ELECTRICAL SERVICES SPECIFICATION

EDMONDS PARK
NEW GROUNDS BUILDING
DIDCOT
OXFORDSHIRE

PSB Consulting Engineers Oxford LTD
Suite 4, Merchant House,
5 East St Helen St,
Abingdon
Oxfordshire
OX14 5EG

Document Approval	Name	Signature	Date
Prepared by	Peter Quigley	*P Quigley*	April 2018

CONTENTS

PART ONE

GENERAL CLAUSES

INDEX

1.01 DEFINITIONS

The following definitions shall be applicable throughout this specification, and to all Tender and Contractual documents.

The Employer shall mean Didcot Town Council, Britwell Road, Didcot Oxfordshire. OX11 7JN

The Architect shall mean RPA Architects. Strathfield House. Chilton Road, Upton, Oxfordshire. OX11 9JL.

The Quantity Surveyor shall mean TBA

The Mechanical and Electrical Engineer shall mean PSB Consulting Engineers (Oxford) Ltd. Suite 4, Merchant House, 5 East Helen Street, Abingdon, Oxfordshire, OX14 5EG.

The Structural Engineer shall mean TBA.

The CDM Supervisor shall mean TBA.

The Main Contractor shall mean the Firm appointed to carry out the main contract building and civil engineering works and to whom the Electrical Sub-Contractor shall be appointed as a domestic Sub-Contractor.

The Electrical Sub-Contractor shall mean the firm appointed to carry out all the services works that are the subject of this specification.

The Works shall mean the design, supply, delivery, unloading, handling, installation and erection, testing, commissioning, setting to work, formally handing over and provision of record drawings and documentation for the whole of the engineering systems as described in this specification and/or shown or implied on the Drawings, Schedules and Appendices referred to herein.

The Tender Drawings shall mean the drawings listed in the Appendices of this Specification.

1.02 EMPLOYER'S REQUIREMENTS

The Electrical Sub-Contractor shall note that he shall conform to all aspects of the Employer's Requirements clauses in addition to the requirements of any clauses contained within this section of the specification.

1.03 BUILDING IN OCCUPATION

The Electrical Sub-Contractor shall take all reasonable steps to keep noise and disruption to a minimum and ensure that all possible measures are taken to keep the site safe. Refer also to the Main Contract Preliminary clauses which shall have precedence over this document.

1.04 RESPONSIBILITIES

The Employer's Agent will be responsible for providing adequate information sufficient to illustrate the electrical services systems performance and the Employer's Requirements.

The Electrical Sub-Contractor shall be responsible for: -

a) Providing installation and builderswork drawings of all ducts, trenches, bases, holes through floors, chases and all major holes through walls, etc.
b) Making an early appraisal of the requirements of all plant and equipment related to the electrical services works.

c) Completing the works as set out in the documents and demonstrating both its satisfactory performance, and its satisfactory standards of workmanship and accessibility of the installation to facilitate maintenance work.

The Electrical Sub-Contractor shall note that the actual performance of any bought-in plant is his responsibility and each item must be demonstrated as being capable of fulfilling the specified duties. Any defective equipment will be rejected and shall be replaced at no cost to the contract.

1.05 INTERPRETATION OF DOCUMENTS AND DRAWINGS

This Specification and the associated drawings shall be read jointly and the Electrical Sub-Contractor shall draw the Employer's Agent attention to anything which, in his opinion, may be unsuitable, undesirable or inconsistent with his guarantees and responsibilities.

The Specification and associated drawings shall be interpreted in accordance with the best installation practice relevant to the circumstances.

The Electrical Sub-Contractor shall note that the drawings are indicative only and the exact locations of equipment and accessories shall be clearly shown on the Electrical Sub-Contractor's own installation working drawings to be agreed with the Employer's Agent or his representative before the installations are commenced.

1.06 CO-ORDINATION WITH THE BUILDING CONSTRUCTION AND OTHER SERVICES

The Electrical Sub-Contractor shall ensure that all aspects of the electrical installations are fully co-ordinated with the buildings structures and with all other services. Installation and builderswork drawings shall be produced by the Electrical Sub-Contractor to show detailed co-ordination of the electrical services (see later clause), and these drawings, etc. shall be submitted to the Employer's Agent prior to commencement of any installation work or ordering of materials associated with the particular section of the works.

Any holes required through structural members shall be agreed with the Structural Engineer. All major builders work will be carried out by the Main Contractor, and the Electrical Sub-Contractor shall mark the requirements on site. All minor builders work including small holes through walls and all fixing of equipment shall be carried out by the Electrical Sub-Contractor under the electrical services works.

The final positions of all visible equipment shall be agreed with the Employer's Agent before the installations are commenced. The Electrical Sub-Contractor shall note that adjacently mounted equipment must be exactly in line and/or at exactly the same mounting height, to the satisfaction of the Employer's Agent.

The Electrical Sub-Contractor shall be responsible for ensuring that the final positions of all items of plant and equipment are accurately set out and that the proposals are agreed with Employer's Agent.

The Electrical Sub-Contractor shall allow for liaison with all specialist installers and with the relevant Public Utility and Statutory Authorities as necessary during the course of the works, and he shall include all costs in this respect in his Tender.

1.07 COMPLIANCE WITH PUBLIC UTILITIES, STATUTORY AND LOCAL AUTHORITIES

All aspects of the installations shall fully comply with the regulations of all relevant Public Utilities Statutory and Local Authorities and in particular with the following:-

a) The 17th Edition of the IEE Wiring Regulations 'Requirements for Electrical Installations'.
b) Regulations under the Factories Act.

c) Regulations under the Electricity Acts.
d) Gas Safety Regulations.
e) Health and Safety at Work Act, 1974.
f) The Clean Air Acts.
g) Any special regulations issued by the Public Utilities and Local Authority.
h) The Control of Pollutions Act.
i) Construction Design and Management Regulation, 2015.
j) National Water Council Bye-laws
k) The Fire Precautions (Workplace) Regulations 1997.
l) Electricity at Work Act, 1989
m) The Building Regulations
n) The Joint Code of Practice for Construction Sites & Buildings Undergoing Renovation.
o) The Noise at Work Regulations, 1989.

1.08 STANDARDS AND REGULATIONS

The Electrical Sub-Contractor shall strictly adhere to the current requirements of all relevant British Standards and Codes of Practice.

The installations shall accord with British Standard BS 7671, The Seventeenth Edition of the IEE Wiring Regulations 'Requirements for Electrical Installations', including all amendments, and with the Electricity Authority earthing system regulations, including any amendments.

The Electrical Sub-Contractor shall ensure that all equipment and materials supplied and installed shall fully comply with the current Codes of Practice or British Standards and shall be to the current editions, or those subsequently issued during the contract.

The requirements of the Health & Safety at Work Act 1974 and subsequent amendments thereto are brought to the attention of all those who design, install, operate or maintain the plant and equipment required by this specification and/or drawings forming a part of the tender documents or who are required to enter the areas covered by the specification or depicted on any such drawings. This specification and any drawings forming a part of the tender or contract documents indicate the Employer's Requirements and are in no way deemed to be complete working instructions or drawings.

It is the Electrical Sub-Contractor's responsibility to check that the design and working drawings show all necessary details and instructions and to ensure that the Operating and Maintenance Instructions and Record Drawings comply with the requirements of the Health & Safety at Work Act and any other applicable legislation as, for example, the Building Regulations, the Fire Precautions Act, etc.

The Electrical Sub-Contractor shall be responsible for ensuring that all items of plant, machinery and systems comply and that all the necessary manufacturers' instructions are included in the Operating and Maintenance Instructions and, where necessary, fixed to the items of plant as well.

The Electrical Sub-Contractor shall be responsible for ensuring that all plant rooms and plant within have the necessary notices, warnings and/or instructions. These shall cover maintenance, working, operating and access or egress thereto and there from. For example, all plant rooms shall have a notice permanently secured to all doors stating 'No Admittance to Unauthorised Personnel' in letters 50mm high.

1.09 STANDARDS OF WORK AND MATERIALS

The Electrical Sub-Contractor shall ensure that all work carried out on this contract is of a high standard. The standard of materials used shall be commensurate with the building finishes of the area.

The work shall be carried out by competent staff in an expeditious and workmanlike manner under skilled supervision.

All plant and material shall be new, undamaged, free from corrosion, not sub-standard, and shall conform to the requirements of the Specification.

`Approval' of any bought-in items does not imply any acceptance of responsibility for the satisfactory operation of these items, which must always rest with the Electrical Sub-Contractor.

Where quality or standard of materials are not specified, they shall be of adequate quality and equivalent standard to specified items.

The equipment listed on the drawings represents the quality of materials and equipment which shall be provided under this contract. Tenders shall be based upon the equipment specified, however, if Tenderers are able to offer alternative equipment and materials of an equal or higher standard to that specified they should forward details of these alternatives during the Tender period, clearly stating any cost savings to be made. Such alternatives shall not be included in the Tender unless specifically agreed in writing by the Employer's Agent before the Tenders are submitted. Claims for cost increases will not be entertained if any suggested alternatives are, or are not, accepted.

1.10 OMISSIONS

The Electrical Sub-Contractor shall make due any allowance in his tender for any item or items such as manufactured bends in trunking, support, brackets, etc. which, although not indicated on the tender drawings or mentioned in the Specification, are necessary for the proper construction of the works and the correct operation of the systems in accordance with the best current practice and to comply with this Specification.

Any items shown on the drawings but omitted from the Specification, or described in the Specification but omitted from the drawings, shall be deemed to be included.

The Electrical Sub-Contractor shall not omit any part of the works described in the Specification or shown on the drawings without the consent of the Employer's Agent in writing.

1.11 SURVEY OF THE SITE AND EXISTING INSTALLATIONS

It shall be a condition of tender that a thorough inspection of the site be carried out by the Tenderers during the Tender period to ascertain all relevant details of the existing buildings, and the proposed means of access to the site and any other relevant details.

Claims for any subsequent additional costs to the contract due to not carrying out the above inspection of the site will not be entertained.

It will be deemed that full advantage has been taken of the facilities available to visit the site prior to Tendering, to ascertain and check dimensions where plant or equipment is to be installed within or close to existing buildings or structures. These dimensions shall take precedence over any dimensions shown on the Employer's Agent or his representative's drawings or supplied under the Contract. Immediately any discrepancy is found it shall be drawn to the attention of the Employer's Agent.

1.12 EXISTING INSTALLATIONS AND ENGINEERING MATERIALS

The Electrical Sub-Contractor shall take care not to disturb or damage in any way the existing installations within or on the existing buildings and in underground locations, where the installations are to remain unchanged. Where existing services are to be removed and replaced with new

and/or re-routed the work shall be carried out or programmed to avoid disruption to the use and occupancy of any existing buildings to remain on neighbouring premises.

1.13 INSTALLATION WORKING DRAWINGS, & SPECIFICATION (ELECTRICAL SUB-CONTRACTOR'S PROPOSALS)

The Electrical Sub-Contractor shall prepare and submit his installation working drawings for appraisal and comment. A specification detailing proposed plant, equipment, materials and installation methods shall also be provided.

The drawings shall include the following information:-

a) 1:50 scale drawings showing full details of the layouts of the general, emergency and external lighting, small power and mechanical services wiring installations including details of circuiting and circuit reference nos., routes of conduit, cable trunking, floor trunking, cable tray, sub-main cables etc., and locations of all equipment.
b) 1:50 scale drawings and schematic showing the layout and details of the fire alarm system installation.
c) Schematic diagrams of electrical distribution system showing sizes, types and rating of all main, sub main and final circuit cables, panel boards, distribution boards, MCCBs, MCBs, MCB/RCDs, earthing, main and supplementary equipotential bonding conductors and circuit protective conductors.
d) Schematic diagrams of the electrical wiring to mechanical services plant and controls showing sizes, types and rating of all cables and control cables, protective devices, isolators and circuit protective conductors.
e) Design calculations to verify that all cables, conductors and equipment referred to items (iii) and (iv) above have been selected in accordance with the requirements of the current edition of BS7671, IEE Wiring Regulations, 17th Edition.
f) Design calculations to verify that general, and emergency lighting levels in all areas comply with the recommendations of the current editions of the appropriate CIBSE lighting guides and British Standard BS5266, and with any particular requirements listed in Section 2 of this Performance Specification.
g) Large scale plan and elevation drawings showing the layout of all equipment in the electrical switch cupboards.
h) Any additional drawings and diagrams necessary to ensure the suitability, compatibility and the correct location of all equipment, luminaires, accessories etc.
i) Details of supports and fixings for all equipment, conduits, cable trunking, floor trunking, cable tray, cables, luminaires etc.
j) Details of the estimated maximum demand of the installation broken down to show lighting loads, power loads, mechanical services loads etc.
k) Any additional drawings necessary to show the intended method of co-ordination with other services, i.e. mechanical services, with the structure and other building or architectural features.
l) Illustration of maintenance access space, access facilities and panels etc.
m) Builderswork drawings.

Prior to the production and submission of the installation and working drawings, the Electrical Sub-Contractor shall submit a schedule of the drawings intended to be produced, for the approval of the Employer's Agent or his representative.

All design information shall be provided in a concise manner enabling a full analysis to be carried out by the Employer's Agent.

All calculations, drawings, plant and equipment selections and specification information shall be submitted and commented upon before ordering any plant or materials or carrying out any work.

The Electrical Sub-Contractor shall include for all necessary discussions and correspondence with manufacturers and suppliers to ascertain full details of the required method of installation.

The Electrical Sub-Contractor shall include for all liaison necessary with others involved in the production of the Electrical Sub-Contractor's proposals and shall fully co-ordinate all aspects of the electrical services works with all other aspects of the building and its services.

The Electrical Sub-Contractor shall be responsible for taking site dimensions and for the accuracy of the information he provides and shall be liable for all costs arising from any errors in such information.

At least two weeks shall be allowed for the Employer's Agent to inspect the submitted documents, from receipt in his Head Office, and also sufficient time shall be allowed to incorporate any comments by the Employer's Agent and re-submission of the documents prior to commencing any associated work on site. The time for this process shall be included in the programme of works to be agreed.

Whenever the Electrical Sub-Contractor submits information to the Employer's Agent for approval, such approval will be approval in principle only and will not, in any way invalid at the Electrical Sub-Contractor's responsibility for ensuring the accuracy and suitability of the information in accordance with requirements specified elsewhere.

The exact position in the Works of the above items relative to grid lines, floors, beams, ceilings, walls and other structural items and any other services is the Electrical Sub-Contractor's responsibility and the Employer's Agent's approval does not absolve the Electrical Sub-Contractor from the necessity of checking these items with his subcontractors.

Note also that approval of drawings will not relieve the Electrical Sub-Contractor of responsibility for complying with the specification.

The Electrical Sub-Contractor shall give due regard to the needs of inspection, efficient maintenance and replacement of the installations, and shall note that 'Approval' of any bought-in items does not imply any acceptance of responsibility for the satisfactory operation of these items by the Employer's Agent, and this must always rest with the Electrical Sub-Contractor.

1.14 BUILDERSWORK AND BUILDERSWORK DRAWINGS

The Electrical Sub-Contractor shall provide builderswork drawings showing his requirements for all holes through walls, floors, ceilings, etc. and any other necessary builderswork, including the provision of underground ducts and trenches.

All major builderswork will be carried out under the building works. The Electrical Sub-Contractor shall allow, for marking the exact positions of all holes, for drilling any small holes as necessary and for all fixing of the electrical installations equipment.

The Electrical Sub-Contractor shall note that preliminary builderswork information has been included under the building works and he shall check that this is suitable and shall add any further requirements necessary to satisfactorily complete the works.

1.15 INSPECTION OF THE WORKS AND DEMONSTRATIONS

Inspections of the works will be made by the Employer's Agent during the course of the contract to check on observance of the Electrical Sub-Contractor's Proposals and Employer's Requirements. Any defects thus observed will be notified to the Electrical Sub-Contractor who shall rectify these at his own expense to the satisfaction of the Employer's Agent.

All assistance necessary shall be given to enable the Employer's Agent to examine or measure the works and no section of the works shall be covered or concealed prior to completion of a witnessed satisfactory test.

Due notice shall be given when works which are to be covered or concealed are ready for examination and/or measurement.
On completion of the works, the Electrical Sub-Contractor shall demonstrate at agreed times with the Employer's Agent or his appointed representative, the tests as set out in subsequent clauses of this Specification.

The Electrical Sub-Contractor shall demonstrate the satisfactory operation of all electrical systems, as required, to the Employer's Agent, to the Employer and where appropriate, to the Fire Officer and other Statutory and Local Authorities, at separate agreed times. Where specialist systems are to be demonstrated, the specialist shall carry out the demonstration with the Electrical Sub-Contractor in attendance.

1.16 CDM REGULATIONS

A preliminary Risk Assessment related to the electrical services works has been undertaken in compliance with the CDM Regulations, 2015. Refer to the Planning Supervisor's pre-tender Health & Safety Plan.

The Electrical Sub-Contractor, in his role as a "Designer" as defined in the CDM Regulations, shall prepare the final Risk Assessment and submit to the Planning Supervisor for inclusion into the Health & Safety Plan.

1.17 MATERIALS STORAGE

All materials and equipment shall be stored safely under proper cover and in such a manner that deterioration or damage does not, and cannot, occur.

The storage or materials by laying them directly on the ground will not be permitted.

Where materials, plant and equipment cannot be stored in suitable buildings, they shall be raised and supported clear of the ground and shall be protected against frost damage and damage due to building works and operations by others, with waterproof covers or other appropriate means.

Machine and bright surfaces shall be protected by paint, grease or similar, where this has not been carried out by others or has become removed in transit. On completion of their installation, surfaces so coated shall be cleaned and, where appropriate, polished.

All plant and equipment shall be left in a condition ready for painting where painting is specified either as part of this contract or by others. Parts liable to corrode shall be painted immediately after removal of the temporary protection. Any damage to finishes/paintwork of manufactured items shall be made good by the Electrical Sub-Contractor to the satisfaction of the Employer's Agent.

1.18 REJECTION OF UNSUITABLE MATERIALS, ETC.

Subject to the terms of the Contract, any plant, materials, etc. and workmanship not complying with this Performance Specification or the Electrical Sub-Contractor's Proposals or the terms of the Contract or which are in any way unsuitable may be rejected; and any faulty plant, materials or workmanship may be ordered to be replaced without extra cost to the Employer.

1.19 CLEAN AND TIDY WORKING

The Electrical Sub-Contractor shall, in respect of his own works, keep the site clean, tidy, free from waste and superfluous materials and take all necessary precautions to avoid damage to the new and existing building structures and their contents.

1.20 INTERRUPTION OF UTILITY SERVICES

The Electrical Sub-Contractor shall not interrupt or interfere with the operation and performance of existing utility services such as gas, water, electric lighting and power, buried cables, sewers, drains, etc. nor, in the case of works of Statutory Authorities, Public Utilities or private owners, without the written permission obtained from the Employer's Agent.

Should the Electrical Sub-Contractor cause any damage, he shall be responsible for the making good thereof at his expense to the satisfaction of the Employer's Agent or Statutory Authority.

1.21 INSPECTION AND TESTS AT MANUFACTURERS WORKS

The Electrical Sub-Contractor shall make arrangements for the Employer's Agent to inspect for quality of workmanship at all reasonable times during manufacture of any materials and/or equipment being supplied as part of this Contract. Such inspections shall in no way absolve or reduce the Electrical Sub-Contractor's responsibilities under the contract.

Electrical or performance tests of all specified materials and/or equipment shall be allowed for and arranged at manufacturer's works. Tests shall conform to appropriate British Standards and/or as specified subsequently herein and shall, at the Employer's Agent's discretion, be carried out in the presence of their representatives.

Test certificates shall be provided by the Electrical Sub-Contractor, or his specialist, in a form approved by the Employer's Agent prior to the test. Copies shall be sent to the Employer's Agent within ten days of completing a satisfactory test.

Should any test not be successful, no extra charges will be accepted for subsequent re-testing, delay in delivery, demurrage or transport, and the Electrical Sub-Contractor shall be liable for all costs associated with abortive tests, including reimbursement for the time and associated travelling costs of the Employer's Agent.

1.22 INSPECTION BEFORE CONCEALMENT

Whenever work requiring inspection or testing is subsequently to be concealed, due notice shall be given to the Employer's Agent by the Electrical Sub-Contractor so that inspection may be made or tests witnessed before concealment.

Failure to give notice may necessitate the Electrical Sub-Contractor's uncovering the work and re-instating it at his own expense.

1.23 SITE SUPERVISION

The Electrical Sub-Contractor shall maintain on the site a competent supervisor, who is experienced in the class of work and who shall meet the Employer's Agent's approval.

The approved supervisor shall not be removed from the site without prior notification to, and receipt of approval from, the Employer's Agent.

The supervision shall be available from commencement of the internal or external contract works until finalisation of the works and demonstration to the Employer.

The Electrical Sub-Contractor shall maintain on-site drawings which shall be marked-up on a weekly basis to indicate the extent of the completed works. These shall be available for inspection by the Employers Agent and/or their representatives at all times.

1.24 ELECTRICAL SUB-CONTRACTORS TOOLS AND EQUIPMENT

All tools and equipment used during the installation of the Contract Works shall comply with all the current safety requirements and, in particular, with the following:

a) Electricity (Factories Act) Special Regulations
b) BS 7671: 2008: The Seventeenth Edition of the IEE Wiring Regulations - 'Requirements for Electrical Installations'
c) Electricity Authority Regulations.
d) The Health and Safety at Work etc. Act, 1974.
e) BS4363 and the recommendations of BS 7375.
f) Electricity at Work Act, 1989.

1.25 QUALITY ASSURANCE

Where it is specified that the Electrical Sub-Contractor may select products, the BSI Buyers Guide shall be consulted to ensure that products are manufactured, or stocked, under the following schemes are always given priority:

- BS 5750 QUALITY ASSURANCE SCHEME
- BSI KITEMARK Scheme
- BSI SAFETY MARK SCHEME
- Firms of Assessed Capability
- Stockists of Assessed Capability.

The Employer's Agent shall be notified of any instances where these schemes could be, but are not, used and the reason for such action.

1.26 TESTING, COMMISSIONING AND EMPLOYER INSTRUCTION

For particular details of testing, commissioning, Acceptance testing, Employer instruction and handover, refer to Section 3. The following indicates the general performance requirements expected from the Electrical Sub-Contractor.

1.26.1 GENERAL

The Electrical Sub-Contractor shall:-

a) Allow sufficient time and specialist labour to complete the Works correctly to a pre-arranged commissioning programme properly integrated into the overall Contract Programme of site activities in a systematic and progressive fashion, such that all testing, setting to work, commissioning, documenting of the works to the user has been completed and all systems are operating satisfactorily before Practical Completion can be considered.
b) Prepare a separate Commissioning Programme as part of the Contract Programme in conjunction with other contractual parties and with agreement of the Employer's Agent to describe the commissioning demonstration and instruction procedures, dates and personnel involved. The Programme to be agreed and distributed at least four weeks before commissioning is due to commence.
c) Include for all arrangements to enable the Employer's Agent or his representative or nominated insurance company to witness tests, or test and inspect at site or at the manufacturer's premises.
d) Note that the Employer's Agent or his representatives will only witness the proceedings, confirm the recorded results and determine whether the specified requirements have been met.
e) Allow for the Employer's Agent to receive ten days written notice of the date and place of each (or series of) test, inspection, commissioning or demonstration procedure.
f) At any reasonable time, demonstrate to the Employer's Agent that the test instruments and equipment used are accurate when compared with a recognised standard.

g) Provide all labour, materials (excluding fuel and energy) and apparatus required for carrying out the testing, commissioning, Acceptance testing and instruction of the staff.

1.26.2 TESTING

The Electrical Sub-Contractor shall provide a separate set of drawings and/or report sheets to accurately record the following test and inspection information:-

a) Section and installation under test.
b) Manufacturer's reference number where applicable.
c) Date, time, duration of test (and weather conditions, if appropriate).
d) Test results with itemised readings.
e) Test all equipment, material and services installations as detailed and specified elsewhere in the Performance Specification.
f) Keep proper records of all checks and tests.
g) If the first inspection or test fails, repeat the procedure within a reasonable time, adhering to the time cycles and other requirements, as specified for the first test.
h) Complete all tests before any paint, cladding or similar materials are applied or before services are concealed.

The Employer’s Agent will:-

a) Give twenty-four hours written notice of his intention to be represented at the test.
b) If he decides after inspection or testing, that such plant or any part thereof is defective, or not conforming with the specification, reject such defective parts by written notice.
c) If he considers the tests are being unduly delayed, arrange for instruction to carry out the tests within ten days.

1.26.3 COMMISSIONING

The Electrical Sub-Contractor's Commissioning Engineer shall:-

a) After the foregoing tests are completed and he is satisfied that the installation is in a safe and satisfactory condition, set it to work and proceed to regulate and adjust as necessary to the design requirements before offering any installation to the Employer’s Agent for final acceptance.
b) In general terms, include the following procedures:-
c) Adjusting all systems as specified and ensuring that the performance requirements have been achieved.
d) Balancing and regulating all systems to meet specified performance requirements.
e) Make final adjustments and before practical completion, demonstrate by commissioning procedures detailed elsewhere in this Specification, that the provisions of the contract have been met in total by complementing the previous testing and setting to work procedures and by showing that the completely integrated installation will function in accordance with the specified performance requirements.
f) Record all test results on the sheets provided, complete all commissioning documents and at all stages, ensure that the Employer’s Agent has certified the documents. Subsequently, to demonstrate these test results to the Employer if required and obtain his signature on Acceptance Test Certificates.

1.26.4 COMMISSIONING PROCEDURES

The Electrical Sub-Contractor's Commissioning Engineer shall witness and record the following when commissioning the engineering works:-

a) Progressive static testing by the Electrical Sub-Contractor when the work is presented for testing.

b) Pre-commissioning examination and testing by the Electrical Sub-Contractor shall ensure that each system or item of equipment is complete, in a safe condition and all notices displayed. Completion for operational purposes implies the bulk of the snagging of work has been offered to the Employer's Agent and remedial work completed.
c) Meet with the Employer's Agent and other members of the contractual team to discuss the Commissioning Programme (previously prepared) and written commissioning method statement and take account of any problems arising, availability of related services, agree access required for controls and agree documentation to be used, etc. and adjust programme as necessary for a clear understanding of the position.
d) Commissioning of completed installations carried out by the Electrical Sub-Contractor shall include setting to work, and adjustment of the systems.
e) The Employer's Agent will examine the results achieved against the design intent, indicate and certify agreement and/or arrange instructions for any remedial work to be carried out.
f) Demonstration of agreed systems and equipment to the programme by the Electrical Sub-Contractor will be witnessed on behalf of the Employer by the Employer's Agent and results examined and adjusted for final acceptance. One series of demonstrations of completed systems for Acceptance Testing shall be undertaken by the Commissioning Engineer for witnessing by the Employer's representatives. Results to be typed cross-referenced with diagrams and passed to the Employer's Agent.
g) With all systems operating satisfactorily, snagging complete and record drawings and operation and maintenance manuals available the Employer's Agent will be in a position to consider a date for Practical Completion and handover.
h) Instruction to the Employer's staff to be planned for completion by handover.
i) Any outstanding final acceptance testing such as for specialist systems and accurate temperature measurements, are to be listed and dates agreed in the defects liability period.

1.26.5 INSTRUCTION PERIOD

On completion of an installation (or part of) as the programme dictates the Electrical Sub-Contractor's Commissioning Engineer shall:-

a) Apply to the Employer's Agent to provide names of the Employer's staff to be involved in the operation and maintenance, before planning, preparing and formally recording arrangements for the instruction period.
b) Instruct the Employer in safe operation and maintenance of all systems and items of equipment and where necessary running, maintaining and supervising in each case under normal working conditions for an adequate and reasonable period of time based on manufacturer's recommendations, or, alternatively, at the manufacturer's works.

1.27 RECORD DOCUMENTS

The content of the Record Documents shall be in accordance with Section 3 of this specification.

The Electrical Sub-Contractor shall provide copies of all record drawings and maintenance and instruction manuals of the various systems installed, in accordance with the following requirements: -

Record Drawings (prints)	- 3 sets
A3 size Record Drawings (prints)	- 3 sets
Record Drawings current AutoCAD Release	- 1 set
Operating & Maintenance Manuals	- 3 No (plus CD ROM)

One set of Record Documents shall form part of the CDM Regulations Health and Safety file and shall be incorporated into this document in a manner to be agreed with the Planning Supervisor.

The Electrical Sub-Contractor shall keep on site one set of white prints of manufacturing and installation drawings as necessary to provide a complete record of the contract works. These

drawings shall be kept in good condition and shall be marked up, at least once in each week, to show the progress of the work installed and shall incorporate all alterations, omissions, variations and amendments agreed during the progress of the works. The drawings shall be available at all times for inspection by the Employer's Agent, clearly defining the detail and arrangement of all installed equipment and systems.

The Operating & Maintenance manual shall clearly and fully describe to the staff that shall run the building, the operation of all systems, the manufacture and reference of all materials, the local stockists and services specialists for the various components of the overall installation, the periodicity/detail of the maintenance that the systems require.

The manual shall be produced with all pages in protective plastic envelopes and the document shall be overall finished in a fully labelled, hard bound cover.

The Record Drawings (prints) shall be incorporated into the manual within protective plastic envelopes. CAD CD ROMS shall be similarly incorporated, within purpose made protective plastic envelopes.

Initially, draft copies of the Record Drawings and the Maintenance Manual shall be submitted to the Employer's Agent for approval, allowing sufficient time for comment and preparation of the final documents.

The above requirements shall apply to any sectional or phased handover in addition to the final handover.

The Electrical Sub-Contractor shall also provide information to enable the Mechanical Sub-Contractor to produce the Building Log Book, to the requirements of The Building Regulations 2002, Part L2, including advice on anticipated energy use in the building in relation to lighting and small power loads.

The Electrical Sub-Contractor shall note that it is a contract condition that all record documents are provided before Practical Completion of the project and before acceptance of any section of the works.

1.28 SAMPLES

The Electrical Sub-Contractor shall check with the Employer's Agent regarding the actual samples required as soon as his order for the works is received.

1.29 PROTECTION OF THE WORKS

The Electrical Sub-Contractor shall be responsible for leaving any uncompleted sections of the contract works in a safe condition and shall include for and provide any temporary works necessary to give protection from unauthorised interference. No responsibility for the protection of the works can be accepted by the Employer until the installation is taken over. (Also refer to other parts of this Specification.)

1.30 FIRE PROTECTION AND FIRE BARRIERS

The Electrical Sub-Contractor shall take all necessary precautions to avoid the outbreak of fire during the contract period, particularly in work involving the use of naked flames. He must impress on his workmen the dangers involved in the careless disposal of matches and cigarettes, etc. and the accumulation of rubbish on the site.

Proper precautions shall be taken to prevent the accidental spread of fire. Extinguishers of the appropriate type shall be placed adjacent to all cutting and welding plant when in use.

Permanent approved type fire resistant barriers shall be installed within and around all and around trunking and trays, etc. on the site, where they pass through fire walls and floors, etc. to the satisfaction of the Employer's Agent.

1.31 BENEFICIAL USE OF INSTALLATIONS PRIOR TO TAKE OVER

The Electrical Sub-Contractor shall, if required, prior to Practical Completion and after the issue of written instructions by the Employer's Agent, operate the installations or any part of them, provided that such operation is practicable and does not prejudice the Electrical Sub-Contractor's responsibilities and obligations under his contract, and does not negate the manufacturers 12 months warranty of plant, equipment, etc.

1.32 DEFECTS LIABILITY

The initial period for monitoring defects in the installations prior to release of retention shall be twelve months from the date of Practical Completion. This shall not be deemed to have expired until the Sub-Electrical Sub-Contractor has made good all defects or faults notified by the Employer's Agent.

If, subsequent to the issue of a Completion Certificate, any defects or faults develop which in the opinion of the Employer's Agent are due to faulty materials, workmanship or goods, the Electrical Sub-Contractor shall rectify these at his own expense.

1.33 SCHEDULE OF PRICED QUANTITIES

All Tenderers must provide a fully priced Schedule of Quantities of all materials and equipment to be utilised on this project when requested.

The Schedule shall comprise a complete list of quantities with the rate per metre or per item. The rate per metre or per item shall include labour, overheads, profit and other on costs. Each rate or item shall be extended to show the total cost, and the quantities shall equate to the Tender sum. Any omissions shall be deemed to be included.

The schedule shall be presented and costed in such a manner as to demonstrate the elemental costs which summate to the Electrical Sub-Contractor's Tender for the whole works.

The Schedule will be used for the valuation of all variations where such work is of a similar character.

Where the work is not of a similar character the work shall be valued at fair rates and prices. The labour rate given in the Schedule shall be used when determining such rates.

Where the valuation relates to the omission of work included in the contract documents the rates and prices in the Schedule for such work shall determine the valuation of the work omitted.

PART TWO

GENERAL DESCRIPTION OF THE WORKS

AND PERFORMANCE REQUIREMENTS

INDEX

1.0 DESCRIPTION OF WORKS

The works consist of the complete replacement of the existing grounds building in Edmond Park Didcot Oxfordshire.
This specification documents the electrical works associated with the installation of new lighting, data, fire alarm, security alarm, mechanical supplies and power circuits into the new grounds building. The existing services shall be stripped out as a part of these works.

The grounds building is located in Edmond Park, Park Road, Didcot, Oxfordshire.

The works include: -

1.1 Removal of all the existing lighting and power circuits within the building including the old switch gear.
1.2 Provision of a new main distribution board.
1.3 Provision of an extension of the existing supply into the new building.
1.4 Provision of new sub-main cables to the new mechanical plant.
1.5 Provision of a new distribution board including MCBs and RCBOs.
1.6 Provision of small power distribution.
1.7 Provision of internal lighting, external and emergency lighting.
1.8 Provision of data wiring, outlets and containment.
1.9 Provision of a new fire alarm system to include detection and sounders.
1.10 Provision of an intruder alarm system.
1.11 Provision of lighting control systems.
1.12 Provision of containment where required for sub main cables, power, lighting, fire alarm, and Data.
1.13 Provision of supplies to mechanical plant items.
1.14 Removal of all power circuits to the redundant mechanical services.
1.15 Testing and Commissioning
1.19 Provision of O&M Manuals/Record Drawings.

2.0 STANDARDS

The works described within the specification and drawings shall be installed fully in accordance with the following Standards.

Publication and related Documents

- The Building Regulations.
- The Health & Safety at Work Act.
- The Environmental Protection Act.
- The Electricity at Work Act.
- BS.7671 17th Edition IEE Wiring Regulations Including Latest Amendments.
- The Statutory Fire Officer's Requirements.
- BS 5839-1:2 Fire Alarm.
- CDM Regulations 2015.
- CIBSE Code of Practice, Guides and Commissioning Codes.
- COSHH Regulations.
- Relevant British Standards.
- BS 5266 Part 1: 2005.

Comply with British Standards and Codes of Practice where these exist for materials, equipment, workmanship, design and testing associated with the works.

3.0 DRAWINGS/O&M MANUALS

3.1 TENDER DRAWINGS

Tender drawings have been prepared containing sufficient detail to enable tenderers to interpret correctly the design and to submit competitive tenders for the execution of the works.

The tender drawings forming part of this technical specification are as listed in Appendix 3.

The tender drawings are to some extent diagrammatic and will **NOT** give full installation details. Read with the specification, architectural, structural, other engineering systems and other relevant drawings and documents and access constraints by pre-tender site visit. Obtain all details of every description required to provide a complete and operable system. Give written notice of any discrepancy discovered.

3.2 OPERATION & MAINTENANCE OF THE FINISHED BUILDING

The Electrical Sub-Contractor shall include for preparing operating and maintenance manuals. The manuals should contain information relating to the operation and maintenance of the completed installation. As fitted drawings shall be provided in electronic format.

3.7 INSTALLATION DRAWINGS

The Electrical Sub-Contractor shall include for developing detailed installation drawings for approval prior to commencement of the installation works. CAD files of the tender drawings will be made available to assist with the development of these installation drawings. Include 4 copies to circulate to the design team. As built drawings shall be supplied at handover/completion.

4.0 SCHEDULE OF WORKS

4.1 METHOD

The schedule of work which follows should be read in conjunction with all other documentation and drawings.

Unless otherwise stated below, allow in each item for providing facilities described for, or for supply, erecting, connecting and testing the goods and materials specified.

Include for everything necessary for the proper and satisfactory execution of the work to the approval of the Contract Administrator and the true intent of the specification and the drawings.

4.1.1 NOISE

Take all reasonable precautions during the progress of the work to prevent or reduce inconvenience to building occupants, and to the general public caused by noise.

Generators, compressors and other noisy plants are to be muffled at all times by means of silencers, screens and the like.
The premises around the library shall be occupied throughout the works; the Electrical Sub-Contractor shall take precautions to ensure these other occupiers are not disturbed by the works.

4.1.2 CO-ORDINATION

The Electrical Sub-Contractor shall prepare such detailed drawings of the proposed positioning of plant and equipment as may be required to enable his work to be co-ordinated with the building elements and to attend any meetings that may be called for this purpose.

4.1.3 SETTING OUT OF WORKS

The drawings are indicative of the design intent. The Electrical Sub-Contractor shall verify, take measurement on site as necessary, taking into consideration existing site constraints for the setting out of the works. Produce installation drawings as necessary to adequately detail the installation proposals.

4.1.4 FIRE STOPS

All trunking/services penetrations through walls/floors shall be 'made well' to maintain the integrity of the fire barriers in accordance with the main specification. Note there is a large retail unit above the library and a bus station behind.

4.1.5 BUILDER'S WORK

Builders work is to be undertaken by the Main Contractor. The Electrical Sub Contractor shall include for developing detailed installation drawings showing all builders work prior to commencement on site.

4.1.6 TEMPORARY WORKS

The Electrical Sub Contractor shall provide lockable storage to secure the contractor's own equipment on site.

The Electrical Sub Contractor shall install temporary supplies and cables to ensure the fire alarm system and any security systems throughout the library remain in operation throughout the works.

4.1.7 SITE VISIT

Tenderers are advised to visit the site to ascertain conditions and to satisfy themselves as to the accessibility of the site, the full extent and character of the site, the availability of the works and of all local conditions and restrictions. No claims arising from failure to visit the site shall be accepted.

4.1.8 PROGRAM

Refer to main contract preliminaries and drawings.

4.2 ELECTRICAL SERVICES

4.2.1 GENERAL

The installation should integrate fully with all other service elements to allow all parts of the installation to function correctly in line with the design intent.

The existing SP+N supply to the old building shall be disconnected to allow for the demolition of the old building. The Electrical Sub-Contractor shall allow for obtaining a quotation from Scottish and Southern Energy to disconnect and make safe the existing supply. This supply could be used as a builders supply under a separate arrangement with Scottish and Southern Energy.

A new supply shall be run from the old cable to the new building. A new 100A single phase cut out and meter shall be installed. The Electrical Sub-Contractor shall obtain a quotation for this new supply.

4.2.2 GENERAL OVERVIEW OF EXISTING ELECTRICAL SERVICES INSTALLATION

The existing electrical services including lighting, power, fire alarm, data, toilet alarm system and wiring to mechanical services are to be replaced with new services as shown on the drawings and detailed in this specification.

Any holes shall be made good as a part of the works; fire stopping shall also be installed where required.

4.2.3 SITE SURVEYS AND IDENTIFICATION OF EXISTING SERVICES

The Electrical Sub Contractor shall undertake his own intrusive surveys of sufficient detail to identify existing systems, which will be affected by the works. Allow for a half day's survey by an electrician to be carried in advance of the works.

The Electrical Sub Contractor shall allow for taking measurements of PSCC (prospective short circuit current) and ELI (earth fault loop impedance) at the incoming terminals prior to commencement of works. Details of the readings taken shall be issued to the design engineer.

RISK ASSESSMENTS AND METHOD STATEMENTS

Prior to works commencing the Electrical Sub Contractor shall develop specific (not generic) risk assessments and method statements to address each activity and element of the works including the following: -

- Identification of existing circuits and supply arrangements
- Strip-out of all redundant electrical systems.
- Installation works as mentioned in description of works item **1.0.**
- Access for installation of high level services.
- Delivery and offloading of large plant.

4.2.4 ISOLATION

The Electrical Sub-Contractors Competent Person shall be responsible for the control of electrical danger associated with the contract.

At no time shall the Electrical Sub-Contractor work on any electrical circuits in which both the phase and neutral poles have not been isolated. The Electrical Sub-Contractor shall ensure that the supply is isolated by following the safe isolation procedure and either physically removing links or fuses, or locking devices in the `OFF` position using a unique/dedicated mechanism.

Substantial warning notices shall be securely fixed to the isolating device clearly labelled "DO NOT OPERATE THIS DEVICE, THE SUPPLY IS THE RESPONSIBILITY OF, (Electrical Contractors name, address and telephone number where the Authorised Person may be contacted 24 hours a day)."

In the event of any isolated electrical system becoming energised, it is the Electrical Sub-Contractors responsibility to ensure that measures have been taken as to prevent danger. This may be achieved by the use of barriers and enclosures in accordance with BS 7671.

Before commencing work all poles shall be tested using the safe isolation procedure to ensure they are electrically "dead".

The Electrical Sub-Contractor shall be responsible for providing warning notices at all areas of work.

4.2.5 REMOVAL OF REDUNDANT ELECTRICAL SERVICES

The Electrical Contractor shall allow within this tender to survey, positively identify and remove the existing electrical services that become redundant due to the proposed works.

Items of equipment identified as redundant shall be offered to the client and if required shall be carefully removed and re-assembled with all unwanted items removed from site and disposed of.

4.2.6 SUB-MAIN CABLING INSTALLATION

The Electrical Sub-Contractor shall provide install, terminate and connect the sub-main cabling as indicated on the drawings or detailed within the specification.

All cabling will be hidden from view within public areas where possible by installing it within ceiling voids, stores, plant rooms, risers, roofs and switch rooms.

All sub-main cabling shall be installed on dedicated containment as detailed within clause 4.2.8. This containment shall be run in the risers ceiling voids and roof spaces.

All new sub main cabling shall be Cu XLPE/LSF/SWA. Sub-main cabling size and type as indicated on the circuit schedules appended to this specification. Single phase supplies shall use a three core cable utilizing the third core as the circuit protective conductor along with the armoured cabling. In all cases the steel armouring of the sub-main cabling will also be used as the auxiliary circuit protective conductor in parallel with the CPC conductor.

The exact route of all sub mains shall be agreed on site.

Include for labelling the cable throughout its entire length above ground using traffolyte labels clearly indicating the distribution board/equipment that it is feeding. Agree exact wording with Engineer. The traffolyte labels shall be attached to the sub main cable using nylon cable ties.

4.2.7 DISTRIBUTION BOARD

The new distribution board are to be located in the cupboard and as noted on the drawings. All circuits shall be supplied by this new distribution board. All blank ways shall have blanks fitted except for the ways on the schedule denoted as having MCBs or RCBOs.

The Electrical Sub Contractor shall provide a detailed circuit identification schedule within a transparent wallet fixed to the inside of the distribution board access door. This schedule shall include as well as the circuit data, the date, PSCC, ELI of the supply and supply sub main MCB rating.

The distribution board shall be labelled to suit the Didcot Town Council labelling system. The labelling in this specification is for Tender and installation purposes. Final labelling shall be confirmed by the Contract Administrator.

4.2.8 CONTAINMENT

The Electrical Sub Contractor shall provide and install the cable containment installation and associated support systems as indicated on the drawings and detailed within the specification.

All systems to be installed shall be continuous and shall include all necessary manufactures component elements in order to present a completed installation.
All systems shall be installed in accordance with manufactures recommendations.

The precise containment routes will need to take regard of building restrictions and co-ordination with other installations, additionally allow for all drops and connections between high level/low level as necessary to provide a continuous wire way. Allow for proprietary sets and bends to accommodate building construction and site obstructions.

Provide earth bonds across trunking, basket and tray joints to provide an electrically continuous system.

There is a large amount of cable tray installed within the ceiling void, most of which shall be reused as part of this contract as the distribution boards and racks are located in their current positions. Where there is no existing containment, where the new services are to run, the Electrical Sub-Contractor shall install new containment.

HEAVY DUTY CABLE TRAY

Provide galvanised cable tray within the main switch cupboard, risers ceiling voids and roof spaces. The cable tray shall be utilised to carry/support mains sub-main cable through out their entire length. All cables shall be fixed to the cable tray by use of nylon cable ties with appropriate spacing.

The cable tray shall be fixed to the building structure using manufactured channel supports and Uni-strut.

MEDIUM DUTY CABLE TRAY

Provide galvanised cable tray to carry/support fire alarm and BMS cabling through areas where there is no other containment for these cables. Allow for cable tray to support the cabling throughout the entire length. All cables shall be fixed to the cable tray by use of nylon cable ties with appropriate spacing.

Note: cable tray shall be installed so that the cables are laid on top of the tray and not clipped to the underside. In the result that cables need to be clipped to the inverted tray the fire alarm cables shall be fastened using metal cable ties or clips. The BMS cables shall be fixed to the cable tray by use of nylon cable ties with appropriate spacing.
If the cable trays are inverted above entrance ways and corridors all cables shall be fixed with metal cable ties.

The cable tray shall be fixed to the building structure using manufactured channel supports and Uni-strut.

The cable tray shall be routed through voids, stores etc and within boxing installed by the main contractor.

The Electrical Sub-Contractor shall allow for 30m additional cable tray in his tender figure.

LIGHT DUTY CABLE TRAY OR BASKET

Provide galvanised cable tray or basket to carry/support data, intruder alarm, power and lighting cabling through areas where there is no other containment for these cables. Allow for cable tray or basket to support the cabling throughout the entire length. All cables shall be fixed to the cable tray by use of nylon cable ties with appropriate spacing.

Note: cable tray shall be installed so that the cables are laid on top of the tray and not clipped to the underside. In the result that cables need to be clipped to the inverted tray, the cables shall be fixed to the cable tray by use of nylon cable ties with appropriate spacing. If the cable trays are inverted above entrance ways and corridors all cables shall be fixed with metal cable ties.

The cable tray shall be fixed to the building structure using manufactured channel supports and Uni-strut

The cable tray shall be routed through voids, stores etc and within boxing installed by the main contractor.

The Electrical Sub-Contractor shall allow for 60m additional cable tray or basket in his tender figure.

TRUNKING INSTALLATION

The Electrical Sub Contractor shall provide manufacture’s bends to ensure a complete installation.
The trunking shall be fixed to the building structure using manufactured channel supports and Uni-strut

GENERAL CONDUIT

Provide high impact plastic conduits from the ceiling voids to all final outlets in the new partitions. Conduits shall be installed flush/concealed within the building fabric where possible with the exception of ceiling voids, roof voids, and plant-space. Conduits are not shown in completion on the drawings; some are shown for indication purposes. All conduits shall be sized, supplied and installed as part of this contract in full accordance with BS 7671: Circuits to be arranged as indicated on drawings and schedules.

All conduits shall be installed as discretely as possible, with the maximum use of back entry to sockets from stores and dado installed on the other side of walls.

All conduits shall be supported with appropriate saddles spaced in accordance with the manufacturers' recommendations.

4.2.9 FINIAL CIRCUITS

Wiring shall be PVC/LSF singles in galvanised conduit and trunking or LSF twin and earth cables or SWA LSF cables run on cable basket and dropped down walls in conduit and trunking. Twin and earth cables shall only be dropped down the partitioning within trunking or conduit.

LSF SWA cables shall also be used for some loads as shown on the drawings and schedules. These cables shall utilise the containment as noted above.

Cable sizes shall be as indicated on drawings and schedules.

Separate circuit protective conductors shall be installed with each circuit and shall be in accordance with BS 7671.

4.2.10 POWER INSTALLATION

The power installation shall be provided as indicated on the drawings and schedules, including final connections. Allow for final connection from fused connection units and isolators etc., to suit application.

Generally 13 amp socket outlets shall be wired on ring circuits with no "spurs" from MCB/RCBO's. All socket outlets should be protected by RCD.

In the staff room Kitchenette area there will be a fridge and dishwasher these and any other appliances mounted below the worktops shall have a labelled fused spur located above the work top feeding an unswitched socket at low level below the work top. The exact location of the kitchen appliances shall be confirmed by the Contract Administrator.

Power and lighting accessories shall be either MK logic plus or Crabtree equivalent.

Most of the socket outlets shall have dual earthing terminals, be arranged on a ring circuit and protected by type C MCB's. Earthing arrangements shall be in accordance with section 543.7 of BS7671: (IEE Wiring Regulations 17th Edition).

Include for all power supplies to specialist contractors equipment as shown on the drawings.

4.2.11 LIGHTING

Provide and install the lighting installation complete with all accessories and lamps as detailed on the drawings and specification. Final connection to recessed luminaires within the suspended ceiling shall be in heat resistant flexible cable from a klic type socket mounted to the soffit or unistrut.

All luminaires mounted within the suspended ceiling grid shall be provided with additional support so that the ceiling is not supporting the weight of the luminaire.

Cabling size and type shall be as per circuit distribution board schedules in appendices at the back this specification.

Some of the lighting shall be controlled by PIR occupancy detectors as indicated on the drawings. In order to obtain the best coverage the final location shall be in accordance with the manufacturer's instructions and advice.
The lighting control shall be either presence or absence control as noted on the drawings, for absence control the lights shall be manually turned on by the staff entering the room and timed off by the lighting control when no presence is detected for a set time (time to be confirmed by the library staff).

Where presence detection is noted on the drawings the lighting shall be PIR and photocell controlled (presence). The toilets shall be PIR controlled.

The lighting control system shall be manufactured by Ex-Or.

External light fittings shall have their own in built microwave and photocell control. Light fitting denoted with an “E” shall be 3 hour emergency light fittings.

4.2.12 EMERGENCY LIGHTING INSTALLATION

Emergency lighting shall be provided by means of maintained dedicated emergency light fittings as shown on the drawings. All the emergency lighting shall have local test key switches located at the distribution board. A drawing shall be displayed by the distribution boards showing the location of each emergency light connected to that board. Each emergency light shall have a clear label with black print fixed to it with the individual number of that emergency light fitting (DBH/EL001etc); this number is to appear on the drawing located by the distribution board.

4.2.13 FIRE ALARM SYSTEM

The Electrical Sub Contractor shall provide a new fire alarm system as shown on the drawings and as listed in this specification.
This shall include a new fire alarm panel, detectors, sounders, Audio and Visual alarms, call points and all cables and containment to provide a fully working system to L2 standard.

The new fire alarm panel shall be a Kentec panel with Hochiki devices.

The new fire alarm system shall be in accordance with BS 5839 part 1 L2 Design Standard.

The system shall comprise of the following equipment:

Detectors
Sounders and Beacons
Break Glass Call points
Input Output units
Fire alarm Panel

The system shall be wired in red sheathed 2.5mm² Firetuf enhanced fire resistant, zero halogen low smoke red coloured cable run in conduit drops and run on cable tray as detailed in section 4.2.8 Containment. The cabling shall be installed within flush/chased conduit in the offices, staff room and in galvanised conduit where it drops to wall mounted devices in the other areas.

The Electrical Sub Contractor shall employ a fire alarm specialist to design, install, test and commission the installation upon completion of the works. Allow to liaise with specialist when carrying out any works to the system.

4.2.14 INTRUDER ALARM

INTRUDER ALARM
The Electrical Sub Contactor shall supply install a new supply to the security alarm system.
The intruder alarm system shall comply with PD6662: 2010 & EN50131-1:2006 and in accordance with NSIGold Codes of practice & BS8243:2010, Grade two. The system shall be designed to provide perimeter detection supported by internal trap detection.

The system shall consist of:-
Galaxy intruder alarm control panel c/w power supply and back up batteries.
Zone expansion modules powered/unpowered and back up batteries.
One, entry/exit keypad.
Grade 2 door contacts.
Grade 2 Passive Infrared detectors.
One, internal alarm sounder.
One, external alarm sounder.
Grade 2 Dual comm remote signalling.

The Electrical Sub Contractor shall employ an intruder alarm specialist to design, install, test and commission the installation upon completion of the works. Allow to liaise with specialist when carrying out any works to the system.

4.2.15 DATA SYSTEM

The Electrical Sub-Contractor shall supply and install the data system containment and wiring, as detailed in section 4.2.8 Containment. The data cables shall be installed within flush/chased in PVC conduit where it drops to wall mounted devices in the offices and conference room or in surface galvanised conduit or trunking in the plant areas or run in dado trunking along the walls. Above the ceilings the cables shall be installed on cable basket.

The data cable that will be installed is Cat5e low smoke zero halogen; the Electrical Sub-Contractor shall allow for this in the routing and sizing of the containment.

The Electrical Sub-Contractor shall install the data cables from the master socket to all the locations as shown on the drawings, the Electrical Sub-Contractor shall also install all the back boxes face plates and terminations.

Al the data cables shall be labelled in a logical sequence around the building.

4.2.16 WIRING IN CONNECTION WITH MECHANICAL SERVICES

The Electrical Sub Contractor shall supply and install the wiring and isolation to the items of mechanical plant as shown on the drawings, the wiring shall include all extract fans, water conditioning devices, immersion heater, fan convectors, air source heat pump, hot flow unit and heating manifold pumps.

All interlinking wiring and wiring of ventilation PIR's shall be by the controls specialist employed by the mechanical contractor.

Allow for all necessary liaison with the mechanical contractor and specialist contractors to obtain copies of all wiring diagrams and exact locations of mechanical equipment.

4.2.17 EARTHING & BONDING

Provide all necessary main, supplementary and equipotential earth bonding as required by BS 7671 and as shown on the drawings.

All sinks, mechanical services pipework and duct work, a/c units casing etc shall be supplementary bonded using 4mm² green/yellow sheath cabling and appropriate bonding clamps.

Ensure all new containment systems are linked using earth leads or earth tags to provide continuity.

4.2.18 TESTING & COMMISSIONING

Testing and commissioning shall be implemented upon completion of works, as required by BS 7671, record Zs test readings for extraneous metalwork on the As Installed drawings.

Test Certificates shall incorporate the test results for all testing including reports or documents as necessary. Provide NICEIC approved test sheets for the complete electrical installation.

Fully test the fire alarm system in accordance with BS 5839 and provide documentation/certificates.

Fully test the emergency lighting installation in accordance with BS 5266 and provide documentation/certificates.

4.2.19 LABELLING

- In addition to the labelling requirements of BS 7671 the following labelling shall be implemented,

- Distribution boards – reference number using engrave labels fixed with screws and nuts
- All Electrical accessories socket outlets, lighting switches, fused connection units, isolators etc. – circuit reference i.e DBC/LTG/1L1
- Sub-main Cables – Indicating what it is feeding using traffolyte labels every 3 metres along the length of the sub-main.
- Final circuit cables shall labelled with ferrules.
- Include for providing labels to final circuit cables identify phase (L1, L2, L3) and neutral (N) conductors, in compliance with BS7671 and NICEIC guidance notes.

4.2.20 RECORD DOCUMENTATION

- Provide record documentation as outlined in clause 3.7.

- The Contractor shall detail on drawings the primary containment routes and sizes.

PART THREE
TECHNICAL CLAUSES

INDEX
PART THREE - TECHNICAL CLAUSES

INDEX (CONT.D)
SECTION THREE - TECHNICAL CLAUSES

PART THREE
TECHNICAL CLAUSES

3.01 GENERAL CONTRACT AND TENDERING RESPONSIBILITIES

The Sub-Contractor shall execute the works generally in accordance with the following clauses in this Section of the Specification. Nothing in the following clauses, however, shall alleviate the Sub-Contractor from his overall responsibility for the quality of workmanship during the execution of the works. If any portion of these clauses is inhibitive to the satisfactory execution of the works, it shall be brought to the attention of the Engineer in writing prior to commencing the works.

3.02 QUALITY

All workmanship and materials shall comply with British Standard Specifications and Codes of Practice, whilst also satisfying all recognised trade standards and in all instances meeting the requirements of the Engineer.

To ensure compliance with the Specification, the Sub-Contractor shall maintain on site during all working periods, a competent and qualified foreman having authority to take and execute site instructions relating to the electrical services works. Samples of materials and workmanship, as may be requested by the Engineer for consideration prior to overall progression of aspects of the works, shall be provided by the Sub-Contractor at a time to permit a decision to be made in advance of the relevant item causing any impact upon the progress of the works.

Paintwork finishes and equipment enclosures shall be in perfect order at the completion of the works and any item that does not satisfy the Engineer shall be replaced at total cost to the Sub-Contractor.

The Sub-Contractor shall be responsible for providing all general systems fixings, brackets, etc. and shall apply at least two coats of protective paint to all such items prior to any exposure to corrosion. Any item that deteriorates from not being treated as prescribed shall be replaced as directed by the Engineer, at no cost to the contract.

3.03 REGULATIONS

Each aspect of these installations shall, as appropriate, comply with: -

a) The current edition of the British Standard BS 7671, `Requirements for Electrical Installations', IET Wiring Regulations Seventeenth Edition, as issued by the Institution of Engineering and Technology, (known as the Wiring Regulations) including all amendments.

b) The current editions of the C.I.B.S.E. lighting and electrical guides.

c) Materials and workmanship shall comply with the requirements of the current editions of British Standard Specifications and Codes of Practice applicable to the works and materials referred.

d) The Regulations of the Local Authority and the Regional Electricity supply company.

e) The current edition of the CDM Regulations.

f) The current edition of the Building Regulations and associated approved documents.

g) The requirements of the District Surveyor's Building Control Department and/or independent Building Control Inspector.

h) CE Marking Regulations.

These Regulations shall be strictly complied with as shall the Offices, Shops and Railway Premises Act, The Factories Act, Government Wages Resolutions and the Health and Safety at Work etc. Act and the Electricity at Work Regulations.

3.04 SYSTEMS IDENTIFICATION

Engraved traffolyte labels, secured with chromed round head bolts, self-tapping screws, nylon bolt rivets or by any other agreed means shall be provided by the Sub-Contractor to clearly identify:-

a) Presence of hazards.

b) Referencing of Control devices and electrical control and switchgear.

c) Warning that maintenance attention is required, clearly defining the action required.

Every electrical distribution board and consumer unit shall be provided with:

a) An electrical warning label screw fixed to the outside of the distribution board or consumer unit (yellow label with black lettering showing a black triangle containing an 'electrical flash').

b) A screw fixed, black label with white lettering giving the designation of the distribution board or consumer unit and where it is fed from.

c) An identification chart showing the circuit ways, protective device ratings and cable sizing (both sub-circuit and sub-main). These charts shall be typed on white card, and shall be contained inside the front cover of the board within a transparent protective envelope or laminated.

Every main and sub-main cable shall be provided with a printed label identifying the cable size, number of cores, source of supply and destination. Labels shall be applied to a carrier plate and tie-wrapped to the cable at source, destination and at all places where the cable passes through compartment walls.

3.05 SUPPRESSION OF INTERFERENCE AND NOISE

All electrically operated equipment shall be provided with suppression sufficient to reduce all electromagnetic interference within the limits set by the Authorities.

The Sub-Contractor shall further be responsible for ensuring that all plant and equipment utilised, both during the period of the installation works and also all equipment installed as part of the electrical systems, shall be attenuated to within recognised environmentally acceptable sound levels. All works shall conform to the Control of Pollution Act, 1974: with all current amendments.

3.06 PROTECTION OF WORKS

Until formal acceptance of the Contract Works by the Engineer, the Sub-Contractor shall bear full responsibility for protecting all plant and equipment, both stored and installed, to prevent any damage being sustained.

Any damage suffered by the installations shall be rectified at the expense of the Sub-Contractor, in a manner to satisfy the Engineer.

3.07 NOTICE PRIOR TO COVERING UP

Notice shall be given in reasonable time by the Sub-Contractor, to the Engineer, whenever any works or materials are intended to be covered up by earth, lagging, structural duct covers, walls, floors, ceilings, building in or otherwise.

3.08 SWITCHBOARDS

Not Applicable

3.09 BUS BARS

Not Applicable

3.10 FUSE SWITCHES, SWITCHES AND ISOLATING SWITCHES

Fuse switches, switch fuses and isolating switches shall be metal-clad with an oven dried enamel finish, have un-switched neutrals unless specified otherwise, be suitable for 500 Volt operation and be constructed to comply with BS EN 60947. The front access panel shall be hinged and gasketted and mechanically interlocked such that it is impossible to open with the operating handle in the `ON' position, or to energise the switched terminals with the access panel open, and shall include provisions for locking the operating handle in the `off' position.

3.11 DISTRIBUTION BOARDS AND CONSUMER UNITS - CONSTRUCTION

Unless specified otherwise in the descriptive section of this Specification, all distribution boards shall be metalclad with an oven dried enamel finish, be suitable for a 500 Volt operation and constructed to comply with BS EN 61439, Parts 1 and 2. Access shall be via front covers which shall be hinged and gasketted and Distribution Boards shall incorporate a facility for locking.

Distribution Boards shall be arranged for easy removal of the miniature circuit breakers, to enable cables to be drawn into the housing. Screw terminations that are readily accessible working from the front of the unit shall be incorporated, of adequate size for the cables specified. All live parts shall be shrouded and/or insulated against accidental contact during fuse or MCB operation.

The order of the allocation for distribution circuit ways/phase connection shall be maintained for the neutral bar, which shall also be referenced. An adjacent fixed label defining the neutral connections shall be installed for each Distribution Board, in addition to the Schedule of Distribution Ways.

Fusing shall be H.R.C. pattern to Class P or Q, unless specifically stated otherwise elsewhere in these documents. All fuses shall comply with BS HD 60269.

Where additional earthing terminals are required for compliance with Clause 543.7 of the Wiring Regulations, high integrity earthing for computer installations, an additional earth bar shall be added, if the existing provision is insufficient.

Where distribution boards are located on escape routes and/ or in domestic premises, they shall be of metal clad construction unless located in a fire rated builder's work enclosure.

Where metering is required it shall meet the requirements of BS 8431 and shall record those values detailed on the drawings elsewhere in this Specification. The meter shall be provide pulsed outputs and/or be network connected as detailed on the drawings elsewhere in this Specification

3.12 MOULDED CASE CIRCUIT BREAKERS (MCCB)

Not Applicable

3.13 MINIATURE CIRCUIT BREAKERS

Miniature circuit breakers shall be suitable for operation at 440 volts, shall fully comply with BS EN 60898, category of duty M6 or greater, as specified elsewhere in this Specification or on the drawings.

The type of miniature circuit breakers shall be as follows, unless specified to the contrary elsewhere in this specification or on the drawings:-

Lighting circuits Small power circuits (for general power supplies)	Type B MCBs
Motor starting Circuits exceeding 16 Amps Contactor controlled transformers Contactor controlled lighting banks	Type C & D MCBs

3.14 RESIDUAL CURRENT DEVICES (RCD)

Residual current circuit breakers shall comply with BS EN 61008 or BS EN 61009, and shall have the current rating, number of live connections and fault operating current specified elsewhere in this Specification or on the drawings.

Except where specifically identified elsewhere in this Specification, final circuits requiring residual current protection shall be protected by combined RCBOs or RCCBOs and NOT split distribution boards.

3.15 SWITCHBOARD OPERATORS MAT

Not Applicable

3.16 SYSTEM CABLING

Unless specifically stated elsewhere in this Specification or on the drawings, all cables shall be low smoke and fume type (LSF).

a) Non Armoured Single Insulated Single Core Cables

Unless specified elsewhere in this Specification, or on the drawings, single core cables, of the non-armoured type shall generally only be installed within protective conduits and trunking. Unless specified elsewhere in this Specification, such cables up to 10mm^2 shall comply with the requirements of BS 6004 for PVC thermoplastic insulated cables and cables 16mm^2 and larger shall comply with the requirements of BS7211 for XLPE thermosetting insulated cables. Stranded copper conductor cables shall be used except where specifically agreed otherwise in writing by the Engineer.

A minimum conductor size of 1.5mm^2 shall be used except where specifically identified elsewhere in this Specification or on the drawings.

For single phase circuits, single core cables coloured brown and blue shall be used. For three phase circuits, single core cables coloured brown, black, grey and blue shall be used.

Sheath colouring for special services shall be as particularly specified elsewhere in this Specification.

b) Insulated and Sheathed Cables

Where specified in the descriptive section or on the drawings, insulated and sheathed cables with copper conductors shall be used for general installations where little or no physical abuse is to be encountered and an economical installation is required. Such installations shall be limited to the following, unless particularly specified:-

i) Exposed metering tails which shall be phase identified by insulation colour.

ii) Surface clipped multicore cables (with cpc) installed through ceiling/roof voids or dressed to walls, either clipped to the surface, or buried within plaster finish after capping with plastic or galvanised steel protective channelling.

c) Armoured Cables

Cables shall be 600/1000 volt grade and shall comply with BS 5467 for XLPE insulated type. Conductors shall be stranded copper to BS EN 60228 and all neutrals on multicore cables shall have the same cross sectional area as the other live conductors. The armouring shall be either steel wire or aluminium alloy strip as specified with a final outer protective sheath.

The insulation applied to the cores of the cables shall be colour coded using core insulation colours in accordance with the IEE Regulations.

Glands shall be CW or CY type for cables terminated inside buildings and type EW or EY for those terminated outside and shall be fitted with shrouds. Where glands are not fitted to a threaded hole, a brass earthing ring shall be provides. The ring shall be bolted through the enclosure with an appropriately sized brass bolt with nut and shake proof washer and bonded by an appropriately sized lead.

Bends in cables both during and after the final installation of the cables shall comply with the Regulations.

All cable terminations shall be of the correct size to contain all of the strands contained in the cores of the cable. Under no circumstances will undercutting of cores, to permit ease of termination, be allowed. Where lug terminations are required or specified in the particular specification, they shall be of the compression crimped type manufactured from copper and shall comply with the procedures set out in BS EN 61238-1.

d) Mineral Insulated Cables

Not Applicable

e) Silicone Rubber Insulated Aluminium Sheath – Fire Rated

Examples of these cables are FP200 Gold and Firetuf, manufactured to BS 7629 and BS 6387 – CWZ Standard. The sheath shall be coloured white or red for fire alarm systems and white for emergency lighting systems.

Metal fire rated clips shall be used to secure the cabling – plastic clips or tie-wraps are unacceptable.

Immediately upon installation, the manufacturer's ferrules shall be installed to prevent possible damage to core insulation.

Cables in flush installations shall be enclosed in walls in flush mounted PVC conduit to enable cables to be withdrawn, if necessary.

At all times, the manufacturer's installation recommendations shall be followed.

f) Silicone Rubber Insulated Aluminium Sheath – Non Fire Rated

Not Applicable

3.17 CABLES APPLICATIONS

For the general installation of the foregoing types of cables, the following requirements must be met:-

a) Bending of Cables

The bending radius of cables shall not be less that the minimum bending radius shown in Table 3 of BS EN 50565-1 or Table G2 of IET Guidance Note 1 or the cable manufacturer's recommendation.

b) Cable Supports

Cables shall be supported at centres not less than those shown in Table 1 of BS EN 50565-1 or Tables G1, G3 or G4 of IET Guidance Note 1 or the cable manufacturer's recommendation.

To prevent collapse of wiring systems under fire conditions, where cables are installed in or cross escape routes, supports for cables shall be supported using metal fixings. This shall be achieved by either installing the cables on a metal cable tray; the use of metal cable ties or metal cable cleats.

c) Through Jointing Cables

No through jointing of cables will be permitted unless particularly specified elsewhere in this Specification.

Where specified, joints for armoured cables shall be made by means of crimped connectors and cold pour, resin compound filled joints to BS 6910-2.

d) General Termination of Conductors

At cable terminations, all conductors shall be fitted with phase identification sleeves of appropriate size and colour. Conductor ends of stranded cables for normal sub-circuit wiring shall be twisted together. However, sub-circuit stranded cables 4 mm² and 6 mm² shall be twisted and bound to fill terminal socket, unless flat clamp type terminals are utilised.

Solid conductor, and stranded conductor distribution cables to switchgear/starters and other terminal sockets of bore diameter exceeding 6mm², shall have crimped, cable lugs or thimbles which shall be of the manufacturer's recommended size and type for the appropriate conductor and application.

Gland plates receiving single core cables shall be non-ferrous. Steel gland plates may only be installed if they are split or cut between all circuit conductor glands.

e) Cables Drawn Into Conduits or Trunking

Where cables are to be drawn into conduits or trunking the maximum number of cables shall be calculated in accordance with Appendix A of IET Guidance Note 1 with an additional allowance of 15% space capacity

f) Installation of Cables in Cold Weather

Cables shall not be installed in ambient temperatures lower than those recommended by the manufacturer, unless specific measures, agreed with the Engineer, are employed.

3.18 WIRING SYSTEMS GENERAL BASIS

Wiring installations shall generally be of the loop-in type having live feeds looped at control switch positions and not at items of equipment. All circuitry shall comply with the diagrammatic formations shown on the drawings.

For all earthed A.C. supplies, care shall be taken to ensure that the line and neutral conductors of each circuit are installed via the same steel conduit, bushing trunking or metal sheath (i.e. Mineral Insulated Cables).

Any single pole isolator controlling a 2-wire circuit shall be installed to break the line conductor of the supply.

Where the fixed wiring installation is required to change to a flexible type at termination to equipment, the fixed wiring shall be terminated in a fixed screw clamp type connection block of appropriate rating, housed within a surface or flush round BS conduit box or galvanised adaptable box, as applicable.

The fixed wiring shall, unless particularly specified otherwise, be run in a concealed manner from the equipment isolator down to the connectors in the flush conduit box; which shall be located in the closest practical proximity to the equipment connection point.

Appropriate flexible single conductor cables shall be installed via KOPEX pattern, or equal approved LSF coated flexible conduit of sufficient length to permit any necessary movement and access to the fixed wiring terminals.

To reduce the protrusion from the wall caused by the flexible conduit, the latter shall terminate at the wall in a terminal conduit box, mounted flat on top of the flush connector block box, and having its back drilled and bushed for entry of the flexible cable tails. The terminal conduit box shall be complete with the appropriate lid.

Where free movement of an item of equipment is essential, the final connection shall utilise the appropriate multi-core flexible cable of sufficient length to not impede operation, complete with a compression type gland at each cable end.

This method of connection shall only be accepted where the flexible cable is not liable to receive any physical abuse in its particular surroundings and where flexible conduit/ armaflex cable would cause unacceptable resistance to movement.

All mains voltage wiring shall use the colour codes:-

Three Phase	Single Phase
L1 = Brown	L = Brown
L2 = Black	N = Blue
L3 = Grey	
N = Blue	

3.19 UNDERGROUND CABLES

Cables to be run underground shall either be run in ducts or directly buried. Only cable types suitable for use underground shall be used and only armoured and sheathed MICC cables shall be direct buried except where specifically noted on the drawings or elsewhere in this specification.

Unless otherwise stated on drawings or elsewhere in this Specification, underground cables shall be installed with the minimum cover as noted below.

Cable Type	Location	Cover
HV Mains Cables	In soft ground	750mm
HV Mains Cables	Under paved areas & roadways	900mm
LV Mains Cables	In soft ground	450mm
LV Mains Cables	Under paved areas & roadways	600mm
Communications Cables	Any	450mm
Other Cables	Any	600mm

Direct buried cables shall be laid on 100mm of soft sand and covered by a further 150mm of either soft sand or sifted soil. The remainder of the trench shall be back filled in compacted layers with a warning mesh or tape installed 300mm below the final ground level. Where indicated on the drawings or elsewhere in this Specification, concrete cable protection covers to BS 2484 or polymeric cable tiles shall be installed on top of the layer of soft sand/ sifted soil. The covers shall be of sufficient width to more than cover the cables below.

The routing of underground cables shall be carefully recorded by means of dimensions from fixed objects and plotted on the record drawings. Where called for on the drawings or elsewhere in this Specification, the routes of buried cables shall be marked on the ground be means of 600 x 600 concrete markers placed flush with the final ground level. The markers shall incorporate impressed wording appropriate to the cable(s) marked and have the details of those cables shown on an engraved plastic plate fixed into a recess on the marker. The details shall include the number, size and type of cables buried beneath. These markers shall be located within 2000mm of the position where cables enter a building, a distribution cabinet or similar; at each chance of direction and at intervals not exceeding 45m. Where cables enter a building, a similar engraved label shall be fixed to the building if possible or to an upright concrete cable marker.

The Sub-Contractor shall provide all covers, markers tapes etc. The trenching, providing and laying the sand, back filling, the installation of covers or tiles and the installation of markers shall be by the Main Sub-Contractor but the Sub-Contractor shall be responsible for ensuring compliance with this Specification. Where there is no Main Sub-Contractor, the Sub-Contractor shall be responsible for all aspects of the installation of underground cables.

3.20 UNDERGROUND CABLE DUCTS

Underground cable ducts for cables other that incoming cables belonging to the local electrical network operator shall be flexible or rigid, twin wall plastic ducts to BS EN 61386-24. Unless noted otherwise on the drawings or elsewhere in this Specification, cable ducts shall be coloured and installed with the minimum cover as indicated in the table below.

Duct Use	Location	Cover	Duct Colour
HV Mains Cables	In soft ground	750mm	Red
HV Mains Cables	Under paved areas & roadways	900mm	Red
LV Mains Cables	In soft ground	450mm	Black

LV Mains Cables	Under paved areas & roadways	600mm	Black
Street Lighting	Any	450mm	Orange
Communications Cables	Any	450mm	Green, White or Grey
Other Cables	Any	600mm	Black

Ducts for the local electrical network operator shall be to meet their specific requirements.

Where ducts are located under roadways, they shall be encased in a minimum of 400mm of mass concrete, well tamped.

In locations where ducts are only indicated for road crossings, the duct(s) shall extend a minimum of 1000mm beyond the edge of the road and any pavement. Ducts under roadways with shall be sealed to prevent the ingress of material. These seals shall be of the mechanical seal type with the facility to accommodate different sized cables and not to require the cables to be threaded through the seal.

Bends shall be 'easy' with a minimum radius of 600mm. All Ducts shall have a 6mm blue nylon draw rope installed and anchored to prevent it being pulled out accidently. A replacement rope shall be pulled in when cables are installed to allow for additional cables to be installed in the future.

The routing of underground cables ducts shall be carefully recorded by means of dimensions from fixed objects and plotted on the record drawings. Where called for on the drawings or elsewhere in this Specification, the routes of buried cable ducts shall be marked on the ground be means of 600 x 600 concrete markers placed flush with the final ground level. The markers shall incorporate the impressed word 'DUCT'. These markers shall be located within 2000mm of the position where ducts enter a building, a distribution cabinet or similar; at each chance of direction, at intervals not exceeding 45m and either side of any road crossing.

Cable draw pits/access boxes shall be provided as follows:

a) at changes of direction where bends are inappropriate
b) at the junction of duct routes
c) within 3000 of a duct terminating in a building unless the duct terminates in a cable trench inside the building
d) at least every 40m
e) where indicated on the drawings

Except where noted on the drawings or elsewhere in this Specification, cable draw pits/access boxes shall be of modular construction and manufactured from polypropylene. They shall have composite covers to BS EN 124 Class B125 when located in soft landscaping and ductile iron covers to BS EN 124 Class B125 when located in paved areas. A minimum of one set of lifting keys for each cover type shall be handed over to the Client.

The Sub-Contractor shall provide all ducts, draw ropes, markers draw pits etc. The trenching, laying of the ducts and installation of draw pits, back filling and the installation of markers shall be by the Main Sub-Contractor but the Sub-Contractor shall be responsible for ensuring compliance with this Specification. Where there is no Main Sub-Contractor, the Sub-Contractor shall be responsible for all aspects of the installation of underground cable ducts.

3.21 FLEXIBLE CABLE APPLICATIONS

For applications requiring the use of flexible cables, where an electrical connection to an item of equipment will be subject to regular movement, or where problems of heat dissipation dictate the necessity to change from normal fixed wiring to heat resistant cable, the following Schedule of appropriate type of cable shall apply, all cables complying with the appropriate British Standard (generally BS EN 50525):-

i) High Ambient Temperatures

Connecting cables run within spines of fluorescent fittings and through conduits to fixed appliances in areas subject to ambient temperatures up to a maximum of 85 degrees C shall be single core heat resisting Butyl insulated and sheathed cables of an appropriate rating for the equipment load and protection.

ii) Medium Ambient Temperature

Multicore connecting cables required to be run in unprotected form to moving or movable items of equipment from adjacent fixed terminals, where the item of equipment to be connected is operating at temperatures up to a maximum of 60 degrees C, or in similar ambient temperatures, shall be vulcanised rubber insulated tough rubber sheathed cables of the appropriate rating for the equipment load and protection.

iii) Domestic Equipment

Connecting cables required to be run from normal domestic portable items of equipment to plug tops and where no heat problem applies, shall be unkinkable domestic (UDF) flexible cord of the appropriate rating for the equipment load and protection.

3.22 PENDANT SUSPENSION

Flexible cables which will also form a means of suspension from a ceiling rose of a pendant type lighting fitting of weight not in excess of 3 kg shall be LSF insulated multicore and sheathed, rated to the circuit protection.

3.23 STRUCTURED CABLING INSTALLATION

Structured cabling for voice/data installations shall be to standard of Cat 5e or Cat 6and shall comply with BS EN 50173. Unless otherwise specified cables shall be of the Unshielded Twisted Pair type (UTP)

The installation shall be tested to ANSI/TIA-568 standard.

Where cables are installed on cable basket they shall be bundled together and secured using soft ‘hook and loop’ cable ties. Where cables are installed in or cross escape routes and it is necessary to install the basket inverted additional metal cables ties shall be installed to prevent the cables collapsing under fire conditions but these must not be pulled tight.

3.24 METAL AND PVC CONDUIT SYSTEMS

Conduits shall be formed into required sets and bends using bending machines fitted with the appropriate sized formers of radii to suit the conduit concerned. Manufactured bends shall only be used at the Engineer's written instruction.

Inspection type `tee' and elbow' accessories shall not be used other than with the Engineer's written permission.

The system of conduits shall be so arranged to permit and facilitate easy installation of all wiring on the `loop-in' principle, after completion of the conduit installation.

Not more than two right angle bends, or a 10 metre run, shall occur between cable draw-in points which shall generally be the accessory outlet boxes. Any intermediate draw-in boxes required shall be agreed on site with the Engineer, their location being recorded on the `Record' Drawings.

Conduits installed flush in walls shall be secured by means of heavy gauge crampets; multi-conduit runs being spaced a minimum of 12 mm apart and chased to a sufficient depth to permit a minimum of 6 mm cover with cement/plaster of all crampets/conduits.

Conduits fixed to structural steelwork shall utilise purpose-made sprung steel self-grip clips, bolted clamps, or welded steel flanged which may then be drilled for fixings.

Conduits installed within floors and ceiling voids shall run generally either with, or at right angles to, joists or beams.

Conduits shall not be installed diagonally.

Conduits at right angles to timber joists requiring notching or drilling shall only be permitted for conduits up to 25 mm that are run within a distance of 300 mm from the load bearing wall supporting the joist.

Conduits shall be fixed with saddles at the manufacturers recommended spacing (not more than 1.5 metre centres).

Under no circumstances shall any structural steelwork or pre-cast concrete be drilled or cut to establish fixings, without the prior written permission of the Engineer.

Immediately on completion of erection of each conduit run, all exposed terminations shall be plugged effectively against the ingress of water and dirt. Where concrete is to be poured, seals of polystyrene waste shall be used. Such seals as are employed shall be maintained in good order for such time as necessary to complete wiring and connection of fittings.

3.25 METAL CONDUIT INSTALLATIONS

Metal conduits shall comply with the requirement of BS EN 60423 and BS EN61386 with no conduit of less than 20 mm diameter being used. Metal conduits shall be heavy gauge steel, welded and screwed, finished either black enamel or hot dip galvanised, as specified.

All accessories shall be heavy gauge metal type of matching finish, with all fixing/retaining screws/bolts of solid brass.

Metal conduit shall terminate at pressed/folded sheet metal enclosures, the conduits shall be threaded to receive a flanged coupler, to butt against the outer face of the metal box. The insertion of a male brass bush passing from the inside of the box, through the appropriate knockout, shall sandwich a lead compression washer, for a solidly formed metallic joint. All male brass bushes shall be heavy gauge type.

To ensure electrical continuity of the earth patch provided by the metal conduit/trunking system, the manufacturer's protective/paint finish shall be neatly removed at every joint/termination.

Damage to the finish of any length of metal conduit (including threaded sections) shall be made good by the application of a coat of rust inhibiting paint, of a type to be approved by the Engineer. Galvafroid paint shall be applied to damaged areas of galvanised conduit paying particular attention to exposed threaded sections.

All metal conduits buried in wall chases shall be painted overall after installation, with a coat of bitumastic paint.

3.26 PVC CONDUIT INSTALLATIONS

Rigid PVC conduits and fittings shall be heavy gauge, high impact grade Class 1 not less than 20 mm diameter and complying with BS EN 61386-21.

The PVC conduits shall be supported at not less than 1000 mm centres and at either side of boxes and bends by PVC spacer bar saddles. Expansion couplings and accessible draw-in boxes shall be incorporated in straight lengths of PVC conduit in excess of 5000 mm.

Not more than two 90 degree bends shall be installed in any length of PVC conduit without an outlet or accessible draw-in box. Bending and setting shall be carried out without distorting the PVC conduit, strictly in accordance with the manufacturer's instructions.

PVC conduit outlet boxes shall be the standard circular type and draw-in boxes shall be with circular or adaptable types. Inspection type bends and tees shall not be used.

PVC conduit boxes shall have securely anchored threaded brass insets for fixing outlets or plain covers. Standard circular boxes shall incorporate female conduit entry spouts.

Where PVC conduits terminate in unspouted entries the end of the conduit shall be fitted with a coupler and secured through the entry with a smooth bored PVC male bush.

All PVC conduit boxes and accessories boxes shall be securely fixed with not less than two rust protected screws and shall be fitted with a terminal for the termination of not more than three earth continuity conductors.

Jointing of PVC conduits and fittings shall be with PVC solvent strictly in accordance with manufacturer's instructions.

No PVC conduit smaller than 20 mm diameter shall be installed without the written consent of the Engineer.

The maximum number of cables drawn into any one PVC conduit shall not excess 80% of the maximum number of cables shall be calculated in accordance with Appendix A of IET Guidance Note 1 with an additional allowance of 15% space capacity.

PVC conduits shall not be installed in, or cross escape routes.

3.27 ADAPTABLE BOXES

Adaptable boxes for metal conduit systems shall generally be manufactured from sheet steel or cast iron and shall be galvanised cast iron type with heavy duty lids made watertight where used externally. Adaptable boxes for PVC conduit systems shall be manufactured from rigid high impact PVC. Overlapping lids shall be provided where used on all flush installations, and barriers shall be provided where it is necessary to segregate services (earthed as necessary).

All adaptable boxes shall be adequately sized for the number and size of cables entering and leaving and for the largest size of conduit used.

3.28 CABLE TRAY

Cable tray shall be to BS EN 61537 and have a minimum 13 mm return edge at each side, shall be installed spaced 25 mm from wall or ceiling, and be supported at not greater than 1 metre intervals to limit deflection. Where cable tray drops to remote items of plant it shall be braced by a suitable length of 40mm x 40mm support channel securely anchored at floor and ceiling.

Cable tray shall be installed using factory formed bends and, when cut sections are used for sets, they shall be free of sharp edges and raised welds. Cut ends shall be painted with Galvafroid to maintain the galvanised protection of the material.

Cables run on cable tray shall be anchored to the tray at not greater than 600 mm intervals using purpose made saddles, brass nuts and screws or proprietary forms of plastic cable clips, saddles, straps, etc. where ambient temperatures are not expected to be high.

Wherever more than two mineral insulated cables or armoured cables follow the same route or require excessive sets to be dressed to walls, they shall be installed on the appropriate width galvanised perforated cable tray.

3.29 METAL CABLE TRUNKING

Cable trunking shall generally be used where detailed on the drawings or in the Descriptive Section of this Specification, and at the Engineer's discretion in lieu of multiple conduit runs where the Sub-Contractor requests to do so at no extra charge to the contract.

Metal cable trunking and accessories shall be manufactured from zinc plated steel sheet and shall comply with BS 4678. It shall be completely free from all sharp projections and edges, and shall be of a minimum thickness as follows:-

i) 1.2 mm for sizes up to 50 mm x 50 mm trunking,
ii) 1.6 mm for sizes between 50mm x 50mm and 100 mm x 100 mm,
iii) 2 mm for larger sizes.

Metal cable trunking shall be joined for forming to the required length and set by using manufacture's matching fittings, which shall all be jointed in turn using internally fitted flange plates, tightly fitting to butt to the three inner plain sides and be bolted together in a secure manner completely free of internal metal bolts. All such fittings must be installed entirely to the Engineer's approval.

The metal cable trunking lid shall be overlapping and shaped in a manner ensuring it is easily removable, yet giving stability of shape to the trunking section.

Manufacturer's fittings shall be of easy sweep internal bend type and the metal trunking shall be supplied complete with cable retaining straps. Where vertical runs in excess of a 3 metre vertical distance are installed, the trunking shall be fitted with pin racks at not greater than 1.5 metre intervals, to support the cables.

Continuous runs of metal trunking used for suspension of luminaires shall be joined with long span flanged connectors to permit reduction of support interval.

Where metal trunking passes through floors or through fire barriers, internal fire barriers of fire resistant fibre glass, or purpose made fire barriers to suit the fire rating of the barrier/floor installed as per the manufacturer’s instructions, or similar shall be installed at each floor or barrier position. Expanding foam shall not be used inside cableways. The trunking shall also be provided with a separate section of lid where it passes through the barrier.

Internally fitted copper earth bonding links shall be supplied and fitted at every metal trunking joint. As a safeguard against loss or earth continuity, a separate earthwire, of a size determined by the largest cable installed within the trunking, shall be installed and bonded to the earth point of each outlet fed from the trunking, and subsequently bonded to the earth point of the distribution board or switchgear concerned.

Any part of the metal trunking received damage to its finish during installation, shall be cleaned and coated with a rust inhibitor, primed and painted to match the manufacturer's trunking finish.

This procedure shall be rigidly followed, for the completed installation to appear neat and of overall matching finish.

All cable trunking shall be installed in a neat and orderly manner utilising secure fixing methods.

All trunking runs shall terminate in blank end accessories. Flanged collars shall be used where trunking to metal enclosure joints are required.

With the Engineer's written approval, it shall be permitted to fabricate certain sections of trunking sets on site. These shall be welded at all joints without any deformation of the trunking shape, and all bends, etc. shall be fully radiused.

Except in the case of purpose made lighting trunking, or bus bar carrying trunking, it shall not be permitted to install trunking with the lid facing down.

Where metal trunking is securely fixed in a continuous run to parts of a structure that is liable to movement by expansion and/or contraction, such trunking runs shall incorporate a flexible coupling, of a type fully approved by the Engineer. The installation of such a flexible coupling shall incorporate an earth continuity bonding lead connected to fixed terminals fitted within the trunking body, either side of the coupling.

3.30 PVC CABLE TRUNKING

PVC cable trunking installations shall be carried out using the equipment specified in the Descriptive Section of this specification or on the drawings. PVC trunking and fittings shall be manufactured from high impact heavy duty PVC to comply with BS 4678 and be cuboid in section with clip in self-retaining lid. The PVC trunking systems shall be of colour specified and shall be installed in full compliance with the IEE Regulations.

The Sub-Contractor's attention is particularly drawn to the trunking manufacturer's recommendations on expansion of the PVC trunking system. PVC trunking runs shall be surface fixed or concealed within the building finishes as specified.

All PVC trunking accessories and fittings shall be purpose made and the same manufacture as the PVC cable trunking. Where, due to practical difficulties, this is not possible the Sub-Contractor shall provide written assurance and details of the alternative accessories and fittings are compatible with the main system and that the contact adhesives used will not result in chemical deterioration of the materials.

All cable trunking shall be installed in a neat and orderly manner utilising secure fixing methods. Cable trunking shall not be installed with the lid facing down.

All trunking runs shall terminate in blank end accessories. A separate earthwire, of a size determined by the largest cable installed within the trunking, shall be installed and bonded to the earth point of each outlet fed from the trunking, and subsequently bonded to the earth point of the distribution board or switchgear concerned.

Where PVC trunking passes through floors or through fire barriers, internal fire barriers of fire resistant fibre glass, or purpose made fire barriers to suit the fire rating of the barrier/floor installed as per the manufacturer's instructions, or similar shall be installed at each floor or barrier position. Expanding foam shall not be used inside cableways. The trunking shall also be provided with a separate section of lid where it passes through the barrier.

PVC cable trunking shall not be installed in, or cross escape routes.

3.31 EARTHING

The Sub-Contractor shall install a complete and effective system of earthing for the electrical installation. The system of earthing shall comply with the recommendations stated in the Wiring Regulations and BS 7430, and the requirements of the local electricity network operator.

All non-conducting metal work forming part of the electrical installation shall be effectively bonded to the earth continuity system. Similarly, other metalwork which, under fault conditions, could become live or constitutes an alternative earth fault return path shall be bonded to the earth continuity system.

Metallic services, including gas mains, water mains, dry risers, etc. entering or leaving the building or structure, shall be effectively bonded from their point of entry to the main earth box or terminal. Connections shall be made with purpose made clamps.

The effectiveness of the local supplementary bonding to the above building systems shall be demonstrated by electrical continuity tests, to the Employer.

The cross-sectional area of any earthing, bonding and circuit protective conductor (CPC) shall comply with the recommendations of the Wiring Regulations and (where applicable) with the P.M.E. requirements of the local electrical network operator. Except where described otherwise in this Specification, or on the Drawings, all earthing conductors shall be copper, manufactured in accordance with BS EN 13601 for strip and BS EN 13602 for cables.

Single core cables forming part of the earthing system shall be of stranded copper, insulated to 600/1000V standards with green/yellow PVC or XLPE insulated with LSF sheath. These cables shall comply with BS 6004, Table 5 for PVC insulated, or BS7211 for XLPE insulated.

The system of earthing may be provided by cable sheaths and/or armouring, where these are of adequate capacity for the passage of fault currents, except where detailed elsewhere in this Specification or on the Drawings.

Where separate CPCs or strip are employed, then these shall be installed along the route of their respective circuit conductors. Joints in earth system conductors, other than at terminal points, will not be permitted without the express approval of the Engineer.

Where metal conduit, trunking or cable armouring is employed as part of the earthing system then all joints, terminations and connections shall be constructed such as to afford a low impedance path for fault currents. All such joints and connections shall be suitable protected with an inert tenacious material to prevent deterioration caused by by-metallic or other corrosion.

Mechanical joints between aluminium and copper shall have joint faces smeared with a suitable compound such as `Denso' paste, before the connection is made.

Where conduits, or small glands for mineral insulated or armoured cables, terminate on switchgear, distribution boards, starter panels or other apparatus, the brass compression washers shall be used to ensure an effective earth connection.

Where connections are made between sections of trunking, then the manufacturer's earth continuity links shall be installed across the joint. Connections made between trunking sections crossing a building expansion joint shall be made with a flexible copper braid.

Sections of cable tray shall be thoroughly cleaned before overlapping and securing with a minimum of two screwed fixings. The remote ends of the cable tray shall be effectively bonded to the earthing system.

The armouring of plastic sheathed cables shall terminate in a suitable compression gland fitted with a purpose made earth tag. A suitable earth lead shall connect the earth tag with the

apparatus earth bar or terminal. The earth tag shall be manufactured from a high conductivity material compatible with the cable gland.

The armouring of metal sheathed cables shall be securely clamped to the gland at the cable termination with a purpose made bolted clamp. Any earth lead shall be installed to connect the armour clamp or gland fixing bolts to the apparatus earth bar or terminal.

In unheated areas, the armouring shall be suitable protected to prevent corrosion.

Where metal sheathed and/or armoured single core cables are employed, then earth bonds shall be installed at either end of the cable run and connected to the apparatus earth bar or terminal. These bonds shall effectively connect the sheaths and/or armouring of the single core cables.

Where unarmoured plastic sheathed cables are installed on metal cleats, then all such supports shall be effectively bonded to earth.

Where flexible conduits are installed, then a suitable P.V.C. or XLPE insulated CPC shall be installed and connected to the equipment at both ends of the flexible connection.

The earthing terminal of all equipment shall be connected to the CPC. Where the CPC is formed by conduit, trunking or the metal sheath and/or armouring of cables, then the earth terminal of the equipment shall be connected to the earth terminal in the box or enclosure associated with the conduit trunking or cable.

Connections between earth bars, equipment frames, etc. and stranded copper cables shall be made with the appropriate compression lug, bolt, washers, nut and lock nut. Connections between earth bars, equipment frames, etc. and copper strip shall be made with the appropriate bolt, washers, nut and lock nut. Contact surfaces shall be thoroughly cleaned and tinned prior to connection and washers shall be of sufficient size to prevent any distortion of the copper strip.

The diameter of fixing holes shall not exceed one third the width of the earth box or strip. Where a larger hole is required in an earth bar, then connection shall be made to a suitable copper lug welded to the bar.

Copper strip joints shall be riveted and brazed using hard silver solder and suitable copper rivets, four to a joint and not less than 6mm from the edge of the copper strip. The joints shall be made using zinc free brazing material with a melting point of at least 600°C. The amount of overlap between the two tapes to be jointed shall not be less than the width of the larger conductor.

3.32 HIGH INTEGRITY EARTHING FOR INSTALLATION WITH HIGH EARTH LEAKAGE

In areas where three or more computers are likely to be connected to the same ring main or radial final circuit, it is essential that the installation of the circuit protective conductor (CPC) is in accordance with Section 543.7 of the IET Wiring Regulations. Compliance with this section is required in order to avoid potentially lethal voltages on the protective conductor system, in the event of a break in the CPC. Compliance shall be achieved by the following : -

i) Installing socket outlets having dual CPC terminals so that the CPC can be installed as a ring which will remain effective in the event of a break or disconnection.

ii) Connecting both ends of the CPC ring into separate CPC terminals of the distribution board, including the provision of an additional earthing terminal bar, if the standard provision is inadequate.

iii) The minimum size of CPC connected in the above manner shall be 1.5 sq mm.

If the final circuit is not a ring main, but the leakage current is likely to exceed 10 mA, the requirements of Section 543.7 shall apply.

3.33 LIGHTING SYSTEMS AND LAMPS

The luminaires shall be installed in the approved manner at the mounting height and position specified. In any instances where the information is not clear, the Sub-Contractor shall obtain a ruling from the Engineer.

The Sub-Contractor shall include in his Tender for all adjustments to suspension tubes, chains, etc., that may be necessary to comply with the specified mounting heights.

All luminaires shall be thoroughly cleaned prior to erection and finally wiped when in position to remove finger-marks, etc.

Fixing and suspension plates shall be suitable for direct connection to BS conduit boxes, or as otherwise specified.

All `Discharge' type luminaires shall be provided with an integral capacitor for the purpose of power factor correction, and each luminaire shall be fused.

Break joint rings or `biscuit' rings of approved colour shall be provided for all suspended luminaires and fluorescent batten luminaires of the `slim' type where the batten is of insufficient clearance hole in the ceiling.

Ceiling roses fitted direct to conduit boxes shall be of the semi-recessed type and, if fitted to flush boxes, a break joint ring shall be provided.

Ceiling roses shall not be connected to fixed wiring in such a manner that one of the terminals remains live when the associated switch is off, unless that terminal cannot be touched when the ceiling rose is dismantled to the extent necessary for the replacement of the associated flexible cord.

All luminaires shall be efficiently earthed.

All lamps shall be of the correct voltage rating for the particular supply concerned.

3.34 FLUORESCENT LUMINAIRES

Not Applicable

.

3.35 EMERGENCY LIGHTING

Emergency lighting units shall be maintained or non-maintained, as indicated and shall be of the self-contained type except where specifically indicated.

Emergency lighting equipment shall comply with Industry Standard ICEL:1001 and systems shall comply with BS 5266.

Each circuit incorporating self-contained emergency lighting units shall include a tamper proof key switch, labelled ‘EM LTG TEST’, to simulate mains failure.

Except where noted on the drawings or elsewhere in this Specification, the test switch and neon indicator shall be incorporated within a multi-ganged, grid switch arrangement adjacent to the associated lighting switch for the circuit monitored.

In circuits where the normal lamp or a luminaire is arranged to operate as an emergency lamp under mains failure conditions, the test switch shall be connected to isolate the normal circuit, in addition to the emergency hold-off circuit, in order that the performance of the lamp in the emergency mode can be monitored with other lamps de-energised.

3.36 ACCESSORIES

Accessories shall generally comply with BS EN 61184, BS 5733, BS EN 60670 and BS 7288. BS EN 60309 shall apply for industrial socket outlets and associated equipment.

All accessories used in the installation shall be designed for the appropriate working voltage and be capable of withstanding double that pressure during any test. All fixing screws shall be rust proofed by sherardizing or other approved means. Brass fixing screws shall be used whenever possible.

All flush and surface mounted accessories shall have cover plates finished to the same quality and colour specified for that area, and shall be approved by the Engineer.

Where plates are installed adjacent to each other of two different manufacturers, the Sub-Contractor shall ensure that good matching is obtained.

Unless otherwise stated, socket outlets shall be wired on a ring circuit system and shall comply with BS 1363.

Unless otherwise specified, 13 amp fuses shall comply with BS 88-3.

3.37 FIRE ALARM SYSTEMS

Fire alarm systems shall comply with the requirements of BS 5839 and BS EN 54.

3.37.1 FIRE INDICATOR PANELS

The Fire Alarm system shall operate at 24 volts d.c.

Battery units shall comprise re-chargeable sealed lead-acid cells of adequate capacity to power the system under standby conditions for a forty-eight hour period and then immediately supply an evacuation alarm signal for a minimum of thirty minutes unless otherwise specified. When the mains supply fails, the battery shall immediately and automatically take over the system load.

The charger unit shall keep the batteries in optimum condition, having automatically variable charging rates, dependent upon the battery condition.

In the event of battery failure, the charger shall be capable of driving the entire system.

If necessary, the batteries and charger shall be accommodated in a separate sheet steel cubicle having lockable gasketted doors. Any indicator or warning lights, and instruments shall be mounted on a panel, arranged to be visible without the necessity to open the cubicle doors.

The systems shall incorporate zone and fault indicators.

A luminous indicator coloured red shall be provided on the indicator panel for each detector zone clearly labelled to demote the zone location.

Amber warning lights, operating in conjunction with a buzzer unit, shall denote:-

i) Mains supply failure.

ii) Battery failure.

iii) Zone wiring or equipment fault, which shall also cause the faulty zone indicator lamp to flash.

Each system shall be of the continuously monitored type to provide the above functions.

A minimum of two electrically separate audible monitored alarm circuits shall be provided, operating simultaneously.

3.37.2 ADDRESSABLE FIRE ALARM SYSTEMS

Where an addressable or analogue addressable fire alarm system is to be installed the location and type of each detector shall be carefully noted, together with its address reference. The system shall be programmed so that when an alarm is indicated at a detector the address reference, location and detector type are displayed.

The display details to be programmed for each detector shall be submitted to the Engineer for approval prior to completion.

The manufacturer's specific requirements in respect of loop length, cable type, quantity of devices per loop, device addressing and order of device connection (if appropriate) shall be strictly adhered to.

The loop number and address of each device shall be indicated on the record drawings.

3.37.3 FIRE ALARM BREAK-GLASS CALL POINTS

All break-glass call points shall be suitable for semi-flush or surface mounting and shall be supplied complete with hammers and chains, where necessary. The units shall be of robust material with good heat resistant characteristics which will not support combustion. Each unit shall be coloured `signal red'.

3.37.4 FIRE ALARM SOUNDERS

Alarm sounders shall be of the electronic type, unless specified otherwise elsewhere in this document, and shall be provided for fitting to various types of conduit box, or directly to a flat wall surface.

An audibility test will be carried out throughout the building under full working conditions, i.e. with plant running.

The wiring to all sounders shall be sized to minimise voltage drop to acceptable operating limits. The manufacturer's instructions concerning loading shall be strictly adhered to.

3.37.5 VISUAL ALARM DEVICES

Visual Alarm devices (VADs) shall comply with BS EN 54-23. They shall incorporate a white or red flashing LED indicator as indicated on the drawings or elsewhere in this Specification.

3.37.6 AUTOMATIC FIRE DETECTORS

Automatic detectors shall be manufactured to an accepted standard to operate on a two wire system.

They shall be factory set for sensitivity with no external moving parts or adjustments.

Each detector shall have an integral red indicator lamp or light emitting diode and the facility for wiring to remote indicator lamps. These indicators shall be illuminated in the event of the detector operating.

Where smoke detectors are installed in locations normally out of sight from corridors, galleries, etc. and extended flasher lamp unit shall be installed above the door to the room or space. These lamps shall flash when an alarm situation has been detected by the particular unit, and shall be installed for units in plant rooms, lift shaft, etc. as shown on the drawings.

3.37.7 MAGNETIC DOOR HOLDERS

Magnetic door holders shall comply with the requirements of BS 7273-4, and shall release on the following conditions:-

a) Operation of the fire detection and alarm system, which may be limited to the zone in which the door is located, whether by operation of a manual call point or activation of an automatic fire detector, unless specified otherwise elsewhere within this document.

b) Any failure of the fire detection and alarm system including system error.

c) Any electrical power failure, unless specified elsewhere within this document.

d) In the case of electronically locked doors, activation of a clearly labelled and identifiable manual release control, which shall be readily distinguishable from a fire alarm manual call point which shall be located adjacent to the doors.

Except where the hold-open device is combined with the door closer, the closer and the door holder shall be mounted at approximately the same height.

3.37.8 FIRE ALARM SYSTEM ZONE LOCATION CHART

A zone location chart shall be securely fixed in an easily visible location, adjacent to the Main Fire Indicator Panel.

The chart shall comprise an outline of the areas served by the particular indicator panel, suitably coloured and annotated to show the extent of each zone.

The chart layouts shall be drawn at a scale of not less than 1:100 and coloured to show the different zones.

Preliminary drawings of the proposed panel layout shall be approved by the Engineer prior to commencing production.

3.38 WIRING OF MECHANICAL SERVICES EQUIPMENT

The mechanical services systems are specified elsewhere in this Specification. This equipment shall be wired and connected to accord with the wiring arrangements shown on the Electrical Services drawings. The Sub-Contractor shall ensure that all conduits installed are suitable for the possible future installation of an additional 25% cables serving the Mechanical Services equipment.

The Electrical Sub-Contractor shall install all equipment and connect but not make live, until confirmed by the mechanical Sub-Contractor.

3.39 AUDIO INDUCTION LOOPS

Not Applicable

3.40 FIXINGS AND SUPPORTS

The Sub-Contractor shall supply and install all necessary fixings and supports, ragbolts, rawlbolts and plugs, studs, hangers and additional steel work necessary to adequately support all cables, cable trunking, conduits, cable trays, switchgear, luminaires, fuse gear and distribution boards, control panels, starters, etc.

Where installed within escape routes, the fixings shall comply with the requirements of BS7671 clause 521.11.

All items fixed by the Sub-Contractor shall be rigidly supported, fitted square and plumbed in line with the building features.

Fixing to brickwork shall be made in the bricks and not in the bond.

All holes shall be rotary drilled. If it is not possible to make all the fixings in the brickwork, then the equipment shall be positioned to enable the upper fixings to be made in the brickwork.

Woodscrews shall be sherardized and greased before use. Machine thread screws shall be of solid brass and greased before use.

Heavy equipment shall not be fixed by plugs or shot bolts without the written approval of the Engineer.

Approved purpose made clamp brackets, ragbolts or patent fixing galvanised bolts shall normally be used.

Exterior fixings shall be galvanised or similarly protected, and all loose nuts, bolts, washers, etc. shall be galvanised.

The supply and fixing of all supports, brackets, clamps and spacers or any other steel work, whether or not shown in details on the drawings or otherwise, which may be required for the proper and effective fixing of any equipment shall be considered to be included in the material and labour for the supply and fixing of that equipment unless this work is specifically detailed elsewhere.

The drilling, welding to, or cutting of, steelwork (structural or otherwise) shall be avoided. If such drilling, welding or cutting appears essential, the Sub-Contractor must first obtain the approval of the Engineer, before such work is undertaken.

Where cable or conduits pass through walls, floors, partitions or ceilings, the hole provided shall, after installations, be made good with cement or similar incombustible materials to the full thickness of the wall, floor, partition or ceiling.

The Sub-Contractor shall provide and install any ancillary supporting steelwork, cable trays, brackets, etc. necessary to support, in accordance with best current practice, all cables, conduits and trunkings, etc. This applies to all systems, whether such supports are called for in the Specification or shown on the drawings or not, and excluding only those cases where it is specifically stated that supports will be provided by others.

Fabricated brackets, etc. wherever possible, shall be welded in preference to the use of bolts. A 25% reserve margin in size and weight carrying capacity shall be made for any traywork installed.

All luminaires shall be supported from the structure of the building and not carried on the frame of the false ceiling, etc. The Sub-Contractor shall ensure that all supports are sufficient to carry the luminaires.

3.41 LIGHTNING PROTECTION

Not Applicable

3.42 ACCESS TO DANGEROUS VOLTAGES

The following precautions shall be incorporated by the Sub-Contractor throughout the installation:-

a) Any terminals which must normally remain live, such as the incoming terminals of mains switches, shall be shrouded such that accidental contact at any time is impossible.

b) All removable covers to switchgear, distribution boards, terminal boxes, etc. shall be bolted on so that they cannot be opened by hand.

c) All such covers enclosing H.V. and/or L.V. terminals shall be labelled in accordance with the EC directive with electrical warning triangle and the words `DANGER ..... Volts' in black on a yellow ground.

In addition, the Sub-Contractor shall note that warning labels shall be fitted to all contacts where a separate control circuit is used and which is not isolated by the particular contactor isolator.

3.43 TRANSIENT OVER-VOLTAGE PROTECTION

Transient overvoltage protection devices to meet the requirements of BS EN 62305-1 shall be provided to those incoming electrical services and those linking remote buildings, as detailed elsewhere in this specification or on the drawings.

Those devices for mains power protection shall be contained in the relevant distribution board or panel unless otherwise noted. Devices for data and signal protection shall be installed in the equipment enclosure where space can be made available or in a suitable separate enclosure. All devices shall be provided with a transparent window to allow inspection of the indicator lights.

A suitable sized earth bond shall be linked from the device to the local distribution board earth bar.

3.44 DISABLED PERSON'S ALARM SYSTEM

Not Applicable

3.45 NOTICES

At all main electrical distribution points, a notice shall be provided and hung in a conspicuous place giving full instructions for the method of treating persons suffering from electric shock in accordance with the latest of the Electricity (Factories Act) Special Regulations.

3.46 MAINTENANCE

The Sub-Contractor shall include for visits during the first 12 months following Practical Completion to carry out those tests and other procedures listed in the Operating and maintenance manuals. These tests and procedures shall include but not be limited to:

a) testing of the fire alarm system
b) testing of the emergency lighting system
c) checking the tightness of connections etc.
d) replacing failed lamps (lamps to be supplied by the Client)
e) correct operation of RCD devices

In addition, the Sub-Contractor shall record the visit and works carried out in the log books.

3.47 TESTING AND COMMISSIONING

Electrical tests shall be carried out to satisfy the requirement of the local electricity network operator, the Wiring Regulations and IET Guidance Note 3.

The Sub-Contractor shall also be in attendance at tests carried out by any Sub-Contractors, Specialists or Equipment Manufacturer.

The Sub-Contractor shall be fully responsible for the rectification of any damage caused and re-imbursement of any cost involving other persons that his faulty workmanship or incorrect interpretation of Specialist's advised requirements thereby involves.

Insulation tests ('megger' tests) on lighting circuits shall not be conducted with High Frequency ballasts, emergency battery packs, dimming equipment and other electronic equipment in circuit to avoid damage to components. Testing of these circuits shall be carried out after the luminaires have either been unplugged at ceiling roses, where appropriate, or totally disconnected.

The Sub-Contractor shall provide record sheets, in duplicate, of the results of earth continuity, loop impedance, insulation resistance, and all other particular tests of special equipment.

Every outlet point circuit, panel, etc. and each earth return path from every excess current device associated with the electrical installations, shall be scheduled and the appropriate test results clearly indicated on test sheets submitted to the Engineer.

Tests shall be witnessed by the Engineer as desired and the Sub-Contractor shall give reasonable notice accordingly (minimum of five clear working days) of any testing works from which the recorded results are to be taken, in order that he may arrange to be represented to witness such tests. Failure to advise shall make the Sub-Contractor responsible to repeat all such tests in the presence of the Engineer, or his representative, at the Sub-Contractor's own expense.

In addition to the above detailed tests, the Sub-Contractor shall include for proving all systems and measuring and recording the supply voltage at each distribution board, sub-main distribution position, etc. with all installed equipment operating, throughout the first month of full occupation of the building.

Installation Completion Certificates in the format prescribed by the Wiring Regulations shall be submitted to the local electrical network operator at least two weeks in advance of meters being required for any area.

Duplicate copies of all record sheets of system tests shall be handed to the Engineer prior to practical completion being certified.

3.48 BUILDERSWORK DRAWINGS AND WORKING DRAWINGS

The Sub-Contractor shall submit builderswork drawings and also working drawings of the various systems and installations as specified in the Descriptive Section of this Specification, in sufficient time to allow for the Engineer to comment upon the proposals and for incorporation of any such comments onto the submitted drawings prior to approval being given for inclusion of the proposals into the electrical services works.

3.49 SPARES

Not Applicable

3.50 RECORD DRAWINGS AND MAINTENANCE MANUALS

The Sub-Contractor shall keep on site one set of paper prints of all the electrical manufacturing and installation drawings as necessary to provide a complete record of the Contract Works. These drawings shall be kept in good condition and shall be marked up, at least once in each week, to show the progress of the work installed and shall incorporate all alterations, omissions, variations and amendments agreed during the progress of the works. The drawings shall be available at all times for inspection by the Engineer, clearly defining the detail and arrangement of all installed equipment and systems.

The Sub-Contractor shall provide copies of all record drawings and maintenance and instruction manuals of the various systems installed, in accordance with the following requirements:

Record Drawings	3 sets full sized paper prints
Record Drawings	3 sets A3 reduced size prints
Record Drawings	1 copy in AutoCAD Release 2014
Record Drawings	1 copy in pdf format on CD or DVD
Operating & Maintenance Manual	3 paper copies
Operating & Maintenance Manual	1 copy in pdf format on CD or DVD
Building Log Book	3 copies
Building Log Book	1 copy in pdf format on CD or DVD

One set of Record Documents shall form part of the CDM Regulations Health and Safety file and shall be incorporated into this document in a manner to be agreed with the Planning Supervisor.

The Operating & Maintenance manual shall clearly and fully describe to the staff that shall run the building, the operation of all systems, the manufacture and reference of all materials, the local stockists and services specialists for the various components of the overall installation, the periodicity/detail of the maintenance that the systems require.

The manual shall be produced with all pages in protective plastic envelopes and the document shall be overall finished in a fully labelled, hard bound cover. Any ring binders shall have 4 rings.

The Record Drawings (prints) shall be incorporated into the manual within protective plastic envelopes. CD or DVD discs shall be labelled with the project name and the Sub-Contractor's name and be similarly incorporated, within purpose made protective plastic envelopes.

Building Log Books shall be compiled by the Sub-Sub-Contractor in a form that fully complies with The Building Regulations, Part L2, and in accordance with CIBSE Technical Memorandum TM31.

The Log books shall incorporate information related to estimate energy users in the building so that actual energy use can be compared to the anticipated use. Energy use can be assessed utilising CIBSE Technical Memoranda TM22.

Draft copies of the Record Drawings, the Maintenance Manual and Log Book shall be submitted to the Engineer for approval, allowing sufficient time for comment and preparation of the final documents.

The above requirements shall apply to any sectional or phased handover in addition to the final handover.

The health and safety file should contain the information needed to allow future construction work, including cleaning, maintenance, alterations, refurbishment and demolition to be carried out safely. Information in the file should alert those carrying out such work to risks, and should help them to decide how to work safely. The file should be useful to:

a) clients, who have a duty to provide information about their premises to those who carry out work there;
b) designers during the development of further designs or alterations;
c) CDM co-ordinators preparing for construction work;
d) principal Sub-Contractors and Sub-Contractors preparing to carry out or manage such work.

The Sub-Contractor has a legal duty in respect of the health and safety file to supply the information necessary for compiling the file and should make sure that it is accurate, and provided promptly as the project progresses and the information becomes available. Not upon completion of the project. Only information likely to be significant for health and safety in future work need be included.

The Health and Safety file is to include information about each of the following where they are relevant to the health and safety of any future construction work. The level of detail should allow the likely risks to be identified and addressed by those carrying out the work:

a) buried services
b) sources of substantial stored energy
c) hazardous materials used
d) information regarding the removal or dismantling of installed plant and equipment (for example any special arrangements for lifting, order or other special instructions for dismantling etc.); the nature, location and markings of significant services, including underground cables; gas supply equipment; fire-fighting services etc; information and as-built drawings of the plant and equipment.

The Sub-Sub-Contractor shall note that it is a contract condition that all record documents are provided before Practical Completion of the project and before acceptance of any section of the works.

Appendix 1 - SCHEDULE OF SPECIFIED MANUFACTURERS

Item	Specification or Range	Manufacturer	Remarks
Distribution Boards	Type A complete with circuit breakers	Schneider, MEM or Hager	Complete with blanking modules etc. to provide a complete installation.
MCBs	MCB's Size and type as indicated on schedules	Schneider, MEM or Hager	
Cabling	As specification, schedules and drawings	BICC or similar	
Accessories -, FCU's, isolators, socket outlets, etc.	MK Logic Plus Range White and Metal clad back of house. Crabtree equivalent	MK Electric Ltd. Crabtree	Accessories -, FCU's, isolators, socket outlets, etc.
Standard Lighting Switches and faceplates	MK Logic Plus Range White, Grid plus and Metalclad back of house. Crabtree equivalent	MK Electric Ltd Crabtree equivalent	
Local Plug-in roses		MK Electric, MEM Ltd or Klik	
Earth Bonding Clamps	Suitably sized to match pipework.	Tenby	
Flexible Conduit	PVC sheathed steel cored water resistant	Kopex	
Conduits	PVC	Legrand/Walsall	
Cable Tray	MRF General Purpose	Legrand /Swift	
Cable Tray Submain	SRF Heavy Duty	Legrand /Swift	
Cable Tray Light Duty	Galvanised Steel	Legrand/Swift	
Channel Support	Galvanised Steel	Legrand/Swift	
Conduits	Galvanised Steel	Legrand/Swift	
Trunking	Galvanised Steel	Legrand/Swift	

Appendix 2 **Schedule of Luminaires**

AS LISTED ON THE DRAWINGS

Appendix 3 - Tender Drawings

Drawing Number	Drawing Title	Size	Scale
1320.01/E001	Ground Floor Proposed Lighting, Emergency Lighting & Fire Alarm Layout	A1	1:50
1320.01/E002	First Floor Proposed Power, Lighting, Emergency Lighting & Fire Alarm Layout	A1	1:50
1320.01/E003	Ground Floor Proposed Small Power & Ancillary Services Layout	A1	1:50

Appendix 4 – Electrical Tender Summary

See Separate Document.

Appendix 5 – Distribution Board Schedules

Prepared By:- Peter Quigley	Date:- 27/04/2018	Contract Grounds Workshop		Job Number:- SHEET. 1	123
Checked By:- PETER QUIGLEY	Date:- 27/04/2018				
Approved By:-	Date:-	Location PLANT ROOM			
Distribution Board 1		RATING 100	WAYS 18	POLES SPN	DIVERSIFIED LOADS

WAY	PHASE	DESCRIPTION	CABLE SIZE/CPC	MCB RATING	MCB TYPE	DIV %	AMPS			AMPS		
							L1	L2	L3	L1	L2	L3
	L1	Fan Convector circuit	1.5	6	RCBO	25%	6			1.5		
	L2	External Air Source Heat Pump	6.0 SWA	32	MCB	71%	32			22.7		
	L3	Hydro Box	2.5	16	MCB	81%	16			13		
	L4	Water Conditioner and Heating Manifold	2.5	16	RCBO	20%	16			3.2		
	L5	Sockets in Workshop Area	2.5	32	RCBO	10%	32			3.2		
	L6	Sockets in Office and Staff Area	2.5	32	RCBO	10%	32			3.2		
	L7	16 Amp socket in workshop	2.5	16	RCBO	10%	16			1.6		
	L8	16 Amp socket in Vehicle Store	2.5	16	RCBO	10%	16			1.6		
	L9	16 Amp socket in Vehicle Store	2.5	16	RCBO	10%	16			1.6		
	L10	External 16 Amp Socket	2.5	16	RCBO	10%	16			1.6		
	L11	Sockets Vehicle Store	2.5	32	RCBO	10%	32			3.2		
	L12	Lighting Loft, Staff Room, Showers	1.5	6	RCBO	5%	6			0.3		
	L13	Lighting Workshop & Vehicle Store	1.5	6	RCBO	10%	6			0.6		
	L14	External Lights	1.5	6	RCBO	10%	6			0.6		
	L15	Fire Alarm Panel	2.5	16	MCB	10%	16			1.6		
	L16	Spare		0	Blank	0%				0		
	L17	spare		0	Blank	0%				0		0
	L18	Spare		0	Blank	0%				0		
CONNECTED LOAD PER PHASE							254	0	0			
DIVERSIFIED LOAD PER PHASE										59.5	0	0