottom of box
 - High Level accessories such as Double pole or Fan Isolators – 2100mm to bottom
 - Wall Mounted Fire Alarm Sounders – 2100mm minimum to bottom of the device and no closer than 150mm from ceiling where wall mounted.
- 18.1.5. All groups of accessories shall be in line either vertically or horizontally or as detailed on setting out drawings.
 - 18.1.6. Where groups of distribution fuse gear, switches, contactors, etc., are to be installed in the same location, a detailed drawing of the proposed arrangements shall be submitted for approval prior to work commencing.
 - 18.1.7. Liaise with the architect and client as to how to achieve compliance with part M in respect of accessories contrasting with the background colour of the surface they are installed against.

APPENDIX A – SCHEDULE OF MANUFACTURERS

Item	Manufacturer	Notes
Fire Stopping (proprietary)	Rockwool 3M	For accessory boxes in fire partitions
Wall Mounted Electrical Panels	Schneider Eaton Hager Legrande ABB	
Distribution Boards	Schneider Eaton Hager MK Crabtree ABB	
Surge Protection	FJ Furse Limited Surge Protection Devices Ltd	
Isolators	MEM ABB Schneider	
Sub Main Cables	Drakka Pirelli AEI	
Wiring Accessories	MK Ashley Clipsal Legrande	White Plastic – Logic Plus Range Metalclad to plant rooms, ceiling voids etc. (To be agreed with client)
Final Circuit Cables	Drakka Pirelli AEI	
Lighting Equipment and Controls	Thorlux CP Electronics Ashley Klix Danlers	
Fire Alarm	Apollo Ziton Clymac Gent	
Cable Trays/ Trunking	Metsec Unistrut Swift Davies	

APPENDIX B – BENCHMARK STANDARDS

Selected relevant standards (table not exhaustive or exclusive)		
Standard	Short Description	Application Guidance
Building Regulations Approved Document B Volume 2	Fire Safety	Guidance for fire safety in Buildings other than dwellings
Building Regulations Approved Document F	Ventilation	Guidance on building ventilation, including building air quality and preventing condensation in a domestic or non-domestic structure
Building Regulations Approved Document G	Sanitation, hot water safety and water efficiency	Guidance for compliance of cold and hot water services with Building Regulations
Building Regulations Approved Document H	Drainage and waste disposal: Approved Document H	Guidance for compliance of drainage systems with the Building Regulations
Building Regulations Approved Document L2A	Conservation of fuel and power	Guidance for the conservation of fuel and power in new buildings other than dwellings
Building Regulations Approved Document L2B	Conservation of fuel and power	Guidance for the conservation of fuel and power in existing buildings other than dwellings
Approved Document M Volume 2	Access to and use of buildings	Guide to the ease of access to, and use of, buildings, including facilities for disabled visitors or occupants
BESA DW143	Ductwork air leakage testing.	Requirements for air leakage of ductwork and pressure testing procedures
BESA RAC80	Design Specification For DX Packaged Air Conditioning Equipment in buildings	Guidance to sizing, selecting and installing DX packaged air conditioning systems
BESA TR11	Use of plastic pipework	Guidance for the use of plastic pipework
BESA TR20	Installation and testing of hot water services	Requirements for the installation and testing of pipework systems in commercial buildings
BESA TR30	Heat Pump installations	Guidance to the specification and design of heat pump systems for heating and cooling in buildings.
BESA TR6	Site pressure testing of pipework	Requirements for the procedures for site pressure testing of pipework systems
BS 12897	Water supply. Specification for indirectly heated unvented (closed) storage water heaters	Requirements for water heaters installation
BS 3871	Miniature Circuit Breakers	Specification for miniature and moulded case circuit-breakers. Miniature air-break circuit- breakers for a.c. circuits
BS 4514	Unplasticized PVC soil and ventilating pipes of 82.4	Requirements for PVC soil and ventilating pipes, fittings and accessories

Selected relevant standards (table not exhaustive or exclusive)		
Standard	Short Description	Application Guidance
	mm minimum mean outside diameter	
BS 4533	Luminaires	Multi part document dealing with all requirements regarding luminaires
BS 4752	Moulded Case Circuit Breakers	Specification for switchgear and controlgear for voltages up to and including 1000 V a.c. and 1200 V d.c. Circuit-breakers.
BS 5266	Emergency lighting code of practice	Detailed guidance on the application and practice of emergency escape lighting, with a view to ensuring safety in the event that normal lighting is interrupted.
BS 5422	Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating	Requirements of thermal insulation
BS 5839	Fire detection and fire alarm systems for buildings.	Code of practice for design, installation, commissioning and maintenance of fire detection and fire alarm systems in non- domestic premises
BS 6004	PVC Insulated Cables. (non-armoured)	Electric cables. PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power and lighting
BS 6121-5	Mechanical Cable Glands.	Mechanical cable glands. Code of practice for selection, installation and inspection of cable glands and armour glands
BS 6724	LSF Thermosetting Insulated Cables. (armoured)	Electric cables. Thermosetting insulated, armoured cables for voltages of 600/1000 V and 1900/3300 V, having low emission of smoke and corrosive gases when affected by fire
BS 7211	LSF Thermosetting Insulated Cables. (non- armoured)	Specification for thermosetting insulated cables (non-armoured) for electric power and lighting with low emission of smoke and corrosive gases when affected by fire
BS 7346	Smoke control systems	Code of practice for planning, design, installation, commissioning and maintenance of smoke controls systems
BS 7671	IET Wiring Regulations	Requirements for Electrical Installations
BS 7942	Thermostatic mixing valves for use in care establishments.	Requirements and test methods of Thermostatic mixing valves
BS 8558	Complementary guidance to BS EN 806	Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings

Selected relevant standards (table not exhaustive or exclusive)		
Standard	Short Description	Application Guidance
BS 9999	Fire Safety	Code of practice for the fire safety design and management and use of buildings
BS EN 1057	Copper and copper alloys.	Requirements for copper pipework carrying hot water in sanitary and heating installations
BS EN 12056-2	Gravity drainage systems inside buildings. Sanitary pipework, layout and calculation	Design, calculations and layout of waste services
BS EN 12201-2	Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Pipes	Requirements for PE pipes carrying incoming water
BS EN 12449	Copper and copper alloys. Seamless, round tubes for general purposes	Material Specification for copper pipework carrying refrigerant
BS EN 1253	Gullies for buildings	Requirements for trapped floor gullies
BS EN 1254-4	Copper and copper alloys. Plumbing fittings.	Requirements for fittings combining other end connections with capillary or compression ends
BS EN 12845	Fixed firefighting systems	Design, installation and maintenance of Automatic sprinkler systems
BS EN 16005	Power operated pedestrian door sets.	Requirements and test methods of power operated pedestrian door sets
BS EN 274	Waste fittings for sanitary appliances.	Requirements for fittings, traps, overflows for waste systems
BS EN 60335-2-21	Household and similar electrical appliances. Safety. Particular requirements for storage water heaters	Safety requirements for hot water heaters
BS EN 60529	Classification of degrees of protection by enclosures.	Describes a method for classifying degrees of protection provided by enclosures, principally for electrical equipment.
BS EN 61534	Powertrack systems	Requirements and tests for powertrack systems
BS EN 62305-1	Protection against lightning.	General principles for the protection of structures against lightning, including their installations and contents, as well as persons
BS EN 806	Specifications for installations inside buildings conveying water for human consumption.	Requirements and recommendations for the design, pipe sizing, installation of potable water services
BS EN ISO 12241	Thermal insulation for building equipment and industrial Installations.	Calculation rules of thermal insulation for building equipment
BS800	Requirements for the interface level of equipment	Specification for radio interference limits and measurements for household appliances,

Selected relevant standards (table not exhaustive or exclusive)		
Standard	Short Description	Application Guidance
	which may cause interference to radio reception.	portable tools and other electrical equipment causing similar types of interference
BSRIA BG Guide	Commissioning of air systems	Guidance to commissioning of ducted air distribution systems in buildings
CIBSE Code A	Air distribution systems	Guidance to the commissioning of air distribution systems
CIBSE Code C	Automatic controls	Guidance to the commissioning of automatic controls
CIBSE Code L	Commissioning Lighting	Guidance to the commissioning of lighting and associated controls
CIBSE Code M	Commissioning Management	Guidance to the management arrangements required to ensure that building services systems are commissioned to meet compliance with the objectives of Part L of the Building regulations
CIBSE Code R	Refrigeration systems	Guidance to the commissioning of refrigerating plant and systems used in air conditioning applications
CIBSE Guide A	Environmental design	Guidance on external conditions; Guidance on the comfort criteria of the Thermal, Visual, Acoustic environment
CIBSE Guide B	Heating, Ventilation, Air Conditioning and Noise	Design guidance of HVAC systems including noise control
CIBSE Guide G	Public Health and Plumbing Engineering	Guidance for design and installation of PH services
CIBSE Guide H	Building control systems	Guidance for the design and installation of automatic building control systems
CIBSE Guide K	Electricity in Buildings	Guidance on load assessments, supplies, distribution, wiring systems, UPS, earthing, inspection and testing
CIBSE Guide TM13	Minimising the risk of Legionnaires disease.	Guidance on design, operation, maintenance and monitoring of water systems to minimise the risk of infection from Legionella Bacteria
CIBSE Guide TM31	Building logbook toolkit	Guidance to the development of the building logbook
CIBSE Guide TM39	Building energy metering	Good practice requirements for the provision of sub-metering
CIBSE Lighting Guides	CIBSE Lighting Guides	Good practice guidance to the design of lighting
DW 144	Specification for sheet metal ductwork	Specification for the manufacture and installation of sheet metal ductwork
DW/TR19	Internal cleanliness of ventilation systems	Requirements for testing of cleanliness for both new and existing ventilation systems and cleaning procedures

APPENDIX C – LIST OF REGULATIONS AND STANDARDS

- All British Standard Specifications.
- All British Standard Codes of Practice.
- The Health and Safety at Work Act.
- Recommendations of the Health & Safety at Work Executive.
- Factories Act.
- Offices, shops and railways premises act.
- Electricity Acts including Electricity at Work Regulations.
- Water and gas safety regulations.
- Local Byelaws and Regulations.
- Requirements of the Building Control Office, Building Regulations (specifically including Part L), Fire Officer and Environmental Health Officer.
- The Employers Insurers.
- BS 7671 (latest edition) The Wiring Regulations, including all amendments and appendices.
- Clean Air Act 1993
- The Control of Pollution Act 1974
- Control of Pollution (Amendment) Act 1989
- Workplace (Health, Safety and Welfare) Regulations 1992
- The Construction (Design and Management) Regulations 2015
- COSHH.
- IEC Standards
- Healthcare Technical Memorandums (particularly 06-01, 06-02, and 08-02)
- Construction Product Regulations (CPR) EU 305/2011 for the reaction to fire performance of products and materials, including all cables, to a Euro Class category rating of Cca in accordance with EN50399 and EN50575 (unless alternative proof of compliance to CPR is provided).
- All documentation, regulations, guides, technical memoranda etc. produced by the Chartered Institution of Building Services Engineers.
- Construction (Design and Management) Regulations 2015
- BS EN 50110 Operation of electrical installations. General requirements
- Provision and Use of Work Equipment Regulations 1998
- Personal Protective Equipment at Work Regulations 1992
- The Construction (General Provisions) Regulations 1961
- The Construction (Lifting Operations) Regulations 1961
- Other relevant Safety Regulations
- Public Utility Company and/or Statutory Authority regulations, specifications, and requirements
- British Standards and Codes of Practice
- Local Authority Regulations and approvals.
- BSRIA Commissioning Codes
- Manufacturer's stipulations and recommendations for installation, testing, commissioning and maintenance.
- Disability Discrimination Act.

APPENDIX D – DEFINITIONS

TERM	DESCRIPTION
A	Ampere
AC	Alternating Current
AHU	Air Handling Unit
AV	Audio Visual System
BOH	Back of House colleague and storage areas not accessed by customers
BS EN ISO	BS denotes Britain's National Standards. EN denotes a Standard adopted by the Europe controlled by the European Committee for Standardisation (CEN). ISO denotes a worldwide standard issued by the International Organisation for Standardisation
CCTV	Close Circuit Television
CIBSE	Chartered Institute of Building Services Engineers
COSHH	Control of Substances Hazardous to Health - the UK law that requires employers to control substances that are hazardous to health.
CPC	Circuit Protective Conductor
CPR	Construction Product Regulations
DB	Distribution Board
dB (A)	Noise generated over ambient, given as a rating
DC	Direct Current
DIP	Design Intent Package
DNO	Distribution Network Operator
DP	Double Pole
DX	Direct Expansion
ELV	Extra Low Voltage
FOH	Front of House, the sales area of a Demo Store
FCU	Fan Coil Unit
FFL	Finished Floor Level
GA	Global Architects
GC	General Contractor
GFOM	Global Fit Out Manual
Hz	Hertz, Electrical Frequency
HSE	Health and Safety Executive
IP	Ingress Protection
HVAC	Heating Ventilation and Air Conditioning
ITAB	Dyson Demo preferred lighting manufacturer, designer and supplier
K	Kelvin (as used to define colour temperature of lighting)
Kva	Kilovolt-Amp
kVAh	Kilovolt-Amp Hour
kW	Kilowatt, unit of electricity
kWh	Kilowatt Hour, unit of electricity
LD/A	Local Designer/Architect
LED	Light Emitting Diode
LRV	Light Reflectance Value
LSC	Luminaire Supporting Coupler
LSF	Low Smoke and Fume Cable

LSOH	Low Smoke Zero Halogen Cable
LSX	Low Smoke Zero Halogen Screened Multicore Cable
Lux	SI derived unit of illuminance
LV	Low Voltage
MCB	Miniature Circuit Breaker
MCCB	Moulded Case Circuit Breaker
MCP	Mechanical Control Panel
MEP	Mechanical/Electrical/Plumbing
NR	Noise Rating
PA	Public Address System
PH	Public Health
PIR	Passive Infrared (Sensor)
PM	Project Manager (Dyson)
O&M	Operation and Maintenance (Manual)
RAL	Colour matching system used in Europe
RCBO	Residual current circuit breaker with overcurrent protection
RCD	Residual Current Device
RDT	Dyson in house Retail Design Team
SCA	Smoke Control Association
SWA	Steel Wire Armoured
TMV	Thermostatic Mixer Valve
HWS	Hot Water Services
V	Volt
VCD	Volume Control Damper
VRF/VRV	Variable Refrigerant Flow/Variable Refrigerant Volume
WRAS	Water Regulations Advisory Scheme

APPENDIX E – SCHEDULE OF TENDER DRAWINGS

P2-L5 3PE-ZZ-PL-M-001	LTHW Layout
P2-L5 3PE-ZZ-SC-M-002	LTHW Schematic
P2-L5 3PE-ZZ-SC-M-003	Strip out 1/2
P2-L5 3PE-ZZ-SC-M-004	Strip out 2/2
P2-L5 3PE-ZZ-PL-M-005	Domestic water services
L5 3PE-ZZ-SC-E-5001	Plant Room Electrical Strip Out
L5 3PE-ZZ-SC-E-5002	Plant Room Electrical Installation

APPENDIX F – ELECTRICAL ENGINEERING SERVICES SUMMARY OF TENDER

ELECTRICAL ENGINEERING SERVICES

SUMMARY OF TENDER (FIXED PRICE)

<u>Item</u>	<u>Description</u>	<u>Price</u>	
1	Preliminaries & General Conditions	£	
2	Stripping Out	£	
3	Sub Mains and Distribution	£	
4	General Lighting Installation	£	
5	Emergency Lighting Installation	£	
6	Sub Metering	£	
7	Small Power and Containment Installation	£	
8	Data Wiring	£	
9	Fire Alarm Installation	£	
10	Testing and Inspection	£	
11	Operating and Maintenance Manuals and As Installed Drawings	£	
		£	
		£	
		£	
		£	
Sub Total		£	

	<u>Included Sums</u>	<u>Price</u>	
	Contingency Sum	£	
		£	
Grand Total		£	