

The Maritime and Coastguard Agency (MCA is an Executive Agency of the Department for Transport. The MCA is responsible throughout the UK for implementing and developing the UK Government’s maritime safety and environmental protection policy. That includes co-ordinating Search and /Rescue at sea through Her Majesty’s Coastguard 24 hours a day, and checking that ships meet UK and international safety rules. The MCA work to prevent the loss of lives at the coast and at sea, to ensure that ships are safe, and to prevent coastal pollution: **Safer Lives, Safer Ships, Cleaner Seas.**

The MCA provides a full range of search and rescue, counter pollution, survey, inspection and enforcement activities and has 12 major business activities:

|  |  |
| --- | --- |
| Survey | Seafarers’ Services |
| Inspection | Search and Rescue |
| Enforcement | Pollution Response and Salvage |
| Ship Registration | Stakeholder Communication |
| Navigation Services | Ministerial Services |
| Strategic Prevention Design/Development | Regulatory Process |

These activities are supported by support services responsible for providing a range of administrative functions including; infrastructure, MCA people, financial management and administration and corporate management.

In accordance with the Equality Act 2010, in our capacity as a public body we have a statutory duty to eliminate unlawful discrimination, promote equality of opportunity and promote good race relations between people of different groups. Contractors will be expected to ensure that the service they provide promotes good relations between the MCA and its customers and does not directly or indirectly discriminate on the grounds of race in accordance with both the Act and the Duty.

You are invited to submit a tender for the following project:

**MCA REFERENCE TCA 3/7/1005:**

**LED office lighting MCA HQ, Southampton**

**General Requirement**

1. The Maritime and Coastguard Agency (MCA) is seeking to install replacement LED office lighting in its HQ Building in Southampton.

The Government has established targets in relation the reduction of greenhouse gases and as such requires to offset, on a cost effective basis, some of the electricity consumption associated with its major buildings. The total annual electricity consumption of the building is around 950,000 kwh and the Agency is seeking to offset this as far as possible through the use of LED Lighting

2. The total floor area of the building is 6226 m2. The building is made up of both administrative and operational areas.

3. The building was constructed in 1992 and consists of modern open plan office space over 3 floors with a conference facility and operational office located on the ground floor.

4. The full scope of works is detailed in Annex A of this specification and covers the replacement of the existing lighting. The works comprise of strip out, supply, installation, commissioning and setting to work of the lighting to the third, second and first floors.

5. The current ceiling grid is 500mm x 500mm, recessed lights and down lighters on floors 1, 2 & 3 operated by a Delmatic lighting control system across 3 floors.

The following lighting units are looking to be installed.

|  |  |
| --- | --- |
| **SCHEDULE LUMINAIRE REFERENCE**  | **DESCRIPTION**  |
| **A:** 900 units | Belviso C1 500 LED4000nw 34W Modular Recessed 500 x 500 mm White  |
| **B:** 166 Units | Inplana C07 CDP19 1000-840 9W Recessed Downlighter Ø 234 mm IP54 White  |
| **C:** 55 Units | Amatris G2 C04 WR LED2000-840 ETDD 01 24W Recessed Downlighter Ø 138 mm IP44 White  |
|  |  |

6. Site visits can be organised by arrangement. Requests should be sent via email to contracts@mcga.gov.uk

**Guarantee**

7. Once undertaken we would require a full design lay out together with any information relating to installation and any associated warranties as identified within Annex A.

**Training / Commissioning**

8. The system must be fully tested and commissioned to meet all legislative requirements.

9. A comprehensive, detailed handover with associated Operations and Maintenance must be provided to the MCA upon completion of the works.

**Delivery**

10. Final installation is required by 31st March 2017. Works are to undertaken between the hours of 7.30PM - 6.30 AM Monday – Friday and available 24hrs over weekends.

11. Suppliers should state in their tender the lead time for parts and installation and make clear the required timescales.

**Payment**

12. Payment shall be made upon satisfactory installation and commissioning of the system and will be subject to the receipt of a valid and correctly submitted invoice. The MCA pays undisputed invoices 30 days in arrears.

Contractors should note that the MCA has migrated its invoicing activity to the DfT Shared Service Centre (Swansea). Invoices should be provided with full supporting evidence of the goods provided to:

DfT Shared Service Centre

Arvato Bertelsmann

Sandringham Park,

Swansea Vale, Swansea,

Wales

SA7 0EA

**Submission of Tenders**

13. Tenders must be submitted by the deadline date stated in the Invitation to Tender letter, and in accordance with the Instructions to Tenderers. The MCA reserves the right not to consider any tender that is late or otherwise not in accordance with the Instructions to Tenderers. Tenderers must include as part of their bids:

1. The MCA’s Form of Tender, signed and dated by an authorised representative of the tendering organisation;
2. Lead time for both the preparation works and the installation.
3. A full system specification for the **LED lighting Installation**, including all major critical parts and assemblies, and a comprehensive method statement describing how the system operates. It is our preference that Tenderers take the time to answer these questions in the same order as listed here, rather than simply submitting printed literature. The Tenderer is requested to provide details on the following:
4. A breakdown of the system and its parts.
5. A design layout.
6. Installation programme.
7. Recommended Maintenance schedule (If applicable)
8. The expected life of the system, together with a projection of carbon savings over a period of 10 year period.
9. Length of warranty.
10. Commissioning & O&M’s.
11. Delivery timescale.

14. Despite these specific requirements, we would be open to alternatives or innovations which can be proven to achieve the same ends.

15. Although Tenderers may have all this information available on the internet or on printed literature, in order to assist the MCA with the evaluation process it is essential that the responses to the above questions be provided in the order set out above.

17. The Tenderer should submit their completed cost quotation for this work on the Pricing Schedule included within the tender documents.

**Sustainability**

18. The MCA is committed to sustainable procurement. This means making the necessary decisions to protect our environment and to operate its procurement activity in an economically, socially and environmentally responsible way. Tenderers should indicate ways in which their organisation promotes and practices sustainable development and how this can impact on this contract.

19. Consideration should be taken to account for the following areas;

* Origin and recycled/recyclable content of materials
	+ - Tenderers should detail the quantities used and recycled content of the product.
		- Recyclability of product once it has reached its end of life.
		- Type of paints and coverings used.
* Transport mode selected for freight
* Tenderers should detail options to identify and promote measures to reduce emissions during transport of goods. Including rail freight or low emission/fuel efficient heavy goods vehicles

20. More information on the environmental consideration can be found at:

<https://www.gov.uk/government/policies/making-sustainable-development-a-part-of-all-government-policy-and-operations>

<https://www.gov.uk/government/collections/sustainable-procurement-the-government-buying-standards-gbs>

**Selection** **Process**

**Evaluation** **Criteria**

Quality Score represents 60% of Total Scores Weightings

Compliance with the Technical Requirement 50%

Delivery Programme 20%

Sustainability 20%

Aftersales service & Technical assistance 10%

**Quality Points**

0 – Inadequate response

1 – Major weaknesses in the response

3 – Minor weaknesses in the response or detail missing

5 – Satisfactory response that fully meets the requirement and includes all relevant supporting evidence

Each Bidder’s Quality Score

Quality Score = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ x Weightings

 Highest Quality Score Possible for the Criterion

**Price**:

Price Score represents 40% of Total Scores Weightings

Overall cost 70%

Delivery cost 30%

**Lowest Bid Cost**

Cost Score = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ x Weightings

 Each Bidder’s Cost

TOTAL SCORE = Total Quality Score + Total Cost Score

**THE MCA INTENDS TO AWARD THE CONTRACT TO THE HIGHEST SCORING TENDERER**

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For definitions roles and responsibilities of all parties involved in the project refer to the contract preliminaries under the proposed NEC3 contract.

**1.4 CDM REGULATIONS**

The management of health and safety on this project is to be undertaken in conformity with the requirements of the Construction (Design & Management) Regulations 2015 (CDM Regulations) and the corresponding Approved Code of Practice.

A “design stage” project Health and Safety Plan shall be prepared and is included as one of the tender documents. This “design stage” health and safety plan fulfils the preconstruction design risk assessment obligations of the “Designer” under regulation 11 in Approved Code of Practice for the CDM Regulations and this draws attention to significant residual risks to health and safety identified during detailed design. It is not intended to identify all health and safety risks with which a competent Contractor should be familiar.

In all cases the Main Contractor shall develop the project health and safety plan in accordance with the requirements of the CDM Regulations prior to the commencement of works on site. This development of the plan shall set out the arrangements which, taking account of the health and safety involved, shall ensure, so far as is reasonably practicable, the health and safety of all persons at work on the project or that might be affected by the works. The consideration of health and safety risks in the Main Contractors development of the health and safety plan shall not be limited to those particular risks identified in the “design stage” health and safety plan but shall include consideration of all reasonably foreseeable risks. The development of the health and safety plan shall include the arrangements for the management of the construction works and for monitoring compliance by all persons with the requirements of relevant statutory provisions.

The health and safety plan must be adequately developed by the Main Contractor, as far as is reasonably practicable, allowing for any phasing of works, etc, in sufficient time to allow it to be submitted to the Principle Designer and design team for comment prior to the commencement of any works on site. In the case of phased works in the plan relating to the work content of any phase must be adequately developed and submitted for approval prior to the commencement of any work within that phase of the project.

Where the Contractor or any of his Sub-Contractors are involved in, or whose actions affect the design of any elements of the work they must co-operate with and provide information to the Principal Designer – in all cases in accordance with the designers duties under the CDM regulations.

All Contractors shall complete appropriate assessments of the risk to health and safety in respect of their works as required under applicable Statutory Legislation, including the management of health and safety at work regulations 1992, the control of substances hazardous to health regulations 1989 and Workplace (Health, safety and welfare) Regulations 1992.

The Main Contractor shall ensure that all Contractors are issued with copies of the project health and safety plan prior to the submission of their tenders and that they price for compliance.

The Main Contractor shall review, and revise as necessary, the project health and safety plan in line with any information received from Contractors or any changes in the requirements of the project. Any changes shall be promptly advised to all relevant Contractors, the CDM Coordinator and the design team as appropriate.

The Main Contractor shall be responsible for co-ordinating co-operations between Contractors, employees and self-employed persons who are at work on the construction of the project.

The Main Contractor shall ensure, so far as is reasonably practicable, that all Contractors, employees and self-employed persons conform to the requirements of the project health and safety plan and shall on request, provide proof of their health and safety competence.

The Main Contractor shall appoint a competent person on the site to manage health and safety during construction.

The Main Contractor shall ensure, so far as is reasonably practicable, that all persons employed on, or visiting, the site are adequately informed, instructed, trained, supervised and equipped such that they are able to carry out their duties safely.

The Main Contractor shall take the steps necessary to ensure that only authorised persons are allowed into any construction area.

The Main Contractor shall produce “as-built”/”as –installed” records during the course of his work, together with plant and equipment schedules and operation and maintenance manuals. He shall ensure that similar information is produced by all Contractors and Suppliers. This information is to be passed to the Principle Designer in sufficient time to allow them to compile this into a health and safety file, as required by the CDM Regulations, for handover to the Employer upon completion of the project or any intermediate phases of the project.

**2 PRELIMINARIES ASSOCIATED WITH ELECTRICAL SERVICES**

**2.1 GENERAL**

The Main Contractor shall comply in all respects with the overall preliminaries, preambles and contract conditions issued by the Design Team plus the following preliminaries set out in these sections which have specific importance to the Building Services Installation.

Before submitting his tender, the Main Contractor is advised to visit the site to be thoroughly conversant with the position, conditions, character and extent of the proposed Works and the means of access thereto, also storage space for materials, sheds and temporary offices. No claims arising from failure to do so will be considered.

The Tenderer must return a fully compliant bid which shall be deemed to be based on the specified products, listed in the schedules, specification and/or Tender drawings. The Tenderer may if he so choose also return an alternative bid for consideration listing any savings, substitute items, products and/or practices.

**2.2 CONTRACT WORKS**

The works for this project are being procured as an NEC3 Engineering and Construction Contract. The contractor shall provide a Non Productive Overtime cost for undertaking all of the works out of normal working hours

The Building Services Installation works will include but not be limited to the following:

* Removal and Disposal of the existing luminaires;
* Supply and installation of new luminaires;
* Commissions of new luminaire installation

The Electrical Services Contract comprises the complete replacement of the luminaires, the works including the following: -

* Validation;
* Enabling works/strip out;
* Builders Works including cutting and making good holes, pattresses, replacement of any damaged or additional ceiling tiles;
* Lighting installation;
* Testing and Commissioning;
* Client Training.

Where specialist packages are included under the Electrical Services Contract, the Main Contractor shall be responsible for the appointment and co-ordination.

Any work carried out to or which affects new or existing services must be in accordance with the Byelaws or Regulations of the relevant Statutory Authority.

The Electrical Services Contract shall include the supply, delivery, offloading, erection, installation, testing, commissioning and putting into operation of the whole of the services as detailed on the Electrical Contract Drawings, this specification, appropriate schedules and manufacturer’s drawings.

Any items shown on the tender drawings but not described in the Specification or described in the Specification but not shown on the tender drawings shall be provided within the Tender Sum.

In the event of any discrepancy between the tender drawings and the Specification, this shall be referred to the Services Engineer during the tender period. The Services Engineer’s decision will be final. Otherwise the more onerous level of specification shall be deemed to apply and likewise included for in the Tender Sum.

**2.3 CONTRACTOR DESIGN ELEMENTS**

The Contractor shall be responsible for the developing the design proposals contained within this specification and associated drawings and developing it in to a fully coordinated installation;

* Verify all equipment listed in the schedules and on the drawings;
* Re-design of any element of the work where equipment selected by the Main Contractor differs from that listed in the Specification or schedules;
* Verification of loads, cable sizes and protection device sizes, discrimination and fault calculations. Final settings for protective devices;
* Coordinate the building services with the building structure and fabric from record information and surveys carried out. The Main Contractor shall be responsible for liaising with all other subcontractors and ensuring the appropriate services are fully coordinated with the building structure and all base building existing services in the event of any clashes occurring during the design development of the working drawings;
* Final Builders work requirements;
* Final conduit selection and routes from primary containment runs;
* Coordination and interface compatibility with existing systems defined to be retained;
* Supplementary bonding.

Any potential co-ordination problems between elements must be brought immediately to the attention of the Services Engineer during the tender period. No claim for additional costs or an extension of time will be considered for works that could reasonably have been considered and allowed for during this period.

The Principle Designer will require copies of risk assessments/hazard identification for the elements of the works for which the Main Contractor is acting as ‘Designer’ in the terms of the CDM regulations.

These should also be sent to the Services Engineer via the Main Contractor to enable all designers to consult co-operate and reduce risk as required by CDM regulations.

The residual hazards to be incorporated into the Construction Phase Health and Safety Plan.

**2.4 CONSULTANTS DESIGN DRAWINGS**

Coordinated ceiling plan details will be prepared to the Services Engineer’s design requirements. These are the drawings that shall be used for all setting out and shall be the basis of any fabrication drawings.

A coordinated principle has been detailed on the Tender Drawings, however, it is the Main Contractors responsibility to fully coordinate the installation based on this principle or others agreed during the preparation of the Electrical Services drawings.

**2.5 CAD DRAWING STANDARDS**

The Tender Drawings have been produced using Autocad Version 2015. The Main

Contractor shall produce all drawings on CAD to a compatible Standard in either DXF or DWG format. Final details to be agreed with The Services Engineer PRIOR to drawing production.

**2.6 CO-ORDINATION OF THE WORKS**

The Contractor will be responsible for producing working drawings of the following areas;

* Floor Plans (min scale 1:50);
* Cores and risers including toilet blocks for each level (min scale 1:20);

Working sections at a scale no less than 1:20 will be prepared as necessary to demonstrate co-ordination of the installation with all other trades, structural elements and the building envelope.

The Contractor will submit the working drawings and sequence of erection of the installations to the Services Engineer for comment prior to commencing the work. Particular care must be exercised to ensure that obstruction of other services does not occur and access to other services for maintenance etc. is not restricted. The recommendations of BSRIA, CIBSE, equipment manufacturers and any safety requirements shall be followed in all cases.

The Main Contractor shall take his own dimensions on site for all plant and materials to be supplied by him and shall be responsible for the correct setting out and accuracy of dimensions and levels of his work. The Main Contractor shall rectify at his own cost any errors arising from inaccurate setting out.

The service routes indicated on the Tender Drawings do not necessarily detail the number of bends, sets of fittings or transformation pieces required for the installation. The Main Contractor shall be deemed to have made due allowance for all such works within their tender submission. This shall include coordination with structural elements, other trades and services including existing services where applicable, false ceiling construction elements, and the like. Variation claims and drawing re-measures on schemes where the design intent has not altered will not be considered.

The Contractor’s staff involved in coordination will be required to attend coordination meetings as requested with other Contractors. The coordination meetings will be called by and be under the direction of the Lead Coordinator. The purpose of these meetings shall be to:

* Define, sequence and programme the Main Contractors’ activities;
* Obtain information to produce the coordinated multi-service working drawings in sufficient time for him to comply with the programme for the execution of the works, with regard to installation;
* Carry out special investigation as may reasonably be required with regard to coordination and arrange for tests mock-ups of the installations or any other investigations as necessary;
* Give adequate notice in writing to the Project Manager for any drawings, levels or other information required for the purpose of fulfilling his coordination responsibilities.

**2.7 CONTRACTOR DRAWINGS**

**2.7.1 GENERAL**

The Contractor shall produce and submit all the drawings detailed in this specification for confirmation of compliance with the design intent.

The drawings shall be submitted in due time to allow comment, amendment and resubmission to suit the contract programmes and progress.

No responsibility shall be accepted by the Services Engineer for the failure of the Main Contractors to produce fully co-ordinated installation drawings in due time to maintain programme.

The Contractor (in all cases) will be responsible for the coordination of information flow from and between Services Contractors and shall issue these drawings as programmes and progress dictate.

 The Services Engineer will comment on the drawings in the following way:

* STATUS ‘A’ - Conforms to the design intent with no comments and can be released for construction;
* STATUS ‘B’ - Conforms to the design intent subject to comments and can be released for construction after incorporation of these comments;
* STATUS ‘C’ - Does not conform to design intent and must be re-drawn and resubmitted for comment to the Services Engineer prior to the installation commencing.

**Note:** return of installation drawings with a status does not alleviate the Main Contractor’s responsibility to comply with all aspects of the specific and general contract documents.

The Main Contractor shall be responsible for obtaining all necessary dimensions and information required for the preparation of his installation drawings, the Main Contractor shall be responsible for the overall programming of the drawing production and site works to ensure availability of all necessary site information to meet the requirements of the programme and progress.

The Services Engineer’s comments on installation drawings shall not relieve the Main Contractors of responsibility to provide equipment suitable in dimensions, construction finish and function for the location in which, and the purpose for which it is provided and installed.

The drawings to be prepared and provided by the Main Contractor shall be of recognised quality for their purpose and to suitable scales relative to their function and shall include adequate plans, elevations, sections and other views as necessary to provide satisfactory illustration.

The Main Contractors shall include the cost of all drawing production copies for distribution and any necessary revisions and re-issue within the Tender sum.

The Main Contractor shall notify the Services Engineer of any conflict between manufacturer’s drawings and the contract drawings prior to the placing of any orders and in sufficient time to have no programme implications.

**2.7.2 CO-ORDINATED WORKING DRAWINGS**

The Main Contractor shall prepare and submit (where applicable) working drawings dimensioned to a grid line, with invert levels as follows: -

* The location, including level if buried, of all Utility supplies provided within the Electrical Contract whether carried out by the Main Contractor or by the appropriate Utility together with the points of origin and termination, size, or any other relevant information;
* Single line schematic diagrams of each system showing all plant, equipment, terminal devices and components which are to be identified with a unique number and cross referenced to plant schedules;
* Detailed general arrangement floor plan layouts for every level at a scale of not less than 1:50 to indicate:
* Plant rooms, switch rooms, meter rooms and other plant space plans and sections to a scale of not less than 1:20;
* Ceiling/underfloor void sections at a scale of not less than 1:20;
* To 1:20 scale plan and sections of all service ducts/riser cupboards or any other small space that cannot provide adequate information at a larger scale;
* Survey drawings (where applicable) showing details of all existing services that shall either form part of the contract works or pass through the site to serve other areas including sizes, routes and invert levels.

An accurate record of co-ordination progress shall be maintained by the Main Contractor on site and a system for flow of information, detail drawing production, submissions for approval, issue for construction and programming identified along with resource and timescales required to meet the installation dates.

**2.7.3 BUILDERSWORK INFORMATION DRAWINGS**

Such drawings should include requirements for foundations, bases, lifting and supporting structure for plant or equipment, all holes in walls, floors and ceiling elements, provision of services requirements within voids above false ceilings or below false floors, the integration of the services installations into the false ceiling system, and trenches depressions, ducts, etc, in or through building and site elements.

General arrangement and floor plan drawings giving builderswork requirements shall be to a scale no less than 1:50.

Builderswork drawings for plant rooms shall be to a scale no less than 1:20.

In cases where preliminary builderswork and structural information has already been given by the Design Team, such information shall be confirmed and amplified as required above by the Main Contractor (including confirmation of equipment weights, size of access ways, etc) and incorporated on their drawings.

The builderswork drawings shall include access details into voids, risers, shafts and other enclosures for the subsequent operation and maintenance of the Building Services Installations covered by this Contract Package.

It is the intention that all holes, chases etc. shall be left in the building work as it proceeds and not cut out subsequently, except in so far as may be necessary due to subsequent authorized variations to the schemes. The Main Contractor shall therefore acquaint himself throughout the period of the Works and with the detailed construction programme and shall prepare the Builder’s Work Drawings in such order and at such times as to enable them to be commented on and issued early enough to avoid any delay to the construction works. Due account must be taken for any design input required.

**2.7.4 SHOP/FABRICATION DRAWINGS**

Shall mean the drawings produced for the purpose of explaining how the components of the designed works are to be fabricated and assembled.

**2.7.5 MANUFACTURERS AND EQUIPMENT DRAWINGS**

Shall mean the drawings of all items of plant or equipment produced by a manufacturer or equipment supplier indicating technical performance, principle dimensions, fixings, connections and all other relevant details.

Where manufacturers' original drawings are used they shall be specific to the Contract Works and all references to optional features, other machines of a range, etc, shall be deleted or the original drawings redrawn to comply with this clause.

Each drawing shall be stamped CERTIFIED by the Manufacturer that shall mean that:

* The drawing represents accurately the item concerned with correct dimensions and all connections precisely located;
* The item conforms to the specific description given in the Contract Documents, quoting the relevant reference numbers;

The item is shown complete and entire as it shall be supplied for the Works and no extraneous or alternative parts are indicated.

Individual and layout drawings for electrical components shall include wiring both internal and external to panels and controls.

All manufacturers wiring diagrams shall indicate clearly that wiring which forms part of or is connected to the equipment as delivered and shall include the following minimum information to enable the site connections and wiring to be completed:

* Maximum electrical loading for each power cable;
* Cable termination facilities;
* Cable identification and all terminal numbers;
* Inter-connections between different items;
* All manufacturers’ drawings shall be prepared on a CAD system as detailed previously.

**2.7.6 PROGRESS DRAWINGS**

The Main Contractor shall keep on site one set of drawings to show the progress of his work. This set shall be kept up to date by him and all lights, trunking, power, fire alarms and cable routes shall be clearly indicated thereon as they are installed and all modifications and variations to the Tender Scheme are to be shown on these Drawings.

The Progress Drawings shall be available for inspection at any time by the Services Engineer and the professional team. They shall not be used for any other purpose. These are essential to ensure an accurate record of the installation upon completion of the works.

**2.8 RECORD DRAWINGS**

Shall mean the drawings, diagrams and Schedules produced on CAD to provide an accurate record of the whole of the services as installed which shall:

* Fully indicate diagrammatically each individual system installed or modified, showing all plant and equipment and identifying it with a unique number cross referenced to equipment schedules and size of each cable or containment route;
* Identify all installed services on floor plans and sections to a scale of not less than 1:50;
* Show major items of plant and system controls including all field mounted equipment locations;
* Indicate plant room layouts, with sections, to a scale of not less than 1:20;
* Indicate on individual floor plans and sections to a scale of not less than 1:20 in difficult or congested areas, all building engineering services provided under the terms of the Electrical Trade Contract, fully identifying each service and fully indicating with accurate dimensions, the sizes and positions of all plant, coordinated services, equipment, conduits, trunking, under floor ducting, cable tray and cables, together with all inspection, test and maintenance points and cable joints;
* Indicate existing services and clearly demarcate between old and new installations.

Unless otherwise noted all drawings shall be prepared at a minimum of 1:50 scale, with larger scale details as deemed reasonable and appropriate by the Design Team.

The preparation of Record Drawings shall be a rolling programme of work as the installation proceeds - it must not be left to the last moment. The Design Team shall regularly inspect and monitor progress on the preparation of the Record Drawings.

Practical Completion will not be awarded without the receipt of final completed Record Drawings.

**2.9 OPERATING AND MAINTENANCE MANUALS**

**2.9.1 GENERAL**

Provide Operating and Maintenance Manuals that shall incorporate Instruction Manuals on detail requirements covering and including the information detailed below. The manuals shall include comprehensive information on the Health and Safety and CDM regulations specific to the works in the Contract.

**2.9.2 PREPARATION OF MANUALS**

The manuals shall be contained in A4 size, plastic covered, loose leaf, four ring binders with stiff covers, each indexed, divided and appropriately cover-titled. Drawings larger than A4 shall be folded and accommodated in the binder so that they may be unfolded without being in any way detached from the rings.

The manuals shall be returned with comments and, prior to Practical Completion full, final and approved sets shall be issued by the Main Contractor together with CD ROM’s of the entire manual, including manufacturer’s literature. Practical Completion shall not be awarded without the receipt of final Operating and Maintenance Manuals incorporating the Design Teams comments, in both hard and electronic versions.

The manuals shall include the following as an absolute minimum standard:

* A full technical description of each of the systems installed or modified, written to ensure that the Employer’s staff fully understands the scope and facilities provided;
* A technical description of the mode of operation of all systems;
* Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc., and marked with design duties;
* A photo-reduction of all record drawings to >A3< size, together with an index;
* Identification Legend for all colour coded services;
* Schedules (system by system) of all plant, equipment, cables, etc., stating their locations within the building, model type, duties and performance figures. Each item of plant, equipment, cables etc., installed shall have a unique code number cross referenced to the record and diagrammatic drawings and schedules;
* The name, address, telephone number and e-mail of the manufacturer of every item of plant and equipment together with catalogue list numbers;
* Manufacturer’s technical literature for all items of plant and equipment assembled specifically for the project, excluding irrelevant matter and including detailed drawings, electrical circuit details and operating and maintenance instructions (photocopies are not acceptable). Please note requirement for CD Rom information where available from manufacturers;
* A copy of all Test Certificates (including, but not limited to, electrical circuit tests, emergency lighting, fire alarm audibility and generator;
* A copy of all manufacturers’ guarantees or warranties;
* Starting up, operating and shutting down instructions for all equipment and systems installed;
* Control sequences for all systems installed;
* Schedules of all fixed and variable equipment settings established during commissioning;
* Procedures for seasonal changeovers;
* Detailed recommendations as to the preventative maintenance frequency and procedures that should be adopted by the Employer to ensure the most efficient operation of the systems;
* Lubrication schedules for all lubricated items of plant and equipment;
* A list of normal consumable items;
* A list of recommended spares to be kept in stock by the Employer, being those items subject to wear or deterioration and which may involve the Employer in extended deliveries when replacements are required at some future date;
* Procedures for fault finding;
* Emergency procedures, including telephone numbers for emergency services  Health and Safety issues.

**2.10 DRAWING TRANSMITTAL AND RECORD DOCUMENTATION DISTRIBUTION**

**2.10.1 GENERAL**

The Main Contractor must provide all the drawings and documents detailed in this specification for confirmation of compliance with the design intent. Distribution shall be as follows:

**2.10.2 DRAWING/TECHNICAL SUBMITTALS**

* Two copies direct to the Services Engineer for comment;
* Three copies direct to the Project Manager for general distribution.

The Services Engineer shall require an overall period of 7 working days from receipt of drawings/technical submittals to return of co-ordinated comments. The same period shall apply to any drawings that in the reasonable opinion of the Services Engineer require redrawing/development and re-distribution for comment.

The drawings shall be submitted in due time to allow comment, amendment and resubmission as necessary to suit the contract programme and progress.

**2.10.3 RECORD DRAWINGS**

* Two draft copies direct to the Services Engineer for comment four weeks prior to the Electrical contract completion date;

Two copies direct to the Project Manager for general distribution.

The drawings shall be returned with comments within 5 working days of receipt. Prior to practical completion full and final sets incorporating the Design Teams comments shall be issued by the Main Contractor together with CAD discs. Practical completion will not be awarded without the receipt of final completed Record drawings.

Final Distribution:

* One copy print and CAD disc direct to The Services Engineer for record purposes;
* Two copy prints and CAD discs direct to the Project Manager for general distribution.

**2.10.4 OPERATING AND MAINTENANCE MANUALS**

* Two draft copies direct to the Services Engineer for comment two weeks prior to the Contract completion date;
* One copy direct to the Project Manager for general distribution.

The manuals shall be returned with comments within 5 working days of receipt. Prior to practical completion full and final sets incorporating the Design Teams comments shall be issued by the Main Contractor together with CD Rom discs. Practical completion shall not be awarded without the receipt of final completed Operating and Maintenance manuals.

Final Distribution:

* One copy and CD Rom direct to the Services Engineer for record purposes;
* Two copies and CD Rom direct to the Project Manager for general distribution.

**2.11 MATERIALS AND PROTECTION**

**2.11.1 QUALITY AND WORKMANSHIP**

Unless otherwise specified all materials, plant and equipment, and the use and installation thereof, shall comply with the material, test and other requirements of the relevant British Standard Specifications, Codes of Practice, all relevant Institutional regulations statutory requirements and By-laws where applicable.

This Contract is based upon the named manufacturers listed in the Specification being used. Where there is a financial or programme benefit to the employer, the Main Contractor may select from the list of alternative manufacturers given in the Specification, but the acceptance of these shall be solely at the discretion of the Services Engineer.

The Main Contractor shall ensure that:

* Operatives are appropriately skilled, qualified and experienced for the type and quality of work to be undertaken;
* Components of the installation are fixed or laid securely accurately and in alignment;
* Particular care is taken to obtain uniform and tidy arrangements of cables, containment, switchgear, outlets and ceiling mounted equipment;
* Where not specified otherwise, fastenings comply with relevant British Standard;
* All moving parts operate properly and freely;
* No cutting, grinding or planning of pre-finished components and products takes place to remedy binding or poor fit;
* Materials, products and workmanship that are not fully detailed or specified are of a standard appropriate to the works and suitable for the purposes stated in or reasonably to be inferred from the Contract documents;
* All materials, products and workmanship are in accordance with good practice;
* Kite marked products are used where applicable;
* The environmental conditions are suitable for the installation and components.

**2.11.2 SOURCE OF SPECIFIED EQUIPMENT AND MATERIALS**

All materials shall be of British manufacture wherever possible or from other member countries of the European Community.

Should the Main Contractor propose using any products or materials that are manufactured outside the European Community, they shall submit details of each alternative of non-EC origin with their tender.

Any submitted foreign language documents must be accompanied by certified translations into English.

In such instances it is the responsibility of the Main Contractor to confirm and provide verification documentary evidence that the products or materials are equivalent in respect of (but not limited to) material, safety, reliability, function, compatibility with adjacent construction, availability of compatible accessories and, where relevant, appearance.

This shall be done in advance of ordering equipment. Any such substitutions shall be entirely at the discretion of the Services Engineer.

**2.11.3 SPECIFIED EQUIPMENT AND MATERIALS**

Prior to any Contract being finalised Main Contractor shall submit a comprehensive list of proposed manufacturers and suppliers of materials and equipment together with a procurement schedule. This list is to be based on specified manufacturers where identified. All materials proposed are to be to the satisfaction of the Services Engineer and subject to submittal of details for review before placement of order.

Each manufacturer must be willing to admit the Design Team to his premises during normal working hours for the purpose of progress and to examine/ witness the testing of materials and equipment proposed for the Contract Works.

All materials and equipment shall be new.

The Main Contractor shall obtain and implement manufacturers' instructions on the assembly and installation of materials and equipment.

All equipment shall be provided with proper packaging. Safe delivery of all equipment and materials, and return of re-usable packaging to the suppliers shall be ensured.

Materials or substances which are generally known at the time of use to be deleterious shall not be used other than as allowed by British Standards or Statutory regulations current at the time of use.

Materials shall be procured in a timely manner in order to complete the Works within the Contract Period. If necessary this shall include making arrangements for special deliveries.

Identical parts of similar equipment shall be interchangeable and any items, fittings or accessories that are used in quantity shall in each case be the produce of one manufacturer.

Where a choice of manufacturer or source of supply is allowed for any particular product, the whole quantity required to complete the work must be of the same type, manufacture and/or source unless otherwise approved. The Main Contractor shall produce written evidence of sources of supply when requested by the Services Engineer.

Where consistency of appearance is desirable ensure consistency of supply from the same source. Unless otherwise approved do not use different colour batches where they can be seen together.

**2.11.4 SAMPLES**

A sample of each light fitting required by the Contract Documents shall be submitted to the Design Team for approvals according to a procedure agreed prior to commencement of the Contract Works.

Samples of materials, workmanship, components and equipment accepted as complying with these Contract Documents shall be retained by the Design Team, and all related items included in the Works shall be at least equal in all respects to these samples.

The Main Contractor shall provide, or arrange to be provided by the Design Team; safe storage of accepted samples on site including racks for display, reference and inspection.

**2.11.5 WORK AT OR AFTER COMPLETION**

The Main Contractor shall:

* Make good all damage consequent upon the work after every shift;
* Remove all temporary markings, coverings and protective wrappings unless otherwise instructed;
* Cleaning materials and methods to be as recommended by manufacturers of products being cleaned, and to be such that there is no damage or disfigurement to other materials or construction;
* Touch up minor faults carefully matching colour, and brushing out edges;

**Due to the nature of the works each phase fully commissioned and operational prior to occupation by the client. The main contractor shall make allowance within their tender return.**

**2.12 GUARANTEE AVAILABILITY OF SPARES**

The Main Contractor shall guarantee, or provide manufacturer's written guarantees, that spares shall be available for a minimum period of ten years from the date of Practical Completion both to the Employer and to any other future building owner, occupier or contractor having responsibility for the maintenance of the Contract Works.

**2.12.1 REJECTION OF MATERIALS OR WORKS NOT TO STANDARD OF SAMPLES**

Any material or work which is inferior to an accepted sample or is different from parts of the Works already constructed or which is stained or damaged after installation shall be treated as defective work.

**2.12.2 PROTECTION OF MATERIALS AND EQUIPMENT PRIOR TO FIXING**

All installation materials, component parts or complete items of equipment shall be delivered and stored on site in properly labelled boxes, crates or containers, suitably designed and constructed to give protection against transportation and handling damage and deterioration during storage. The packing shall be weatherproof.

All materials shall be stored on raised-boarded platforms under weatherproof cover. Pipes, conduits, trunking and the like shall be stored on racking and ends plugged.

Equipment or component parts of equipment specifically designed to operate in normal room conditions shall be delivered to and stored on site with suitable waterproof protection.

Equipment incorporating components susceptible to moisture damage shall be stored in an environment free from condensation.

Particular care shall be taken in order to protect component parts specifically designed to act as heat transfer surfaces. These surfaces shall have purpose-designed packing to protect them whilst in transit and storage on site.

All materials and equipment supplied under this contract shall be examined on delivery to site by the Main Contractor and immediately prior to installation. Any materials or equipment that are damaged or faulty shall be replaced at no cost to the contract.

**2.12.3 DEFECTIVE WORK**

Defective work shall be replaced with materials, goods or work in accordance with the Contract Documents. Alternatively the Main Contractor may submit proposals for any treatment or making good that is considered to bring the defective work back to the standard required by the Contract Documents. Such proposals shall not relieve the Main Contractor of his responsibility to execute the Works to the full intent of these Contract Documents.

It shall be the responsibility of Main Contractor to protect all sections of the Contract works once installed and until practical completion of the works is granted. All remedial works required to bring the installation up to its ‘as new’ condition shall be deemed to be included within the contract.

**2.12.4 CHECKING COMPLIANCE OF PRODUCTS**

The Main Contractor shall check all delivery tickets, labels, identification marks and, where appropriate, the products themselves to ensure that all products with the Contract comply with the contract documents. Where different types of any product are specified, check to ensure that the correct type is being used in each location. In particular, check that:

* The sources, types, qualities, finishes and colours are correct, and match any approved samples;
* All accessories and fixings, which should be supplied with the goods, have been supplied;
* Sizes and dimensions are correct. Where tolerances of components are critical, measure a sufficient quantity to ensure compliance;
* The delivered quantities are correct, to ensure that shortages do not cause delays in the work;
* The products are clean, undamaged and otherwise in good condition;  Products which have a limited shelf life are not out of date.

**2.13 INSPECTION AND TESTING**

**2.13.1 GENERAL**

The Main Contractor shall agree procedures for notices, witnessing, reporting and recording tests with all parties involved including Local Authorities and Statutory Undertakings, prior to the commencement of the Contract Works.

Submit copies of the formal test certificates signed by the relevant Main Contractor's representative no later than five working days after completion of successful tests.

**2.13.2 ADDITIONAL TESTS**

The Main Contractor shall re-test or carry out at no extra cost any additional tests required to establish acceptability of Contract Works following failure of any part thereof or any item therein to meet the required standard or functional performance.

**2.13.3 INSTRUMENTS AND EQUIPMENT FOR TESTING**

The Main Contractor shall supply, check, recalibrate whenever necessary and maintain in good working order all instruments and equipment for setting out, measurements, gauging inspection, commissioning and performance testing whether they are specifically called for or implied by the Contract Documents.

All such instruments and equipment shall be adequate for the purpose and shall satisfy the purposes and accuracies required by the Contract Documents. All such instruments that require calibration shall have a current calibration certificate available for inspection by the Services Engineer.

**2.13.4 PROVISION OF RESOURCES**

The Main Contractor shall provide all necessary staff with the relevant skills and competence for all inspection testing and commissioning.

**2.13.5 CERTIFICATE FOR MATERIALS AND EQUIPMENT**

All materials shall be manufactured and tested in accordance with the appropriate British Standard or as described in this specification. Should the Main Contractor propose an alternative item without the appropriate certification, independent testing shall be carried out at the Main Contractor's expense to determine compliance with the Contract Documents.

Where appropriate all materials delivered to the site shall bear the manufacturer's name, brand name and any other data that may be required to verify their exact nature and relate it to the requirements of the Contract Documents.

Materials and components shall bear the British Standards certification Trade (Kite) Mark or British Board of Agreement Certificate Mark or CE mark as applicable.

**2.13.6 WORKS TEST CERTIFICATE**

Works test certificates shall include, whenever applicable, full information to enable the item tested to be identified, such as project title, Main Contractor's name, manufacturer's nameplate and serial numbers, the location in the Works and the delivery or batch which the equipment/material represents.

**2.13.7 INSPECTION AND TESTING RECORDS**

Maintain records of all inspections, and testing performed to substantiate conformity with the Contract Documents including those carried out by the Main Contractor and/or third party testing agencies, together with manufacturer's or suppliers test certificates.

All records shall be retained on site and made available to the Design Team on request. On completion of the Contract Works all records shall be handed over to the Design Team unless otherwise directed. In addition, a copy shall be issued to the Services Engineer for record purposes.

These records shall include, as appropriate, but not be limited to, project title, Main Contractor's name, the identification of the element, item, batch or lot, the nature and number of the observations and tests, the dates of testing, the name and signature of the person responsible for the testing, the number and type of deficiencies found, and details of any corrective action taken.

Records that indicate any part of Contract Works inspected or tested does not comply with the Contract Documents shall be submitted without delay in order that the Main Contractor's proposals for rectification may be assessed.

The content and format of the inspection and the test records is to be approved by the Design Team.

**2.14 COMMISSIONING**

**2.14.1 ATTENDANCE AND CO-OPERATION**

Give at least five days’ notice to the Design Team for the attendance and co-operation of other Contractors.

**2.14.2 NOTICE TO DESIGN TEAM**

Give at least two days’ notice of any commissioning or testing to be carried out to enable the Design Team to organise the necessary witnessing.

**2.14.3 CHECKING AND COMMISSIONING**

Commissioning includes the setting to work and regulation of the installation.

Check all installations and commission in accordance with the Contract Documents including but not limited to the following:

* Produce method statements and a coordinated programme for the testing and commissioning of the complete Contract Works;
* Provision of all consumable materials. Check the availability of electrical power, fuel, water etc, costs for which shall be met by the Employer;
* Provision of such temporary communication apparatus as is necessary to enable members of the commissioning team who are unable to be in visual or oral contact with each other to carry out their tasks safely and effectively. Such apparatus shall not cause interference with equipment owned or operated by other parties;
* Provision of proper and permanent records of relevant readings of all quantities taken during the checking, pre-commissioning, and commissioning procedures. The form of the records shall be agreed with the Services Engineer in advance of the commissioning and the record for each complete commissioning procedure shall be dated and signed by the person whom the Main Contractor has appointed to be formally in charge of commissioning.

The Contract works shall only be deemed to be practically complete after the entire installation has operated under full automatic control fault free for a minimum of 7 days.

**2.14.4 EMPLOYER INSTRUCTION AND TRAINING**

The Main Contractor shall provide assistance to the Employer's staff during the course of the installation and prior to Practical Completion to explain the purpose and function of the Works as installed.

A minimum period of five plant operating days prior to Practical Completion shall be allowed to instruct the Employer's maintenance staff or Maintenance Contractor in the day to day running of all plant and systems. The location and function of all systems together with their control functions shall be explained and the procedures given in the Operating and Maintenance Manuals for starting up, shutting down, isolating sections, emergency procedures etc. shall be comprehensively explained and demonstrated to the Employer's satisfaction. This shall include all necessary specialist sub contract works.

**2.15 SPARES, TOOLS AND CHARTS**

**2.15.1 SPARES**

A minimum of four weeks prior to practical completion of the Electrical Services installation the Main Contractor shall produce a comprehensive list of recommended spares for one year’s maintenance of the completed installation including where applicable, existing plant/equipment.

**2.15.2 TOOLS**

At Practical Completion, provide two complete sets of tools and portable indicating instruments for the operation and maintenance of all plant and equipment together with suitable means of identifying, sorting and securing same. These shall include all necessary specialist tools and instruments related to plant items.

**2.16 SAMPLES**

In addition to submitting technical details for all equipment for Design Team approval the Main Contractor shall allow for supplying various samples for Design Team comment as defined in the particular specification.

Where not defined, samples shall include but not be limited to all fittings or accessories that are exposed to view in or on the building.

All such items shall be agreed with the Architect in respect of finish and colour prior to ordering.

**2.17 INITIAL SITE SURVEY**

Immediately upon site access being made available to the Main Contractor, he shall fully examine the site conditions, physical restraints and existing installed services (where applicable) to ascertain that the drawings properly reflect the required works.

Any variations to the Tender Drawings shall be made by the Main Contractor within one week of access such that a properly coordinated set of drawings can be produced prior to the installations commencing.

No additional costs shall be met by the employer for lack of attention and compliance with this clause or for the works required to coordinate with the existing services.

**2.18 VISITS AFTER PRACTICAL COMPLETION**

The Main Contractor shall allow for a minimum of **two** full day return visits by his commissioning and technical staff to fine tune systems for the full term of the Defects Liability Period. This is an essential item to provide support and confidence to the building users and to demonstrate and check seasonal adjustments to the systems.

**3 STANDARD TECHNICAL REQUIREMENTS FOR ELECTRICAL SERVICES**

**3.1 GENERAL**

This section outlines the general requirements for the installation of the Electrical Services. This section shall be read with all other sections of the document which shall be treated as a whole.

Where the works are procured as a Sub-Contract, Works Contract or Trade Contract ‘Contractor shall mean Main Contractor’ etc.

The complete Electrical Services Installation shall be to the highest standards and in accordance with, but not limited to the current editions of the following.

* BS7671: The 17th Edition of the IET Wiring Regulations;
* Electricity Supply Regulations;
* Health and Safety at Work Act;
* Chartered Institution of Building Services Codes;
* The Electricity at Work Regulations;
* COSHH;
* Requirements of the Local Authorities including Building Control Officers,

Environmental Health Department and local Fire Officers;  British Standards.

No materials shall be installed which may pose a hazard to health of the construction, maintenance or eventual occupants of the building.

No materials shall be installed which are potentially damaging to the Environment.

All electrical equipment shall be designed and fitted with interference suppression devices to comply with BS EN 55041-1 and components and filter units shall comply with BS613 and BSEN 50081-1.

**3.2 LOW VOLTAGE SWITCHBOARDS AND DISTRIBUTION BOARDS**

Low voltage switchboards and distribution panels shall be arranged and manufactured in a logical manner to ensure speed and safety during installation and future maintenance is maintained.

**3.2.1 SWITCHBOARDS**

Switch enclosures shall be of the free standing or wall mounted type and constructed of sheet steel of not less than 2.0mm thick.

Each switchboard shall be manufactured in cubicle form to BS5486 Form 4 Type 2 with a rigid steel frame and sheet steel.

Each switchboard shall have a minimum protection rating of IP30.

Working drawings of all switchboards shall be submitted to the consultant for approval before any manufacture commences.

All sheet steel and any internal barriers shall be fixed by either welding or nut, bolt and washer arrangement. No openings shall be accepted where busbars are exposed.

Switchboards shall be arranged for front, rear or both accesses, as specified and all doors and covers shall be manufactured of a rigid construction to avoid any deflection or bending.

To ensure dust, moisture and dampness do not enter the switchboard, neoprene gaskets shall be correctly fitted on the inside perimeter face of all doors and covers.

Neoprene gaskets or suitable grommets shall be installed where holes are provided for cable entry to protect the cables where they come into contact with the edge of the metalwork.

Door fasteners shall be of the screw type on switchboards and push button spring release on distribution boards.

Operating handles and locking devices shall be located within the limits of 450 and 1900mm above the floor level.

External edges, covers and finishes shall be smooth to ensure ease of cleaning and avoid the collection of dust.

Adequate drainage, natural air circulation and panel heating shall be provided to all switchboards.

Any holes in the switchboards to accommodate the above shall be protected for dust, moisture and vermin ingress.

Overall height of switchboards and distribution panels shall be as specified in the particular section of the specification.

All switches, circuit breakers and fuses shall be arranged so that they are fully accessible and are not impeded, or affected by any other adjacent switches.

The switchgear shall be capable of carrying a through fault equivalent to the prospective short circuit breaking capacity rating stated on the drawings and in the particular specification.

To ensure compliance with the overall prospective short circuit fault rating, adequate bracing of all auxiliary busbar connections shall be included.

Adequate space shall be provided within the switchboard to allow the specified cables to bend and spread sufficiently to the terminals in a simple formation without any phase or cores crossing any other adjacent cables.

All cables shall be clearly marked with phase and neutral colours.

Switching devices and cable terminations shall be rigidly supported and sized to accept the number and size of cables specified. The spacing should be adequate so that any future switch cables in any one section can be installed without having to remove another termination.

Lifting eyes shall be provided at strengthened locations on top of the switchboard. Caps shall be installed in the stud holes when they are removed after installation of the switchboard into its final location is complete.

Internal small wiring shall comply with BS6231 and all wires shall have numbered ferrules at both ends. Cables shall be terminated with crimped type lugs.

Enclosures shall be finished internally with rust inhibitor applied to the sheet steel, one coat of zinc chromate paint and two undercoats unless specified otherwise. External finishes shall be as above with the addition of a finishing coat to the colour specified in the particular section of the specification.

Switch cubicles shall be arranged to ensure a minimum of 20% spare cubicle capacity is provided for future switches and adequate logic to construction shall be given by the switchboard manufacturer so that future sections may be added at either end.

This shall be designed to enable a continuous extension to the switchboard both mechanically and electrically. Busbars shall be rated as indicated on the schematic drawings.

Busbars and connections shall be manufactured from high conductivity copper to BS5486 and shall be extendable at both ends. Busbars shall be continuous through the switchboard and within an enclosed chamber of rigid steel construction.

Access to the chamber shall be by the removal of the covers secured with bolts and captive screws. Each cover section shall have a screw fixed traffolyte label marked 'BUSBARS - ISOLATE BEFORE REMOVING COVER'. All busbars shall be colour coded in accordance with BS5486.

All neutral busbars shall be of the same cross sectional areas as the associated phase busbars.

Busbar insulators shall be of such design so that overstressing of the insulation when connections are tightened is not possible.

Busbar and busbar supports shall be adequately arranged to withstand the effects of any fault current including the maximum breaking capacity of the switchboard without sustaining any damage.

All connections to busbars shall be by clamp type lugs and any holes in busbars which may affect its current capacity of fault rating will not be accepted.

Any cable glands or boxes on switchboards shall be supplied as part of the switchboard package.

Entry holes for mains and MICC cables shall have gland plates provided.

Where the cable length between gland and termination within the panel is in excess of 600mm, provision for intermediate support shall be made.

**3.2.2 TRIPPING BATTERY AND CHARGER**

Unless otherwise specified the switchgear tripping system shall use a 30V DC supply.

Battery chargers shall consist of dual compartment self-contained sheet steel cabinet housing respectively a battery and charger. The charger shall be located in the top compartment. The cubicle shall be complete with a lockable door. The interior of the cubicle shall be finished with three coats of anti-sulphuric enamel.

The batteries shall be sealed lead acid gas recombination type and shall comply with BS6290 parts 1-4, BS2782 and 6133.

Maintenance and procedure documents shall be provided with all batteries.

The battery charger shall comprise an automatic potential float charger suitable for a 230v, 50Hz mains input.

The charger shall be complete with a double pole mains switch, main and rectifier output fuses double wound voltage transformer, full wave rectifier and associated controls.

All protective fuses shall comply with BS88 fuse links.

Indication shall be given by a voltmeter, ammeter and status indicator lights.

Common alarm features and individual indication shall be provided for:

* Charge Fail;
* Low Volts;
* Low Electrolyte.

All alarm conditions shall have automatic reset upon rectification.

**3.2.3 SWITCHBOARD INSTRUMENTATION**

All instrumentation shall comply with BS89. Voltmeters and ammeters shall be of the moving iron type.

Each main control switch on each switchboard shall have a voltmeter and ammeter complete with a selector switch.

The voltmeter selector switch shall be capable of giving phase to phase and phase to neutral readings.

The voltmeters shall have full scale deflection at 500v and shall be protected by HRC

Cartridge fuses with primary fuses directly off the main busbars and secondary fuses housed within a front access cover compartment of the instrumentation control section of the switchboard.

Ammeters shall have full scale deflection appropriate to the circuit rating to which they are to be installed.

Individual current transformers shall be provided for protection and instrumentation. They shall comply with BS3938.

Over current factors for current transformers shall be rated to suit the prospective short circuit current rating for the system.

Current transformers shall have primary ratings to suit those indicated on the schematic drawings. Secondary ratings shall be 5 amperes.

The V.A rating and accuracy shall be related to the type of magnitude of the load.

**Switchboard Interlocks**

Interlocks shall be provided on or within the switchboards to prevent the cover of any switching device being opened whilst the contacts are closed.

The interlock shall also prevent the reverse action of any closing of a device being prevented whilst the covers are open.

All changeover contacts shall be mechanically and electrically interlocked to prevent them closing simultaneously.

Castell interlocks shall be installed as indicated on the drawings to ensure correct sequences of the circuit operation.

Electrical interlocks shall operate to ensure the incoming supply is interrupted.

An approved interlocking system shall be provided to prevent hand operation of equipment normally operated electrically.

Mechanical interlocking shall be provided to prevent malfunction at the point where manual force is applied.

**3.2.4 SWITCHBOARD EARTHING**

All non-current carrying metalwork on the switchboard shall be suitably and adequately bonded to the main earth bar to form an integral part of the switchboard.

The earth bar shall be high conductivity copper for each switchboard and shall be sized to suit the fault level specified on the main single line schematic diagrams.

A 25mm x 3mm earth bar shall extend the full length of the switchboard and supported at intervals not exceeding 1m.

The earth bar shall be bolted to the main frame of the switchboard and be made suitable for coupling earth bars of adjacent switchboards. All joints shall be tinned, sweated and bolted.

Connections to the main earth bar shall be taken from all switchboard instruments, relays, meters, star points of current transformers and voltage transformer metal enclosures.

Hinged panels or doors shall have flexible earth connections to the switchboard main frame which shall be of a minimum conductor size of 4mm5

Earth continuity on bolted sections shall be achieved by removing any excess paint from bolts or studs before washers are fitted.

**3.2.5 SWITCHBOARD ANCILLARIES**

Screw fixed traffolyte labels shall be installed on all switchboards to identify all incoming and outgoing sections, instrumentation and all internal fuses, relays and terminals etc, by the manufacturer.

All internal wiring shall be correctly labelled with the labels fixed to the adjacent back plates to the identified item of equipment.

'Danger 400V' labels shall be fixed where appropriate and shall be black lettering on yellow background.

No self-adhesive labels shall be accepted.

Label inscriptions shall be approved by the consulting engineer before they are finally fixed in place.

Labels shall be fitted to a minimum lettering height of 6mm with larger lettering required for overall function descriptions.

General labels shall be black lettering on white background.

Fixings shall be 4BA countersunk brass zinc plated screws tapped or bolted into the equipment covers.

All switchboards shall be provided with anti-condensate heaters located in the bottom chamber of the switchboard to respond to a minimum ambient space temperature of 5EC.

Switchboard cubicle devices shall be provided with padlocks or other locking devices and be capable of locking each switch in the neutral position, each selector switch in all positions, each circuit breaker, fuse switch or switch fuse in the open position only.

Locking devices shall be no smaller than 25mm and shackle holes shall permit easy insertion of each padlock without allowing excessive movement when locked in position. Two keys shall be provided with each padlock upon handover.

Upon successful completion, testing and approval of the switchboards the manufacturers shall supply one set of maintenance and operating tools which shall be located in a purpose made front access cubicle of the switchboard.

**3.3 LV DISTRIBUTION BOARDS**

All distribution boards shall be of the size and type specified and shall be fitted with HRC fuses or circuit breakers as specified.

All distribution boards shall comply with BS EN 60439-1

Enclosures shall comprise of a die cast or sheet metal case and door or doors.

Sheet metal shall not be of less than 1.6mm thick and construction shall be dust protecting or weatherproof, surface or flush to suit the IP rating as specified.

All distribution boards shall be fitted with cylinder locks or industrial pattern suitable for padlocking.

End covers shall be provided with knockouts of not less than the number of outgoing ways and one for the incoming cable(s).

All poles or phases shall be indicated by the appropriate colour and a rigid, insulating material of adequate depth shall be provided in all distribution boards to separate banks of fuses or circuit breakers connected to different poles of supply.

Distribution boards shall have a neutral bar connected with screw type connections for each outgoing circuit. TP&N boards shall have three connections provided for each way where single-phase use is intended.

A separate earth terminal rail shall be provided, with screw type connections for each outgoing way.

Main incoming switches provided within any distribution board shall be provided integral to the board and be capable of carrying the fault current equivalent to the three phase short circuit MVA of the system specified for 3 seconds.

Internal busbars within each distribution board shall be high conductivity copper to BS EN 13601 and be rigidly mounted with all poles relative to their banks of fuses or circuit breakers.

**3.4 FUSES AND PROTECTION**

The ampere rating of air circuit breakers, moulded case circuit breakers, miniature circuit breakers, and fuses given on the single line diagram of electrical distribution shall be the maximum permissible rating on the relevant circuit.

The Main Contractor shall be responsible for setting the overload protection or installing fuses appropriate to the actual loading on each circuit.

Any damage resulting from overloading from improper settings or fuse ratings shall be the Main Contractor's responsibility for making good.

**Air Circuit Breakers**

Air circuit breakers shall be in accordance with BS EN 60947-2 and as specified.

Current ratings and types shall be as detailed on the drawings.

Air circuit breakers shall be of the enclosed double break, air insulated draw out type and shall carry a British Standard Certificate issued by an approved testing authority.

They shall be complete with fitted thermal and magnetic adjustable overload units to each phase.

If the current exceeds the setting on the magnetic overload the breaker shall trip instantaneously.

The air circuit breaker mechanism shall be of solenoid or spring assisted type and prevent slow opening or closing unless the breaker is withdrawn.

The mechanism shall be of the trip-free type with electrical and mechanical releases.

Where automatic operation is required electrically operated mechanisms shall be provided. Three phase rectifier banks shall feed the closing solenoids and be connected to the live side of the air circuit breaker.

A manual device for opening and closing the contacts shall be provided.

Racking out of the air circuit breaker shall be impossible unless the contacts are open where withdrawable devices are specified.

**Moulded Case Circuit Breakers**

Moulded case circuit breakers shall be manufactured to comply with BS EN 60947-2.

Operating mechanism shall be of the overcentre trip free toggle type with an internal cross bar to ensure common tripping of all poles. Mechanisms shall be quick make and break with positive hand indication.

Moulded case circuit breakers rated over 400A shall have a push to trip button, provided on the cover, for mechanically tripping the breaker.

Adequately sized cable lugs shall be provided on the moulded case circuit breaker to suit the cable size on the cable schedules.

Any motor operators, shunt trip or under voltage release coils etc shall be adequately sized for operation where specified.

All moulded case circuit breakers shall be selected to suit the switchboard fault level and shall remain in working order after a fault has occurred.

The rated service breaking capacity shall be higher than the prospective short circuit current of the downstream device.

**Miniature Circuit Breakers**

Miniature circuit breakers shall be manufactured to comply with BS EN 60898. Circuit breakers shall be type A, B, C or D as specified.

Short circuit breaking capacity shall be to type M3, M6 or M9 as specified.

All miniature circuit breakers shall comply with the test requirements of 20EC and 40EC. All miniature circuit breakers shall be rated to withstand the maximum fault current attainable in the circuit they control.

Where the fault current level is higher than the maximum breaking capacity of the breaker, suitably rated back up fuses or moulded case circuit breakers shall be installed.

The operation of the tripping mechanism shall be instantaneous under short circuit conditions. The fitted magnetic thermal or magnetic hydraulic time delay shall be designed to give a delay on tripping inversely proportional to the magnitude of the circuit current.

**Fuses**

Fuses shall be manufactured to comply with the relevant British Standard to the type selected. They shall be supplied to suit the ratings of the circuits protected or as specified.

HRC cartridge fuses provided in distribution switch and fuse gear shall be the fully enclosed shrouded type, category AC4 or DC4, Class Q1 to BS88 Part 2. They shall be arranged vertically with barriers provided between phases. All live parts shall be fully shrouded.

To ensure correct discrimination between fuses, only one manufacturer’s type shall be used, as specified.

HRC fuses shall be used where control circuits are supplied directly from mains power conductors.

Fuses shall be colour coded to the approved colourings and inscribed or labelled to show their ratings.

Fuses to be installed for use with contactor control gear shall be installed to the supply of the contactors.

Fuses installed in plugs and fused connection units shall be sized to suit the rating of the equipment to be protected and comply with BS 1362 for ring main accessories.

The Main Contractor shall provide manufacturers characteristic curves for all proposed fuses and miniature circuit breakers etc.

**Fuse Switches**

Fuse switches shall be manufactured to comply with BS EN 60947-3. Fuse switch type and ratings shall be as detailed on the drawings where applicable and relevant schedules.

Access to fuse links shall not be possible unless the fuse switch is de-energised. Likewise, it shall not be possible to close the switch while the cover door is open, unless the interlock is purposely defeated. Any parts which remain live when the front cover is open, shall be fully shrouded.

All mechanisms shall be non-corrosive.

Arc resistant barriers shall be installed between phases in the vicinity of the arc path.

Isolating switches shall be manufactured to the same standards as fuse switches and shall have fuses replaced by solid links to allow future upgrading to a fuse switch if necessary.

**3.4.1 RESIDUAL CURRENT OPERATED CIRCUIT BREAKERS (RTESO)**

All residual current operated circuit breakers shall comply with BSEN 61009.

Operating residual current is indicated in the appropriate distribution schedule.

**3.5 CABLES**

All cables and flexible cords shall be manufactured by an approved manufacturer.

Only one manufacturer of each type of cable or flexible cord shall be used throughout the installation.

For any final sub-circuit no cable shall be installed with a cross sectional area of less than

2.5mm2.

Flexible cords shall be installed to a minimum size of 0.75mm2.

The current rating of cables shall be as detailed on the drawings and schedules. However, the Main Contractor shall size the cable to suit the fuse or circuit breaker size shown for that circuit, based on overcurrent protection, voltage drop and earth fault loop impedance.

**XLPE/SWA/LSF Cables**

XLPE/SWA/LSF Cables shall be manufactured in accordance with BS6724 with XLPE insulation to BS 7655.

The cable shall meet the minimum reduced flame propagation requirements of BS EN 50265-1, 2-1 for single cables and of BS EN 50266-1 for bunched cables.

The cable shall be made up of XLPE insulated LSF sheathed copper conductors and steel wire armouring with high conductivity wires to BS EN 10257-1 inserted to make the conductivity the same as a separate conductor.

Bending radii of XLPE/SWA/LSF cables shall be as large as possible to the constraints of the building but shall be kept to a minimum of:

 6 x diameter of the cable for insulated control and instrument cable;  8 x diameter of the cable for power applications.

Glands shall be of the compression type to BS6121 constructed to grip both inner and outer sheath so that any strain on the cable is taken by the steel wire armouring. This shall effectively be bonded to the gland.

The gland shall incorporate an efficient seal between the gland itself and the outer cable sheath and shall be covered in an LSF black coloured shroud.

Earth rings shall be installed at each gland position. Stripping of the cable and installation of the gland shall be in accordance with the manufacturer’s recommendations.

**LSF or LSOH Insulated Wiring Cables**

LSF or LSOH wiring cables shall be manufactured to comply with BS 6360 and gas emission shall be less than 0.5% HCI in accordance with BS EN 50267. Reduced flame propagation shall comply with the requirements of BS EN 50265-1, 2-1 and BSEN 50266-1.

Where cables are to be drawn into conduit or trunking particular care shall be taken to ensure the ambient temperature of the operating conditions do not exceed the temperature rating of the manufacturers recommendations.

Where conditions do arise where the ambient temperature exceeds the recommended, a cable shall be selected with the appropriate temperature ratings or the current carrying capacity of the cable shall be derated as recommended by the manufacturer.

Final sub-circuit cables shall be run in separate conduits from submains and lighting and power circuits shall be kept separate from each other as far as practically possible except where conduits cross.

No cables shall be drawn into conduits until all such conduits bends, boxes or other fittings have been permanently fixed in position and all associated plastering works etc are completed.

This shall also apply to any cables to be run in any trunking installation. All cable pins, racks or supports must be fitted before cables are drawn.

The consulting engineer reserves the right to inspect all conduits prior to any cable being installed.

The separate conductors of the same circuit shall in all cases be drawn into one conduit.

Cables sheaths shall be coloured as follows:

Live - Single phase - Brown

Neutral of AC or - Blue

Three phase earthing - Green/Yellow

Phase L1 of three phase circuit - Brown

Phase L2 of three phase circuit - Black

Phase L3 of three phase circuit - Grey

All flexible cables and cords shall be rated in accordance with the current IET Regulations and shall be scheduled to suit the ambient temperature conditions.

Flexible cables and cords shall be of circular waterproof LSF sheathed.

Minimum size cross sectional area of flexible cords shall be 0.75mm2.

Cable conductor sleeve colouring shall be as follows:

Earthing Green/Yellow

Live Brown

Neutral Blue

Apparatus with flexible cable entries shall be fitted with strain relief grips to prevent unnecessary mechanical strain on the conductors.

Where single core cables are used, the plate through which the cable enters the apparatus together with couplings and locknuts when required, shall be non-ferrous.

All cable ends shall be protected and sealed with glands and seals utilising cold plastic compound of a grade recommended by the manufacturer of the cable.

Where multicore cables terminate at a switch or distribution board of any metal clad accessory other than at a specially manufactured control panel, or a spout entry B.S conduit box, the cable gland shall terminate in a screwed conduit socket so arranged as to be in good mechanical and electrical contact with the metal case.

An internal brass bush screwed into the socket shall be fitted from inside the case and the two locked together.

The cable sheath shall be clamped to the gland with the locking device recommended by the cable manufacturer.

Cable conductors up to 4mm2 to be connected to plant and accessories shall be connected to stud type terminals.

The cable shall have a crimped type lug fitted for good contact. This shall be fitted to the stud between two brass or plated washers by a nut and lock nut.

If a solid conductor is to be connected to a stud terminal a lug may not be fitted if the hole is over 90% of the conductor area.

Conductor sizes of cross sectional area over 4mm2 connecting to plant shall have the appropriate size lug crimped to the cable.

Where the cable is to be used for power applications an approved pneumatic or hydraulic crimping tool shall be used.

**Mineral Insulated Copper Covered Cables**

Mineral insulated copper covered cables (MICC) shall be manufactured to comply with BS60702-1 and served with an LSOH sheath to BS EN 50267. MICC cables shall be terminated in accordance with BSEN60702-2.

Mineral insulated copper covered cables to be used for fire or life safety systems shall be manufactured to comply with BS6387 to category CWZ.

For surface installations, spacer bar saddles shall be fixed with brass screws and shall be either plain or LSF covered to match the cable installation.

Where the cable is to be concealed, LSF covered clips shall be used.

Spacing for saddles or clips shall be at recommended intervals of not more than 300mm apart and 150mm apart where a seal or gland is installed.

Where MICC cables are to be run on cable tray in multiples, they may be securely fixed by either LSF clips and brass screws or dressed neatly and secured with cable ties.

Where it is specified that MICC cable shall be used for the wiring of any motor driven machinery including pumps and fans etc, suitable surge suppressors shall be connected to the circuit in accordance with the rating of the motor.

Seals and glands shall be selected to satisfy the type of installation, ambient temperatures and shall be manufactured to comply with BS EN 60702-2.

Seals shall be of the screw on pot type fitted where necessary with an earthing tail, or the 'shrink-on' type which should always be fitted with the manufacturer’s earth tail and used in full accordance with their instructions.

Glands shall be of the three-port ring type with a compression ring to effectively grip the metal sheath of the cable and be threaded with a B.S conduit thread.

Cable manufacturers recommended tools shall be used throughout the work.

Bending levers with padded faces shall be used for making all bends and offsets.

Bending radii shall not be less than six times the diameter of the cable.

Where cables enter fittings offsets shall be definite with at least 50mm of straight cable between the gland and first bend to allow the gland to be removed.

Where MICC cables pass through walls and floors, short lengths of conduit, bushed at each end shall be threaded over the cable to provide adequate protection.

No straight through joints will be accepted without prior approval of the consulting engineer.

Where an MICC cable terminates at equipment, which is susceptible to vibration, a junction box shall be installed and final connections to the equipment shall be made in single core LSF cables contained in LSF served flexible conduit.

Induced circulating currents shall be minimised by having the equipment entry plate at one end manufactured from a non-magnetic material.

All MICC seals shall be tested not less than 24 hours after completion. 500V or 1000V insulation test equipment shall be used for testing only.

All cable tails shall be clearly phase identified.

**3.6 CABLE CLEATS AND SUPPORTS**

All cleats or supports for single core cables shall be manufactured from non-magnetic material.

Cable cleats and ties shall be used to secure cables and shall be spaced at intervals not exceeding those in the IET Wiring Regulations or less if recommended by the cable manufacturer.

Cables shall also be fixed on all vertical runs passing through floors both above and below the floor level.

Cleats shall be provided in all vertical runs of cable at intervals of not more than 600mm.

To minimise underside sheath currents in single core cables carrying three phase systems, cables and cleats shall be trefoil arranged with the cables touching.

Where the trefoil formation has to be separated unavoidably, approved arrangements shall be made to minimise the sheath currents.

Single core cable cleats shall be of sufficient strength to withstand short circuit conditions.

Cables run horizontally on walls or vertical surfaces shall be cleated to channel or similar. Multi-core control or power cables with an overall diameter of less than 30mm may be run securely fixed by cable ties or straps to cable tray.

No cables shall be 'stacked' on the containment system except for cables run in trefoil formation or with prior approval from the consulting engineer.

Cleats shall be fixed at centres not exceeding 1000mm or less if recommended by the cable manufacturer.

Cable ties or straps shall be fixed at spacings not exceeding 600mm or less if recommended by the manufacturer.

Cable ties shall be manufactured from serrated nylon and shall be low smoke emitting.

**Cables Run In Service and Pipe Ducts**

Cables run in service ducts shall be run at least 25mm clear of walls on galvanised steel hangers or claw type clamps.

Hangers and clamps shall be securely fixed to the walls or floors to distances not exceeding those recommended in the current edition of the IET Wiring Regulations.

Cables leaving a service duct and to be run up a wall shall have a suitably sized rigid PVC or galvanised steel pipe threaded over the cable from at least 200mm below the floor level to a distance above the floor level, which shall protect the cable from any mechanical damage.

Cables to be drawn into any ducts shall be adequately supported on rollers during the drawing operation. All cable ducts shall be thoroughly cleaned prior any cables drawn into it.

Any draw-in pits inserted in the route shall be adequately sized so no undue mechanical stresses are placed upon the cables.

All previously stated bending radii shall be applied. Cable ducts shall be fully sealed after all cables have been drawn in by fitting a suitable bush, compound and sealant.

**Cables Laid Underground**

Where cables shall be laid in the ground the Main Contractor shall ensure the ground conditions are acceptable so the maximum current carrying capacity is maintained over the whole route.

Any doubts on the current ratings being achieved shall be discussed with the consulting engineer prior to the works proceeding.

Cables shall be laid to minimum depth of 450mm in footways and 600mm in roadways.

HV cables shall be laid to a minimum of 750mm below surface level in all cases. Any other conditions, cables shall be laid to a minimum depth of 500mm.

Cables shall be laid in the ground on a bed of 75mm of earth riddled through a minimum 12mm2 mesh screen.

Minimum distances between the centres of three core power cables or three phase groups of single core cables shall be 300mm.

Single core cables in trefoil formation shall ensure the top cable is to the minimum depth given below ground.

Cable ties shall be fitted at a maximum of 1200mm centres to keep the trefoil formation.

**3.7 CABLE TRAYS**

All cable trays shall be manufactured from sheet steel to BS1449 and to a galvanised finish to BS EN ISO 1461.

Cable trays shall be manufactured to the following minimum thicknesses:

Cable trays up to 225mm - 1.2mm metric gauge

Cable trays to from - 1.6mm metric 225mm to 450m gauge

Cable trays over 450mm - 2.0mm metric gauge

All cable trays shall have solid return flanges for rigidity and shall be of the perforated type.

No site bends shall be made where possible and all accessories shall be to the manufacturer’s standard range.

All cable tray joints shall have a copper earth-bonding strip fitted to ensure earth continuity.

Cables shall be fixed to the cable trays by either cleats, cable ties, straps or saddles as appropriate to the type of cable being run on it.

Cables shall be arranged in a logical order to avoid unnecessary crossing over upon any length of run including entering or leaving the cable tray.

The Main Contractor shall ensure all sharp edges are removed from cable trays to ensure cables are not abraded or damaged in any way.

Cable trays run horizontally may be supported from soffits by installing plated steel rods of not less than 6mm diameter.

Alternatively, where installation will allow, cantilevered wall brackets may be used.

Cable tray fixings shall not exceed 1500mm centres and the Main Contractor shall fit additional supports where necessary to ensure deflection of the cable tray does not occur.

Cable tray installation shall be fully co-ordinated with other services before the installation commences to avoid any unnecessary clashes.

**3.8 CABLE RACKS**

Cable racks shall be manufactured of mild steel channel sections to BS1449 Part 1 and hot dipped galvanised after manufacture to BS EN ISO 1461.

Channel sections shall be to a minimum size of 40mm x 40mm x 2.0mm thick and be of the welded rung construction.

Propriety components of channel sections, spring brackets and cantilever arms etc shall be fitted to provide a complete cable racking system.

Channel sections shall be spaced at a maximum of 300mm between each rung.

The Main Contractor shall provide 20% spare capacity on all cable racks.

The Main Contractor shall allow for all bridges and auxiliary components of the cable racking system.

All joints shall be made using fishplates and bolts.

A copper braided cable with lugs shall be fitted on all joints to ensure earth continuity is achieved.

Cables shall be neatly arranged on the cable rack system and fixed with cleats, cable ties or straps as appropriate to the type of cable on the rack.

Cable rack run horizontally shall have supports fixed to the building structure.

All supports shall be designed to accommodate the additional weight of a 70kg person without causing any lateral movement of the system.

Therefore if additional side restraints are required the Main Contractor shall allow for these in the tender.

All bends, junctions, reducers and other accessories shall be to the manufacturer’s standard range.

Hinge joints may only be fitted with approval of the consulting engineer.

Cables shall be arranged in a logical order to avoid unnecessary crossing over upon any lengths of run including entering or leaving the cable rack system.

**3.9 FIXINGS**

Fixings to brickwork and concrete shall be by woodscrews and suitable raw plugs, grouted type bolts or expanding bolts.

All screws and bolts shall be greased before installations.

The maximum size screw or bolt shall be used to accommodate the size of hole given in the equipment and every hole provided within the equipment shall be used to ensure security of the fixing.

Fixing screws within brickwork shall be to a minimum size of No.8, minimum depth of 38mm and shall not be fitted in between joints in bricks.

Fixings to steelwork shall be by means of set screws or bolts of the correct size to suit predrilled holes.

Any fixings to steelwork shall be approved by the consulting and structural engineer prior to the work being carried out.

**3.10 TRUNKING**

All steel trunking shall be manufactured from rust proofed mild steel to BS1449 Part 1 and hot dipped galvanised to BS EN ISO 1461 after manufacture. Trunking shall also comply with BS EN 50085. Minimum mild steel thicknesses shall be as follows:

Up to 75 x 75mm - 1.2mm

75 x 75mm and above - 1.6mm

Rectangular trunking shall be manufactured to thicknesses of the largest width or depth size as appropriate.

Trunking shall be sub-divided up to suit the number of separate services to be run through it.

All barriers forming the compartments shall be rigid and continuous.

Trunking lids shall be of the same manufacture as the trunking body and supplied in lengths of no greater than 2m.

Fixing of the lid shall be by captive steel locking screws or steel turnbuckles with screwdriver slots.

All fixings shall be arranged so that there are no projecting screw threads or similar points within the trunking, liable to cause damage to cables.

The lid shall be removable throughout its length.

Trunking joints between sections shall be by fitted internal fishplate connections of not less than 75mm long and fixed with steel bolts and nuts passing through clearance holes.

Copper earth strips shall be securely fitted at each joint to ensure earth continuity throughout the trunking system.

All accessories shall be factory made.

No site made bends shall be accepted.

All cross-over sections in multi compartment trunking shall be fully screened from each other without affecting the overall cross sectional area of the trunking capacity.

Trunkings run vertically shall be fitted with insulated racks to support the cables at a maximum of 1200mm between racks.

Where trunking passes through holes in the building structure, a flange cover plate shall be fixed to the trunking before installation, which shall protect at least 50mm into the building structure on each side.

Internal fire barriers shall be fitted into the trunking where the run passes through fire barriers, walls, floors or building fire compartments.

The barriers shall be rated to the requirements set out in the current edition of the IET Wiring Regulations.

Barriers shall also be fitted where trunking passes through from one ambient temperature to another and a risk of condensation in the trunking may arise.

Holes for conduits in trunking shall be arranged to avoid unnecessary setting of the conduits.

Conduits shall enter the trunking by means of smooth bore male brass bushes, locknuts etc.

Where trunking sizes are not shown on the layout drawings or in the detailed specification they shall be sized to achieve 50% spare capacity of the average size cable to be contained within the particular trunking.

They shall be sized in accordance with the space factors given in the current edition of the IET Wiring Regulations and amendments.

Trunking shall be supported by means of purpose made mild steel brackets or hangers, or where multiple service runs are to be co-ordinated, trunkings may be securely fixed to a channel section and steel supports fixed to structure.

Channel sections shall not be less than 40mm x 40mm and steel supports not less than 6mm diameter.

Fixings shall be to a maximum distance of 1200mm centres and attention must be given to provide sufficient fixings to limit lateral movement.

PVC trunking shall be manufactured to comply with BS EN 50085, & characteristic ‘P’ of BS6476 Part 12 and shall be of rigid construction.

The requirements appertaining to steel trunking shall generally apply to PVC trunking. All dado trunking shall be with end caps, cover seals, cable retainers, couplers and all necessary accessories to provide a complete system.

**3.11 CONDUITS**

Steel conduits shall be Class 'B' heavy gauge seam welded type and shall be manufactured to comply with BS31, BS EN 60423, BS EN 50086.

Conduit finish shall either be galvanised (Class 4) or black enamel Class 2.

No conduit smaller than 20mm diameter shall be used.

Separate conduit systems shall be run for individual service requirements.

Conduit ends shall have all sharp edges removed and be cleaned before installation.

Conduits to be connected to unsupported accessories such as fuseboards, light switches, socket outlets etc. shall be by means of flanged couplers and brass male bushes etc.

Prior to installation the Main Contractor shall ensure every length of conduit is inspected and if it is not perfectly smooth inside and outside and free from flaws it shall be rejected.

Conduit boxes shall be manufactured to the above British Standards and shall be circular of the malleable iron type.

All boxes shall have long bush spouts with the exception of 'loop' in boxes. These shall be of the back outlet type.

All box covers shall be of the heavy steel type and where a flush conduit installation is used, the covers shall be flush with the plaster finish.

Where necessary off sets are likely to occur, adaptable boxes of a sufficient size shall be installed. Circuit separation shall be maintained at all times.

Bends and sets in runs of conduit between boxes shall be limited to the recommendations of the current edition of the IET Wiring Regulations to ensure ease of installation for cables.

Bends and sets shall be made cold and the conduits shall not sustain any reductions in cross sectional area or deformation. The radius of any bend must not be less than the minimum requirements of BS EN 50085.

All joints shall be painted in accordance with the manufacturers recommendations immediately after the installation to ensure corrosion of any part of the conduit does not occur.

In plant and external areas galvanised conduit and accessories shall be used. On external installations all fittings shall be sealed with neoprene gaskets and conduit threads shall have a mastic sealant to prevent the ingress of water and corrosion.

All conduits shall be tightened properly between the lengths and into fittings or boxes so that the wiring is continuously and effectively protected throughout its length.

Conduits shall not be under mechanical stress and shall be electrically continuous including where special arrangements are made using expansion type couplers for traversing expansion joints.

Conduits shall be laid so as to drain off any condense moisture without damage to any connections.

The conduit length between draw in points shall not exceed 9000mm for straight or near straight lengths or 7500mm for runs including two right angle bends without prior consent of the consulting engineer.

Conduits run on the surface shall be fixed with distance/spacer saddles or suspension clips which allow the conduit to be run into all accessories without forming special bends or sets for the purpose.

Pipe hooks shall not be used for surface conduit installations.

Conduit run on the surface of walls and/or ceilings shall be securely fixed at the maximum intervals in accordance with the following schedule:

Size Interval

20mm 1500mm

25mm 2000mm

32-50mm 2500mm

All surface conduits shall have saddles at a distance of not more than 300mm from their point of emergence from floors, walls or ceilings and the remaining saddles shall be consistent with the fixing requirements and appearance.

Saddles shall also be fixed on each side of every bend or junction at a distance of not more than 300mm from the point of intersection of the centre line of the conduits.

Conduits shall be installed with minimum clearance of 75mm between themselves and any other service.

Conduits to be concealed in ceilings, floor voids or chased into walls and buried with a plaster finish, or laid direct on structural floors and concealed by the floor finish shall be sufficiently chased into the material to provide at least 12mm cover over the conduits.

The Main Contractor shall provide sufficient supervision to ensure co-ordination of the chases and depths are correct prior to the conduit installation.

Draw wires shall be provided in all conduit runs to facilitate the cable installation.

Conduits shall be cleaned and inspected before any cables are drawn into them.

Conduit boxes for all lighting points shall be positioned so that future wiring can be easily carried out with removal of any inaccessible ceiling etc.

Flexible steel conduits shall be manufactured to comply with BS EN 50086 and where specified shall be LSF sheathed overall.

Flexible conduits shall be installed where a rigid conduit entry is not possible or desirable i.e. final connections to plant or motors. The fixed conduit shall terminate in a conduit box or adaptable box with earth terminal fitted at a position adjacent to the equipment.

The wiring from this box to the equipment shall be continued in flexible conduit.

A separate earth conductor not less than 2.5mm2 shall be run in the flexible conduit and connected to earth terminals on the connection box on the equipment, and in the conduit box terminating the fixed conduit run where appropriate.

The earth conductor shall be brought out through suitable size holes drilled in the units and connected to the earth terminals outside the units.

**3.12 LIGHTING**

Unless otherwise specified luminaires shall be supplied and installed in accordance with the drawings and schedules.

Luminaires shall be rigidly supported from the false ceiling framework, drop rods, conduit or directly to walls as appropriate.

Where luminaires are suspended from conduit or drop rods, the supports shall be straight and vertical with 40mm of threaded end for height adjustment. Batten type luminaires shall have a minimum of two supports and modular fluorescent luminaires shall have a minimum of four.

Luminaires shall not be supported from ductwork, pipework or any other services or from brackets supporting other services.

All ceiling heights and finished floor levels shall be checked to ensure correct luminaire mounting heights.

All luminaires shall be in accordance with the relevant British Standards and shall be manufactured from sheet steel or aluminium.

The steel shall be de-greased ad treated with rust inhibitor before final finishes of at least three coats of stove enamel paint are applied.

The internal finish of luminaires shall be white gloss.

External finishes shall be as shown on the schedules or to the Architects choice.

All fluorescent luminaires shall be high power factor to not less than 0.95 lagging.

All luminaires shall comply with electromagnetic compatibility directives 89/336/EEC, 93/68/EEC and 89/106/EEC.

Luminaires shall be provided with control gear with a maximum acoustic rating of NC25.

Each luminaire shall be provided with a cartridge type fuse in the gear compartment not exceeding 5 amps or as specified.

All luminaires shall be suitable for 230V 50Hz supply and shall be suitably earthed.

Luminaires shall be designed for easy removal of diffusers and lamps. Control gear shall be mounted on a removable gear tray for easy removal, replacement and maintenance.

Fluorescent lamps shall be of the hot cathode type and manufactured to comply with BS1853. Lamp colours and lumens output shall be as specified on the particular section of the specification.

All lighting circuits and switching shall be as indicated on the drawings and schedules and shall be adhered to unless prior approval is obtained from the consulting engineer.

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

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

Wiring shall be carried out using LSF single core cables in conduit and trunking as appropriate to a minimum conductor size of 2.5mm2. A separate protective conductor of

2.5mm2 shall be run with each final sub-circuit.

Emergency lighting shall be installed as shown on the drawings and to meet BS5266 Part 1 and all luminaires shall be ICEL certified.

All non-maintained, self-contained emergency luminaires shall have red indicator lamps in clear view to indicate the charger condition.

All emergency batteries shall be supplied to give 3-hour operation under mains failure and be of the high temperature Nickel Cadmium or sealed lead acid type.

Batteries shall be integral to the luminaire where possible and any remote battery packs shall be located in accessible areas for maintenance etc.

Remote batteries shall be located at a distance not exceeding the manufacturer’s recommendations to cause failure of operation through volt drop.

Where any remote batteries have to be located over the manufacturers recommended distances the Main Contractor shall submit the proposed method of wiring installation for the consulting engineer’s approval prior to commencement of the work.

Light switches shall be supplied and installed by the Main Contractor and shall be to the specification detailed in the particular section.

Generally single and multigang light switches where the installation is on the surface shall be of the surface pattern metal clad type and shall be mounted in metal boxes.

Single and multigang light switches where the installation is concealed shall be of the flush pattern type mounted in recessed metal boxes.

Where multigang switches shall contain switches of different phases, each switch shall be adequately separated as recommended by the supplying manufacturer and sufficiently labelled 'warning 400V'.

Switches to be installed in external or adverse conditions shall have a protection rating to a minimum of IP54.

All lighting accessories shall be carefully aligned and horizontal edges level.

All flush accessories shall have cover plates fitted correctly flush to the wall, ceiling or adjacent other surfaces.

The Main Contractor shall be responsible for removing and correctly refixing any accessories not aligned correctly.

This shall be carried out to the Main Contractor’s own expense including any remedial works to plastering and decoration.

The same shall apply to socket outlets and all other accessories.

**3.13 EARTHING**

Earthing systems shall fully comply with the current edition of the BS7671 and BS 7430.

Protection against indirect contact shall be by utilising the over current protective devices for earthed equipotential bonding and automatic disconnection of supply.

All metalwork which may provide a path to earth such as all plumbing hot and cold water pipework, waste pipes, stainless steel sinks etc shall be bonded to the earthing system.

All incoming service ducts and pipes shall be bonded to the electrical earthing system direct from the main earth bar.

The resistance between any points on the bonded system and main earth shall not exceed

0.5ohms.

Low voltage switchboards shall be provided with a 25 x 3mm copper tape to which all electrical apparatus shall be connected to form a continuous bonded earth system directly connected to the earth point.

Tapes 25 x 3mm shall be fixed at intervals not exceeding 600mm intervals.

All extraneous conductive parts and metalwork shall be solidly bonded by supplementary bonding conductors of minimum size 6mm2.

Cables shall be LSF sheathed and coloured Green/Yellow.

All bonding conductors shall be concealed by a surface or flush conduit system as appropriate.

Extraneous parts shall include Building Cladding, Raised Floors and Supports, Handrails, Ceiling Supports and Structural Steel Work etc.

Whilst sizes of earthing bonding and protective conductors will have, in most cases, been stated within the specification, it is the Main Contractors responsibility to check the actual resistance in accordance with the examination and test procedures outlined therein and in the current edition of the IET Electrical Regulations.

The Main Contractor shall confirm the tabulated requirements have been met or calculations based on the regulation formulae.

All protective conductor cables shall be connected by properly sized lugs crimped to the cable.

Earth Electrode systems shall be installed as necessary to comply with BS7430.

A single multi jointed earth electrode rod should initially be driven in the ground to obtain the earth resistance specified.

If the resistance cannot be achieved a series of electrode rods shall be driven and connected in parallel until the required resistance is gained.

Earth rods shall be of high conductivity copper 1200mm x 15mm diameter and shall be capable of being extended where necessary.

Earth Electrode rods shall be spaced not less than 1.25 times the depth of the adjacent rods.

The earth rods shall be connected by 25mm x 3mm copper earth tape buried to a minimum of 500mm below ground level.

Suitable clamps shall be securely fixed when connecting the earth tape and rods together.

Inspection pits shall be installed where rods are to be driven and set flush with the ground level.

Inspection pit lids shall have a sufficient seal to prevent the ingress of water into the pit and shall be adequately identified.

**3.14 FIRE ALARMS**

The fire alarm shall be commissioned to BS5839 by a specialist sub-contractor.

Recommendations and requirements of the Local Building Control Officer, London Fire and Civil Defence Authority and local Fire Brigade shall also be taken into consideration.

The specialist sub-contractor shall fully test, commission and issue a BS5839 compliance certificate with any agreed deviations upon completion of the installation.

The full scope of works and system requirements shall be as described in the particular section.

Wiring shall be installed using red FP200 either clipped direct to the structure for single cable runs or on a suitably sized cable tray for multi-cable runs.

Minimum size cables shall be 1.5mm2 for detection circuits and 2.5mm2 for audible alarm circuits.

Battery chargers shall be of the constant voltage type, and be capable of recharging the batteries within 48 hours after they have been discharged to their final voltage, so that they perform the duty indicated and required in BS5839.

Batteries shall be of the lead acid cell type having 24-Volt output and capacity to maintain the maximum alarm load, indicators and signalling devices for a minimum of thirty minutes after a twenty-four hour mains failure.

The capacity shall also include spare capacity for any future additions, which may be required.

Manual call points shall be semi-flush or surface as required and comply with BS5839.

They shall be red and enclosed in a metal or plastic box with an engraved contact glass.

All optical, ionisation smoke detectors and heat detectors shall comply with BS5445 and be suitable for fixing to a standard BESA box.

Fire alarm sounders and bells shall be as indicated on the drawings.

Bells shall not be less than 150mm diameter.

Flashing Xenon beacons shall have a power output of two watts at 24V D.C.

Full zoning of the system shall be engineered with the specialist sub-contractor as shown on the drawings, schedules or as specified.

**3.15 CIRCUIT IDENTIFICATION LABELLING**

All switch fuse gear shall be clearly identified with an engraved three-part laminate 'traffolyte' label with a minimum of 6mm high black lettering on a white background to show their functions.

Standard colour phase buttons shall be fixed on the outside of all switch and fuse gear to indicate to which phases of the supply the various circuits are connected.

All labels and phase buttons shall be secured by brass 4BA instrument headed bolts and nuts and each label shall be fixed with at least two bolts.

All switchgear shall be labelled with the number detailed on the Electrical drawings together with a description of its function.

Each distribution board shall be fitted with a clear plastic wallet on the inside of the enclosure door and be fitted with all relevant distribution board charts for individual circuits showing circuit reference, description and number of points fed, location, cable size etc.

 The Contractor shall supply and install in a suitable location within all main switchrooms the following safety wall charts:

* The Electricity at Work Act 1989;
* Emergency Resuscitation Treatment for Electric shock.

In addition to this the Main Contractor shall supply and install an as fitted non-fading drawing, black on white print of the single line diagram mounted in a glazed wooden frame next to each main switchgear.

The drawing shall be to the size of the original schematic working drawing.

All danger and warning labels shall have black lettering on a yellow background.

All proposed label inscriptions shall be submitted to the consulting engineer for approval prior to installation.

All external lights, switches and other remote circuits shall be labelled with the circuit reference to which they are served from.

Identification markers for cables etc shall clearly identify the circuit reference or cable number.

**3.16 TESTING AND COMMISSIONING**

Upon completion of the works the whole installation shall be tested by the Main Contractor in accordance with Part 7 of the IET Wiring Regulations and shall submit the completion and test certificate forms for approval by the consulting engineer.

The Main Contractor shall give due notification of the date when various tests are to be conducted so the consulting engineer can arrange to be present to witness them.

Failure to notify the consulting engineer may necessitate the tests to be carried out again at the Main Contractors own cost.

The Main Contractor shall arrange for off-site testing for equipment as required in the particular section.

The Main Contractor shall ascertain from the Local Electricity Authority if they require a certificate of test as a condition of accepting the installation for final connection to meters etc and if such certificates are required the Main Contractor shall obtain sufficient copies of the type of certificate required.

They shall then be submitted to the Local Electricity Authority directly.

Full test certification for all off site testing shall be issued by the appropriate manufacturer for approval for the consulting engineer.

The consulting engineer may require additional function tests when equipment has been offloaded, positioned and installed on site.

Control panels shall have an insulation test of 2kV to earth for a period of one minute in addition to normal manufacturers testing.

400-volt switchgear installations shall be tested in accordance with BS EN 60439 Part 1.

Complete mechanical tests shall demonstrate the satisfactory operation of the equipment. All relays shall be set and all overload and tripping devices demonstrated.

Phase rotation of all 3-phase distribution systems shall be demonstrated to the consulting engineer.

Site testing shall include conduit and steel trunking continuity tests.

Testing procedures shall include the following tests:

* Test for ring continuity;
* Test of circuit protective conductors including main and supplementary equipotential bonding;
* Test of Earth Electrode resistance (where fitted);
* Tests of insulation resistance;
* Tests of polarity and connections;
* Measurement of earth loop impedance;
* Functional tests, including operation of residual current devices and fault-voltage operative protective devices.

The 600/1000-Volt LSF insulated mains cable installation shall be tested in accordance with BS6346.

Insulation tests on MICC cables shall be taken 24 hours after the seals have been completed and one month later.

Characteristic curves of fuses and miniature circuit breakers shall be issued by the Main Contractor.

Whilst certificates may show a given prospective fault current at the origin of the supply, the Main Contractor shall measure the external fault loop impedance (Ze) and add this to the test sheets.

This test shall be carried out with the main equipotential bonding conductors temporarily disconnected.

Having determined Ze in this manner, it may be found useful where residual current devices are fitted, to calculate the total earth loop impedance on protected circuits by the calculation method based on direct resistance measurements, rather than to attempt to bridge the 'RCD'.

Residual current devices, where fitted, shall be tested to ensure correct operation and the Main Contractor shall verify the disconnection times are within the values given with the current IET Wiring Regulations.

Functional tests shall also include checking the operation of all luminaires, lamps and lighting points.

Any energy saving systems shall also be fully tested and commissioned to prove the entire system to the consulting engineer.

Records shall be made of all tests carried out and issued with all maintenance documents and a copy shall also be attached in the previously described manner to all equipment.

**3.17 IET WIRING REGULATIONS AND BRITISH STANDARDS**

Full compliance is required with the current edition of BS7671 (IET Wiring Regulations for the Electrical Installation of Buildings) and all relevant British Standards Codes of Practice including all amendments thereto current at the date of tender.

Full compliance will be required with the latest appropriate British Standards Specifications issued in respect of all materials used on the project.

**4 ELECTRICAL SPECIFICATION**

**4.1 GENERAL**

This specification describes the electrical services strip out and replacement providing fully upgraded luminaire installation with longevity for the next 15 years, with only normal wear and tear necessitating further renewal.

The Main Contractor shall visit the site during the Tender period to fully understand the existing installation, the extent of the works to be carried out, with access to the site, the plantrooms and ceiling depths.

No additional costs for removal / replacement of existing services will be accepted after the Tender period, as the Main Contractor will have been deemed to have full access to the site prior to tender submission.

The Main Contractor shall provide a detailed programme for the works including a schedule of deliverables to identify lead times for all equipment.

This specification includes for the Main Contractor to order, supply, deliver, off-load, store, erect, co-ordinate, install, test and commission the new electrical installations as described in this specification.

**The Main Contractor shall provide a phasing programme as part of the tender return detailing their method of installation and impact on the client’s business.**

**4.2 SCOPE OF THE WORKS**

The electrical installation shall comprise the following works but not be limited to:-

* Test the existing installation for operational functionality;

* Strip out the existing luminaires;

* Make necessary builders work holes for down lighters including pattresses where required and make good where required including touching up of paint work;

* Provide and install new luminaires including emergency lighting;

* Commission the lighting and test the emergency lighting;

* Provide client training;

* Provide O & M manuals and record drawings.

The above is a summary of the scope of works for guidance in the preparation of a tender by the Main Contractor.

The term “provide” within this specification refers to the, supply, installation, labelling, testing, commissioning, supply of documentation, training, liaison with specialists and final design to achieve a complete and safe functioning system.

**Note; - NO works except for disconnecting and reconnecting the luminaires to the Lighting Control Modules are allowed for within this Scope of Works document. All works to the existing lighting control system including reprogramming of the system shall be undertaken by the Client.**

**4.3 DESIGN RESPONSIBILITY**

The Main Contractor shall be wholly responsible for verifying the complete design of the Electrical Services as described within this specification and as shown on the tender drawings and schedules. The Main Contractor shall provide a complete set of “Construction” issue Drawings and Documents prior to commencing the installation works.

The Contractor shall liaise with the Design Team in respect to the specific power supply and cable containment requirements to be incorporated into the electrical design.

The Main Contractor shall be responsible for ensuring all isolators, switches and, interfaces are agreed with Design Team and incorporated within the design. In preparing the tender submission, the Main Contractor must review the drawings and specifications prepared by the Design Team and make due allowance for all power and containment.

The Main Contractor shall verify with the Design Team that the design preparation is carried out on the agreed floor and ceiling layout plans, and shall review all architectural and structural drawings incorporating into the tender accordingly.

It shall be noted that the concept scheme layouts on the accompanying tender drawings does not preclude the Main Contractor from putting forward an alternative improved scheme, as a separately detailed and costed proposal to the tendered scheme.

**Minimum Design Criteria**

**Lighting Levels**

Office Areas 400 lux (at working desk height)

Corridor & Circulation Area Minimum 200 lux

Toilet Cores Minimum 200 lux

Lighting load not to exceed 10w/m2

**4.4 TEMPORARY SERVICES**

No temporary services required or the building is fully occupied and operational. The main contractor to advise prior to starting works if any additional temporary services are required.

**4.5 CONTRACT ADMINISTRATION**

Allow for attendance at workshops to proactively progress the works and reduce approval periods for information / documentation.

Generally provide technical query sheets / requests for information with suggested solutions or options for discussion.

Provide weekly snagging sheets and invite the Services Engineer to witness the signing off of these items. The Services Engineer may add to these lists at any point.

Provide benchmark installations to allow quality to be signed off before proceeding with the remainder of the installation. A list of benchmark areas shall be agreed between the design team and the contractors at commencement on site.

**4.5.1 ELECTRICAL PERMITS**

As part of the base build requirements all Electrical Permits must be issued whenever works are to be carried out on the electrical equipment. The permit is to be issued for specific tasks only; not in general. An approved method statement must accompany any application for an electrical Permit. The Main Contractor must return, duly signed, at the end of each working day, stating that the works have or have not been completed.

**Access to confine spaces**

This permit is to be issued when Main Contractors need to do work in areas that are defined as confined space. A risk assessment must also accompany any method statement.

All permits shall be issued by the Client in accordance with the site procedures.

**4.6 STRIP OUT**

The Main Contractor shall allow to strip out the existing luminaires and dispose of all redundant materials including lamps in accordance with environmental good practice.

**4.7 BUILDERS WORKS**

The Main Contractor shall allow to cut out the required holes for the new down lighters including making good to the ceiling where luminaires are to be removed but not replaced.

The contractor shall allow to patch the holes and make good including touching up with paint where required.

The Main Contractor shall ensure that pattresses are installed where downlighters are installed in ceiling tiles.

**4.8 LIGHTING**

**4.8.1 GENERAL**

The Main Contractor shall, supply, install and commission luminaires and emergency luminaires, associated circuits and control devices to meet the specification to achieve a complete and safe lighting installation as shown on the layout drawings.

The luminaires shall be a as detailed in Appendix B LED luminaires as manufactured by Trilux and Formation Lighting.

Trilux House,

Winsford Way,

Boreham Interchange,

Chelmsford,

Essex

CM2 5PD

Phone: 01245 463463/07860683513 – Lesley Baker

Formation Lighting

Suite 211

134 – 146 Curtain Road

London

EC2A 3AR

Phone: 020 7127 8788/07850195780 – Andy Barber

It is the responsibility of the Main Contractor to ensure the final detail of the main luminaires are suitable to be installed within the 500 x 500 mm ceiling grid including fixing details and recess depths.

The client shall have beneficial use of the system due to the phased nature of the installation.

The Main Contractor shall ensure that beneficial use does not affect the warranty period of the luminaires.

**4.9 EMERGENCY LIGHTING**

**4.9.1 GENERAL**

Provide emergency lighting throughout the floors in accordance with the positions as indicated on the drawings and to the final approval of the Local Authority.

Illuminated exit signage shall be provided as detailed on the layout drawings and in the luminaire schedules. Final locations of the illuminated exit signs shall be as the co-ordinated reflected ceiling plan. The District Surveyor shall confirm final locations for the signage prior to installation.

**4.9.2 SYSTEM INSTALLATION**

The Emergency lighting installation shall comply with BS5266 and emergency luminaires shall comply with BS4533 Part 101 and 102.22. All equipment used shall be ICEL certified and copies of the certificates shall be provided.

Where new emergency lighting is specified, the 3 hour battery packs shall be fitted by the manufacturer of the luminaire or the battery manufacturer.

Carry out an emergency lighting illuminance test out of normal hours to prove compliance with BS5266.

Emergency lighting test and completion certificates in accordance with BS5266 shall be provided.

Provide an Emergency lighting test log book within the operating and maintenance manuals.

A clearly visible green LED shall be provided within each new luminaire indicating that the battery is in charge. Batteries shall be protected against polarity reversal and complete discharge. All batteries shall have a minimum life of 4 years.

The battery packs shall only be installed in luminaires or locations where the ambient temperature does not exceed the battery manufacturers recommended ambient temperature for the batteries. All battery packs shall comprise of battery charger, charge indicator, inverter, low battery voltage disconnection circuit and changeover relay.

The emergency battery packs shall incorporate additional devices to ensure that the ballast resets itself after testing and turns on the lamp.

Emergency lighting test switches generally be located on the on floor area control units in risers.

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**4.9.3 METHOD OF WIRING**

Generally, the lighting installation shall be connected to the existing Delmatic Lighting Control system via new 6 core cables and plugs to match the existing.

The contractor shall verify that each lighting control module (LCM) is operating prior to the installation of the new luminaires. Should a LCM be found not to be operating correctly this shall be identified immediately to the Client and Services Engineer for their action.

**4.10 TESTING AND COMMISSIONING**

The entire system shall be tested in accordance with the standard specification BS7671 IEE Wiring Regulation, BS 5266-1:2016 Emergency Lighting Code Of Practice. Upon completion of these tests inspection and completion certificates shall be issued. All tests shall include any part of the existing installation related to the new work.

Provision of a periodic inspection and test certificate is specified in BS EN 50172:2004,

6.2 shall be provided on completion of the works.

The emergency lighting installation shall be tested for full rated duration should be performed on each luminaire. The test shall be performed while the building is empty to minimise risk to MCA employees.

This method statement shall include all specialist standard test procedures.

The Main Contractor shall carry out illumination level checks of the normal lighting installation and record the levels of illumination achieved.

An emergency lighting test certificate in accordance with the British Standard shall be issued prior to practical completion being awarded.

The Main Contractor shall take particular care to ensure sufficient allowance to commission the system and all interfaces to the complete satisfaction of the Consultant Engineer. Following successful testing and commissioning practical completion shall be awarded.

**5 APPENDICES**

**5.1 APPENDIX A DRAWING REGISTER**

|  |  |
| --- | --- |
| **DRAWING NUMBER**  | **DRAWING TITLE**  |
| TES16113-E-1-101  | Proposed First Floor Lighting Layout  |
| TES16113-E-2-101  | Proposed Second Floor Lighting Layout  |
| TES16113-E-3-101  | Proposed Third Floor Lighting Layout  |
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**5.2 APPENDIX B LUMINAIRE SCHEDULE**

|  |  |
| --- | --- |
| **LUMINAIRE** **REFERENCE**  | **DESCRIPTION**  |
| **A**  | Belviso C1 500 LED4000nw 34W Modular Recessed 500 x 500 mm White  |
| **B**  | Inplana C07 CDP19 1000-840 9W Recessed Downlighter Ø 234 mm IP54 White  |
| **C**  | Amatris G2 C04 WR LED2000-840 ETDD 01 24W Recessed Downlighter Ø 138 mm IP44 White  |
| **D**  | Spot139-001-104 7W Recessed Downlighter 4000K Ø 65 mm IP44 White  |
|   |   |
| E  | Denotes standard luminaire complete with integral 3 hour emergency battery pack and invertor  |
|   |   |
|   |   |