Building Services Design
Consulting Engineers

The Corby Cube
George Street
Corby
NN17 1QG

161190 – T3
December 2016

ELECTRICAL SERVICES SPECIFICATION FOR THE CORBY CUBE OFFICE FIT OUT

TENDER

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Specification Expert – Introduction

This document has been compiled using Specification Expert, which the copyright belongs to AMTECH Group.

The content incorporates that of the National Engineering Specification (NES).

NOTES FOR TENDERERS

Dependent on the nature of the works specified within this document, the specification shall contain some or all of the items below:-

1. PRELIMINARIES

The Preliminary clauses (‘A’ sections) included are those that relate to the Engineering Works in particular and must be read in conjunction with the "Preliminaries" of the "Main Contract".

2. SYSTEM SPECIFICATIONS

The system specifications are sub-divided into four parts:-

Part 1 System objectives:

The system objectives are clauses giving details of design information, system performance and description, together with lists of the system schematics and drawings.

Part 2 Selection schedules for the reference specifications:

These selection schedules specify items in the system that is contained in the Reference Specifications (Y group). Required Y group clauses are invoked by reference.

Part 3 Clauses specific to the system:

These specification clauses are specific to the system concerned and in general make no reference to the Y group clauses.

BS Appendix

The BS Appendix contains a list of all the British and European Standards referred to in the particular system specification.

3. APPENDICES

The appendices shall consist of some or all of the following:-

Tender Summary

A pricing schedule for the system specifications.

Equipment Schedules

Schedules for the equipment specified within the document.

Reference Specifications (Clauses from the Y Group).

All the reference specifications relevant to all the systems for the job. Required clauses are invoked in Part 2 (Selection schedules for the reference specifications) for each system.

4. NON-SPECIFICATION CLAUSES

User created, non Specification Expert, clauses may appear within the specification.

Project Revision Sheet

Electrical Services Specification for New Office Fit Out of Corby Cube

161190

Revision T3

Date of issue

Prepared by Tom Wood

Revision	Date	Details	Changes	Author	Checked
P1	02/12/16	Preliminary Issue		M. Ritchie	02/12/16
T1	10/01/17	Tender Issue		T.Wood	10/01/17
T2	18/01//17	Tender Issue		T.Wood	18/01/17
T3	19/01/17	Tender Issue		T. Wood	19/01/17

A10 PROJECT PARTICULARS

110.000 THE PROJECT
- Particulars of the project as a whole are
    - The fit-out of the fourth floor areas of the existing Corby Cube, to comprise of cellular offices and a break-out area.

120.000 THE EMPLOYER:
Corby Borough Council

130.000 CONTRACT ADMINISTRATOR:
The term Contract Administrator (CA) is used throughout this specification and his duties will be carried out by
- DSPM Limited, The White Hosue, Walton Road, Kimcote, Leicestershire, LE17 5RU
- Contact: Gareth Davis
- Tel: 01455 557522
- Email: gareth.davis@corby.gov.uk

140.000 DESIGN TEAM:

- Building Services Engineer
  Mr Tom Wood
  Building Services Design
  1 Brisbane House
  Corbygate Business Park
  Corby
  NN17 5JG
  Tel. 01536 403304
  Email. michaelr@bsd.co.uk

170.000 SUBCONTRACTOR:
The term Subcontractor is used throughout this specification and is deemed to be synonymous with the term Subtrader and the like which may be used elsewhere within the Contract Documentation.

180.000 THE SUBCONTRACT:
This document has been prepared using the Common Arrangement of Sections and this Subcontract comprises the following
- Mechanical Services Installations
- Public Health Service Installations
- Electrical Services Installations
- Automatic Controls Installations

190.000 MAIN CONTRACTOR:
To be appointed

A11 TENDER AND CONTRACT DOCUMENTS

110.000 THE TENDER DRAWINGS:

- The tender drawings are

161190/E/2100 – Proposed Fourth Floor Indicative High Level and Low Level Containment Layout
161190/E/2200 – Proposed Fourth Floor Lighting and Fire Alarm Layout
161190/E/2300 – Proposed Fourth Floor Small Power and Data and Access Control Layout
161190/E/2800 – Proposed Fourth Floor Strip Out and Enabling Works

150.000 INSPECTION:

Drawings and other documents relating to the Contract generally maybe inspected, by appointment, prior to the submission of tender.

- As Built documents may be inspected at the Facilities Management Office, within The Corby Cube
- Engineering Services documents may be inspected at the office of the building services engineer

A12 THE SITE EXISTING BUILDINGS

110.000 THE SITE / EXISTING BUILDINGS:
The site/existing buildings are:
- The site is located on the existing site of Corby Cube

120.000 SITE LOCATION:
The site is located at The Corby Cube Parkland Gateway George Street, Corby NN17 1QG

130.000 EXISTING MAINS / SERVICES:
- Existing mains/engineering services comprise Natural Gas, Mains Cold Water, Mains Electricity and Telecommunications

140.000 RISKS TO HEALTH AND SAFETY:
The accuracy and sufficiency of this information is not guaranteed by the Employer or the CA and the Subcontractor must ascertain for himself any information he may require to ensure the safety of all persons and the Works.
Comply with the requirements of the CDM Regulations by:-
- compiling risk assessments for the sub-contract works
- providing information on the sub-contract works which might affect the health or safety of any person.
- providing appropriate input to the Pre-Construction Information, Construction Phase Plan, and health and safety file for the works.

150.000 SURVEY:
- Ascertain the nature of the site and all local conditions and restrictions likely to affect the execution of the Works.
- Examine all available drawings of the engineering services and report any discrepancies to the CA.

170.000 SITE VISIT:
Before tendering, ascertain the nature of the site, access thereto and all local conditions and restrictions likely to affect the execution of the Subcontract Works. Site visit may be made by the Subcontractor by prior agreement.

A30 TENDERING/SUB-SUBLETTING/SUPPLY

100.000 SUBCONTRACT TENDERING

110.000 SCOPE:
These conditions are supplementary to those stated in the invitation to tender and on the Form of Tender and Agreement.

120.000 TENDERING PROCEDURE:
Tendering procedure is in accordance with the principles of the
- 'Code of Procedure for Single Stage Selective Tendering' 1996.

130.000 EXCLUSIONS:
- If the Subcontractor cannot tender for any part(s) of the work as defined in the tender documents, he must inform the CA as soon as possible, defining the relevant part(s) and stating the reasons for his inability to tender.

140.000 ACCEPTANCE OF TENDER:
The Employer and his representatives:
- Offer no guarantee that the lowest, or any tender, will be recommended for acceptance or accepted.
- Will not be responsible for any cost incurred in the preparation of any tender.

150.000 PERIOD FOR ISSUE OF NOMINATION INSTRUCTIONS:
Where a minimum period has been stipulated by the CA in the Invitation to Tender, it must not be altered by the Subcontractor without the approval of the CA.

200.000 PRICING/SUBMISSION OF DOCUMENTS

210.000 SUBCONTRACT PRELIMINARIES:
- The Subcontract Preliminaries/General conditions section (A10-A55 inclusive) must not be relied on as complying with SMM7.

230.000 PRICING OF PERFORMANCE SPECIFIED WORK:
Ensure tenders include for all work necessary to meet the requirements for the Performance Specified Work and its completion and proper integration with the Works generally.

270.000 QUANTITIES IN THE SUBCONTRACT SPECIFICATION:
- Where and to the extent that quantities are included in the specification, they have been prepared in accordance with SMM7 only where and to the extent stated. Where not so stated, the items, descriptions and measurements:
  - Must not be relied on as complying with SMM7.

Must be priced taking account of the information given elsewhere in the tender documents, including for all associated and ancillary work shown or clearly apparent as being necessary for the complete and proper execution of the work.

280.000 SUBCONTRACT SPECIFICATION WITHOUT QUANTITIES:
Where and to the extent that quantities are not included in the specification, tenders must include for all work shown or described in the tender documents as a whole or clearly apparent as being necessary for the complete and proper execution of the Works.

290.000 PRICING OF SUBCONTRACT SPECIFICATION:
Alterations and qualifications to the specification must not be made without the written consent of the CA. Tenders containing such alterations or qualifications may be rejected. Costs relating to items in the specification which are not priced will be deemed to have been included elsewhere in the tender.

300.000 SUBMISSION OF PRICED SUBCONTRACT SPECIFICATION:
The priced subcontract specification must be submitted
- with the Tender.

310.000 ERRORS IN THE PRICED SUBCONTRACT SPECIFICATION:
Errors in the priced subcontract specification will be dealt within accordance with the `Code of Procedure for Single Stage Selective Tendering' 1996.
Alternative 2. (The word `specification' being substituted for `bills of quantities').

330.000 A SCHEDULE OF RATES:
A fully priced copy must be submitted
- with the Tender.
- The Subcontractor may, if he so wishes, add to this schedule.
- Rates to exclude Contractor's cash discount.

340.000 ATTENDANCES:
Where these have been listed by the CA in the Invitation to Tender, details of any changes must be listed in
- Form of Tender NSC/T Part 2.

350.000 DAYWORK PERCENTAGES:
For method of completing daywork percentages on page 3 of Form NSC/T Part 2, see clause A55.110.000.

360.000 PROGRAMME:
The Subcontractor's proposed programme as specified in Section A32 or a summary thereof showing the sequence and timing of the principal parts of the Works, periods for planning and design, and itemising any work which is excluded must be submitted within 1 week on request

370.000 TENDER STAGE METHOD STATEMENTS:
- Method statements must be submitted within one week of request describing health and safety considerations and how and when the subcontractor proposes and undertakes to carry out the following.
    - Resourcing for design duties.
    - Testing and commissioning.

The Subcontractor may, at his discretion and at the same time, submit method statements for other parts of the Works.

380.000 ALTERNATIVE TENDERS:
In addition to and at the same time as his tender for the Subcontract Works as defined in the tender documents, the Subcontractor may, at his discretion, submit alternative design proposals and/or method(s) of construction/installation for consideration. Alternatives which would involve significant changes to other work will not be considered.
Such alternative(s) must include all additional costs arising from necessary changes to the details of the installation, including changes to the design and drawings, as well as any associated ancillary equipment items.
Such alternative(s) is/are deemed to be alternative tender(s) and each must include a complete and precise statement of the effects on cost and programme.
- Full technical data for each such alternative must be submitted with the Tender together with details of any consequential amendments to the design and/or construction/ installation of other parts of the Works.

390.000 ALTERNATIVE MANUFACTURERS/SUPPLIERS:
In addition to and at the same time as the tender for the Subcontract Works as defined in the tender documents, the Subcontractor may, at his discretion, submit alternative manufacturers or suppliers for consideration. Alternatives which would involve significant changes to other work will not be considered.
Such alternative(s) must include all additional costs arising from necessary changes to the details of the installation, including changes to the design and drawings, as well as any associated ancillary equipment items.
Such alternative(s) is/are deemed to be alternative tender(s) and each must include a complete and precise statement of the effects on cost and programme.

- Full technical data for each such alternative must be submitted with the Tender together with details of any consequential amendments to the design and/or construction/installation of other parts of the Works.

400.000 SELECTION OF MANUFACTURERS/SUPPLIERS:
Where manufacturers, suppliers or installers of products are NOT identified by name select products that comply in all respects with the specification and, as and when requested, demonstrate such compliance.
Where manufacturers, suppliers or installers of products are identified by name, or names, but no reference is made to "Or approved" equivalent use these exclusively.

- Where manufacturers, suppliers or installers of products are identified by name, or names, but reference is made to "Or approved" equivalent the submitted tender must include the named or one of the named suppliers. Alternatives may be selected and shall be submitted to the CA for approval, separately.

Check that any proposed alternatives comply with any stated British (or other equivalent recognised International) Standards. Confirm equivalence in quality, operation and space requirements to those items which have been specified by name. If, and when requested demonstrate the proposed alternative is fully equivalent to the specified item and identify any constructional, cost, programme, maintenance or other differences.

410.000 A LIST OF PROPOSED MANUFACTURERS/SUPPLIERS:
A list of proposed manufacturers/supplies of products, equipment and plant, including all items for which the choice of manufacturer/supplier is at the discretion of the Subcontractor, must be submitted

- with the Tender.

420.000 TECHNICAL INFORMATION:
Technical information relating to the Subcontractor's tender must be submitted

- within one week of request.

430.000 QUALITY CONTROL RESOURCES:
A statement must be submitted describing the organisation and resources which the Subcontractor proposes and undertakes to provide to control the quality of the Subcontract Works. The statement must include the number and type of staff responsible for quality control, with details of their qualifications and duties.

- Within one week of request.

440.000 HEALTH AND SAFETY INFORMATION:
Submit a statement with the tender describing the organisation and resources which the Subcontractor proposes and undertakes to provide to safeguard the health and safety of operatives, and of any person who may be affected by the Subcontract works, including:

- A copy of the subcontractors health and safety policy document, including risk assessment procedures.
- Accident and illness records for the past five years.
- Records of previous Health and Safety Executive enforcement action.
- Records of training and training policy.
- The number and type of staff responsible for health and safety on this project with details of their qualifications and duties.

450.000 RISKS TO HEALTH AND SAFETY:
Submit a statement with the tender describing any significant and unavoidable risks which may arise as a result of carrying out the subcontract works and the measures proposed to safeguard the health and safety of operatives and of any person who may be affected by the Subcontract/works.

460.000 MAINTENANCE CONTRACT:
Provide a maintenance contract for twelve months, from the date of Practical Completion, for the following:
the entire mechanical and public health installation
Ensure that the maintenance recommendations set out in the appropriate standard can be achieved.

- Carry out the maintenance recommendations set out in the appropriate standard.

- Emergency maintenance response times 48 hours
- Include for maintaining the installation in efficient working order including routine checks, adjustments, lubrication and replacement of consumable spares, etc.

470.000 PROPOSALS FOR ANNUAL MAINTENANCE CONTRACT:
Proposal
- Submit within one week of request a supplementary proposal for an annual maintenance contract for the following

the entire mechanical and public health installation
- The proposal should include for maintaining the installation in efficient working order including routine checks, adjustments, lubrication and replacement of consumable spares, etc.
- It should set out the terms of the offer, the work to be carried out, the guarantees of performance and the price of the first 12 months after Practical Completion of the Works or Section thereof.
- The proposal will not necessarily be considered as part of the tender for the Subcontract Works and the Employer does not undertake to accept it.

500.000 SUB-SUBLETTING

511.000 `LISTED' SUB-SUBCONTRACTORS:
Where the Subcontract Documents provide that certain work must be carried out by a person of the Contractor's choice selected from a list of persons given therein:
- The selected person shall be a Sub-subcontractor as provided for in the Subcontract.
- The CA may add additional persons to the list at anytime prior to the execution of a binding Sub-subcontract agreement.
- With the consent of the CA, the Subcontractor may add additional persons to the list and shall, if requested, submit to the CA (in an approved form) evidence of the suitability of such additional persons to carry out the Sub-subcontract work.
- If at any time prior to the execution of a binding Sub-subcontract agreement none of the persons named in the list (including any persons added as provided above) is able and willing to carry out the relevant work, the Subcontractor must notify the CA without delay.

The CA will then forthwith add the name(s) of other person(s) as provided above, or confirm that he does not wish to do so within (weeks) one
If the CA fails to do either within this time of the Subcontractor's notification the work shall be carried out by the Subcontractor who may
Sub-subcontract in accordance with the Subcontract.
- Before the start of the work to which the list relates, the Subcontractor must enter into a binding Sub-subcontract agreement and confirm to the CA that this has been done, giving the name of the selected Sub-subcontractor.

520.000 SUB-SUBCONTRACTORS:
Where the Subcontractor proposes to sublet any portion(s) of the Subcontract Works a list must be submitted
- before the execution of the Subcontract

The list will define such portion(s) and give, for each, the name and address of the proposed Sub-subcontractor.

A31 PROVISION, CONTENT AND USE OF DOCUMENTS

100.000 DEFINITIONS AND INTERPRETATIONS

110.000 MAIN CONTRACT PRELIMINARIES:
Definitions and interpretations given in Main Contract Preliminaries apply to the whole of the Works, including this Subcontract. In the case of conflicting statements the Subcontract Preliminaries will prevail.

120.000 DEFINITIONS:
The definitions of technical terms associated with the engineering services installations are those included in:

CIBSE, IOP and BSRIA Technical Publications
BS 7671 - Requirements for Electrical Installations (IEE Wiring Regulations).
British Standards, including Codes of Practice.
Associated Statutory Acts.

Where used in the documentation the following definitions apply

- Duct: An enclosed space specifically intended for the distribution of services, with direct access for personnel.
- Trench: A covered horizontal service space in the floor or ground with access from above.
- Cavity: A space enclosed within the elements of a building within which services are installed, e.g. the space between ceiling and floor above. See Building Regulations.
- Service Areas: Includes areas within a building with limited finishes such as loading bays, car parks etc.
- Concealed Services: Includes installations within ducts, trenches or cavities.
- System: System means all equipment, accessories, controls, supports and ancillary items, including supply, installation, connection, testing, commissioning and setting to work necessary for that section of the Works to function.
- Services: Services means the inclusion of one or more systems.

130.000 REFERENCES TO BSI DOCUMENTS:
References to BSI documents are to the versions and amendments listed in the British Standards Catalogue

- and in subsequent issues of BSI Update Standards up to and including that for the month of tender issue.
- any subsequent versions and amendments specifically referred to in the project documents.

140.000 MANUFACTURERS' REFERENCES:
Manufacturers' references are those current at tender issue.
References mean the particular product as specified in the manufacturer's technical literature current at that time.

150.000 TENDER DRAWINGS:
Tender drawings means drawings listed in

- the Main Contract Preliminaries

The tender drawings show the general arrangement of the Engineering Services to be provided and the inter-relationship of the Works with work to be installed by others.

160.000 DRAWINGS:
Sketch drawings, schematic drawings, detailed design drawings, co-ordination drawings, installation drawings, installation wiring diagrams, shop drawings, manufacturer's drawings, manufacturer's certified drawings, record drawings, builder's work drawings are as defined in the BSRIA TN 21/97 Appendix A.

161.000 SKETCH DRAWINGS:

Line diagrams and layouts indicating basic proposals, location of main items of plant, routes of main pipes, air ducts and cable runs in such detail as to illustrate the incorporation of the Engineering Services within the Project as a whole.

162.000 SCHEMATIC DRAWING:
A line diagram describing the interconnection of components in a complex system. The main features of a schematic drawing are as follows:

- A two dimensional layout drawing with divisions to show the distribution of the system between building levels. Or an isometric style layout indicating the distribution of systems across individual floor levels. The drawing is not necessarily constructed to scale. Include all functional components which make up the system, i.e. plant items, pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components.
- Symbols and line conventions in accordance with BS EN ISO 11091 Recommendations for symbols and other graphic conventions.
- Symbols and line conventions in accordance with
- Label the drawing with appropriate pipe, duct and cable sizes where these are not shown elsewhere.
- Indicate components which have a sensing and control function and show the links between them, e.g. building management systems, fire alarms and HV controls.
- Identify the major components indicated on the schematic drawing so that their whereabouts in specification and on other drawings can be easily determined.
- Commissioning specification

Include all data essential to testing and commissioning including volumetric flow rates, design total pressure losses at equipment, locations of dampers, valves and flow measuring stations, electrical fault levels, current ratings, short circuit capacities and tripping times.

163.000 DETAILED DESIGN DRAWING:
A drawing showing the intended locations of plant items and service routes in such detail as to indicate the design intent. The main features of detailed design drawings should be as follows:

- Plan layouts to a scale of at least 1:100.
- Plant areas to a scale of at least 1:50 and accompanied by cross-sections.
- The drawing will not indicate the precise position of services, but it should be feasible to install the services within the general routes indicated. It should be possible to produce co-ordination drawings or installation drawings without major re-routeing of the services.
- Represent pipework by single line layouts.
- Represent ductwork by either double or single line layouts as required to ensure that the routes indicated are feasible.
- Symbols and line conventions in accordance with

Indicate on the drawing the space available for major service routing in both horizontal and vertical planes.

164.000 CO-ORDINATION DRAWING:
A drawing showing the inter-relationship of two or more engineering services and their relation to the structure and building fabric. The main features of a co-ordination drawing are as follows:

- Plan layouts to a scale of at least 1:50, accompanied by cross-sections to a scale of at least 1:20 for all congested areas.
- A spatially co-ordinated drawing, i.e. no physical clashes between the system components when installed at the scaled-off positions shown on the drawing. Provide dimensions in areas where tolerances are minimal.
- Make allowance for the service at its widest point for spaces between pipe and duct runs. Allow for insulation, standard fitting dimensions and joint widths on the drawing.
- Make allowance for those plant items specified by the designer and identified in the design specification.
- Make allowance for installation working space and space to facilitate commissioning and maintenance.
- Indicate positions of main fixing points and supports where they have significance to the structural design.
- Arrange the services so that it is possible to demonstrate a feasible sequence of installation.
- Support the drawing with individual services drawings for clarity.

165.000 INSTALLATION DRAWING:
A drawing based on the detailed drawing or co-ordination drawing with the primary purpose of defining that information needed by the tradesmen on site to install the works. The main features of installation drawings should be as follows.

- Plan layouts to a scale of at least 1:50, accompanied by cross-sections to a scale of at least 1:20 for all congested areas.
- A spatially co-ordinated drawing, i.e. no physical clashes between the system components when installed at the scaled-off positions shown on the drawing.
- Make allowance for inclusion of all supports and fixings necessary to install the works.
- Make allowance for the service at its widest point for spaces between pipe and duct runs. Allow for insulation, standard fitting dimensions and joint widths on the drawing.
- Make allowance for installation details provided from shop drawings.
- Make allowance for installation working space; space to facilitate commissioning and space to allow on-going operation and maintenance in accordance with the relevant health and safety requirements.
- Make allowance for plant and equipment including those which are chosen as alternatives to the designers specified option.
- Provide dimensions where the positioning of services is considered to be important enough not to leave to the tradesmen onsite.

166.000 INSTALLATION WIRING DIAGRAM:
Drawing showing the interconnection of electric components, panels etc in accordance with the design intent indicated in the schematic drawings and incorporating the details provided on manufacturer's certified drawings.
Indicate the following; maximum electrical loading for each supply cable; cable termination facilities; and cable identification and all terminal numbers.

167.000 SHOP DRAWINGS:
Drawing prepared by a fabricator or supplier unique to the project. Including supplier's drawings for ductwork, pre-fabricated pipework, control and switchgear panels and associated internal wiring.

168.000 MANUFACTURER'S DRAWING:
Drawing provided by a manufacturer or supplier to indicate a typical representation of the product, components or plant items to be supplied for a particular project.

169.000 MANUFACTURER'S CERTIFIED DRAWING:
Drawing provided by a manufacturer or supplier to indicate details of the product, components or plant items and which the manufacturer or supplier guarantees the supplied equipment will comply with.

170.000 RECORD DRAWING:
Drawing showing the building and services installations as installed at the date of practical completion. The main features of the record drawings should be as follows:

- Provide a record of the locations of all the systems and components installed including pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components.
- Use a scale not less than that of the installation drawings.
- Have marked on the drawings the positions of access points for operating and maintenance purposes.
- The drawings should not be dimensioned unless the inclusion of a dimension is considered necessary for location.

171.000 BUILDER'S WORK DRAWING:
Installation stage

- Drawing to show requirements for building works necessary to facilitate the installation of the engineering services (other than where it is appropriate to mark out on site).

180.000 CONTROLS LOGIC DIAGRAMS:
Diagrams, drawings and/or schematic details of all control components and instruments showing the layout with each item uniquely identified together with a description of the controls operation and details of the associated interlocking.

181.000 SWITCHGEAR, STARTER AND CONTROL INSTRUMENTATION PANEL DRAWINGS:
Drawings showing the construction and internal wiring diagrams of the starters, panels and/or other devices.

182.000 AS-INSTALLED DRAWINGS:
Drawings/records retained on site to record the progress of and any site modifications to the Works including any changes to software.

183.000 PLANTROOM SCHEDULES AND SCHEMATICS:
Frame the following under glass and hang in each plant room and any other appropriate location.
- Schematic drawings of circuit layouts showing identification and duties of equipment, numbers and locations, controls and circuits.
- Valve schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each valve.
- Control schematics.
- Location of mechanical and electrical plant and equipment items.
- First aid instructions for treatment of persons after electric shock.
- Location of isolating switch for electricity supply.
- Location of main incoming gas valve serving gas meter.
- Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
- All other items required under Statutory or other regulations.

190.000 EXAMINATION OF DRAWINGS/INFORMATION:
The CA will examine the propositions submitted for compliance, in principle, with the design intent. Such an examination shall not relieve the originator of such documents of his responsibilities and obligations under the contract.

200.000 DOCUMENTS PROVIDED ON BEHALF OF THE EMPLOYER

210.000 MAIN CONTRACT PRELIMINARIES:
Conditions given in Main Contract Preliminaries under the heading 'Documents provided on behalf of Employer' apply to documents relating to this Subcontract.

230.000 DRAWN AND OTHER INFORMATION:
Drawn information will be provided by the design team and client as follows.
- Sketch drawings
- Schematic drawings
- Detailed design drawings
- Builder's work information

300.000 DOCUMENTS TO BE PROVIDED BY SUBCONTRACTOR

311.000 PRODUCTION INFORMATION:
- Liaise with the CA, Contractor, Mechanical Services Sub-Contractor and others as necessary to help ensure co-ordination of the work with related building elements and services.
- Provide drawings and other information as specified showing such details of the work as the CA may reasonably require.
- Submit to the CA for comment, make any necessary amendments and resubmit for further comment unless the CA confirms that this is not necessary.
- Submit sufficient copies of final information to the CA for distribution to the Contractor and all affected parties.

313.000 CO-ORDINATION OF ENGINEERING SERVICES:

Co-ordination of the Engineering Services Installations will be carried out
- as part of the Mechanical Sub-Contract works
- under the direction of the Mechanical Sub-Contractor's appointed project manager – the Mechanical Sub-Contractor has responsibility for production of the detailed co-ordination drawings.

Agree principles of co-ordination with all parties concerned.
- Provide details for the Co-ordination Drawings, to be incorporated by the Mechanical Services Subcontractor.

Ensure the installation drawings make due allowance for all building elements, structure and other services.
- Prior to submission check and approve all drawings, schedules and any other information provided by manufacturers, nominated suppliers or specialist sub-subcontractors to ensure that all the requirements of the contract documentation have been incorporated. Accompany all documents submitted with a certificate indicating that they have been checked by the Subcontractor.

320.000 DRAWN AND OTHER INFORMATION:

Provide drawn information for the design team and client in the following forms:-

Initial copies for comment
- print form
- CAD format
  - Comply with BS EN ISO 13567-1.
  - Comply with BS EN ISO 13567-2.

Final copies for distribution
- print form
- CAD format
  - Comply with BS EN ISO 13567-1.
  - Comply with BS EN ISO 13567-2.

Provide drawn information for the design team and client in the following numbers

Sketch drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Schematic drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Co-ordination drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Installation drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Installation wiring drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Builder's work information
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Manufacturer's drawings
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Controls logic diagrams
- Initial copies for comment (no) 2
- Final copies for design team (no) 2

Switchgear, starter and control instrumentation panel drawings
- Initial copies for comment (no) 2

- Final copies for design team (no) 2

As-installed drawings

- Site record copy

Record drawings

- Initial copies for comment (no) 2
- 2 preliminary sets for use during commissioning.
- One reduced set incorporated into each Operating and Maintenance manual.

330.000 PREPARATION OF DOCUMENTS:

- Prepare drawings to commonly recognised scales generally on A1 sheets and details and schedules on A4 sheets.
- Agree scales, drawing sheet size and format with the CA before preparing any documents.
- Prepare electrical drawings in accordance with BS EN 61082-1.

350.000 DOCUMENT NUMBERING/REGISTRATION SYSTEM:
Agree with the CA the document numbering/registration system to be used before preparing any documents.

360.000 BUILDER'S WORK INFORMATION:
Confirm and amplify any information provided by the CA.

- Builder's work is excluded from the Subcontract.
- Builder's Work excludes drilling and/or plugging walls, floors, ceilings etc., for fixings for services and holes in walls up to 50mm diameter or 50x50mm, and such work is included in the Subcontract.
- Provide Builder's Work Information, appropriate to the stage of design development, and include requirements for foundations, bases, and supporting structures for plant and equipment.
- Mark out on site, all cut holes and chases required, any pockets cast in concrete, any inserts, any built in sleeves or similar items.
- Holes may not be cut in steelwork, reinforced or precast concrete without written permission from the CA. Under no circumstances will holes be cut in pre-stressed concrete. Permitted holes in steelwork must be drilled - burning by means of welding equipment is prohibited.

370.000 TECHNICAL LITERATURE:
The Subcontractor is

- advised

to keep copies of the following on site, readily accessible for reference by all supervisory personnel

- Relevant BS Codes of Practice.

380.000 MAINTENANCE INSTRUCTIONS AND GUARANTEES:
Retain copies delivered with components and equipment (failing which, obtain), register with manufacturer as necessary and hand over to CA on or before Practical Completion.
Notify CA of telephone numbers for emergency services by Subcontractors after Practical Completion.

BS APPENDIX

BS 7671:2008
Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition icl. all current amendments.
BS EN 61082-1:2006
Preparation of documents used in electrotechnology. Part 1 Rules

BS EN ISO 11091:1999
Construction drawings. Landscape drawing practice

BS EN ISO 13567-1:2002
Technical product documentation. Organisation and naming of layers for CAD. Part 1 Overview and principles

BS EN ISO 13567-2:2002

Technical product documentation. Organisation and naming of layers for CAD. Part 2 Concepts, format and codes used in construction documentation

A32 MANAGEMENT OF THE WORKS

110.000 MAIN CONTRACT PRELIMINARIES:
- Management of the Works applies to the whole of the Works, including this Subcontract. Comply with the requirements specified therein in so far as they apply to the Subcontract Works, and co-operate with and assist the Main Contractor in complying with them generally.

120.000 CO-OPERATE:
Co-operate with the Contractor, other subcontractors, suppliers, local authorities and statutory undertakings in the execution of their work.

130.000 PROGRAMME/PROGRESS:
Provide detailed sub-programmes to assist the Contractor in producing a Master Programme for the Contract Works.
Due allowance is to be made in the programme(s) for the Works for, but not limited to, the following:
- Ordering and installation periods.
- The completion of drawing, etc. including the minimum working days for comment 5
- Work resulting from instructions issued in respect to the expenditure of provisional sums.
- Concurrent work by other trades.
- Any temporary works necessary for the completion of the engineering services installations.
- Pre-commissioning, commissioning and performance testing of the engineering services installations.
- Preparation and provision of Record Drawings and Operating and Maintenance Manuals.

Provide programme information as
- simple bar chart type.

Provide a separate and detailed commissioning programme for agreement with the CA. Make due allowance for the following:
- Commissioning, demonstration and instruction procedures.
- Provision of written notice before each (or series of) test, inspection, commissioning or demonstration procedures are to be carried out, not less than 3 working days
- Demonstration to the CA that test instruments and equipment are accurate.

131.000 COMMISSIONING PROJECT MANAGEMENT:
- Compile a detailed commissioning programme and confirm/agree with the main contractor.
- Compile and submit to the project supervisor the appropriate health and safety method statements and risk assessments.
- Establish a means (such as checklists) of monitoring the progress of the commissioning.
- Ensure that all parties involved on the commissioning process have documentation procedures for dealing with variations to contract. Ensure that a control mechanism is set up which includes documentary back-up of what has been changed, how and why.

140.000 MONITORING:
Record progress of the Works weekly on a copy of the programme kept on site. Update or redraft programme without delay if any circumstances arise which affect the progress of the Works.
- Mark up "As Installed" details weekly and before any work is hidden from view.

150.000 INSPECTION AND MEASUREMENT OF WORK:
Provide all necessary assistance to enable CA to examine or measure the Works.

160.000 COVERING-UP:
Ensure no section of the Works are covered, concealed or insulated until completion of a witnessed satisfactory test.
Give notice when Works which are to be covered or concealed are ready for examination and/or measurement, not less than 3 working days
Give notice to
- CA.

170.000 STATUTORY AUTHORITIES:
Orders for the incoming services (if required) will be placed by

- the Main Contractor.

Liaise with the Statutory Authorities and provide any test notices required to ensure final connections are made in accordance with the requirements of the testing and commissioning programme.

180.000 TEST NOTICES:
Provide all formalities in connection with Test Notices, Agreement and Application for Supply Forms etc. Ensure all documents requiring the Employer's signature are forwarded to the CA in time to meet the building programme in order for the necessary test and supply arrangements to be made. No additional payments will be made for expenses incurred due to reconnections, re-visits etc., by Supply Authorities or any other officials.

A33 QUALITY STANDARDS/CONTROL

110.000 MAIN CONTRACT PRELIMINARIES:

- Quality Standards/control

Applies to the whole of the Works, including this Subcontract. Comply with the requirements stated therein insofar as they relate or apply to the Subcontract Works, and co-operate with and assist the Main Contractor in complying with them generally.

130.000 SUBCONTRACTOR'S PERSON-IN-CHARGE:
Appoint a foreman-in-charge and/or site agent to ensure constant management and supervision of the Subcontract Works.
Give maximum possible notice to the Contractor and CA before changing the foreman-in-charge or site agent.

140.000 DIMENSIONS:
Where installations are dependent upon site dimensions ensure that these are available before proceeding with the Works.
Do not take dimensions by scaling from the drawings.
Where dimensions are indicated on drawings check these on site, as appropriate, to ensure building construction and manufacturing tolerances can be accommodated.

- Do not order or manufacture equipment using dimensions indicated on the Tender drawings, specification or schedules.

150.000 SETTING OUT FOR THE SUBCONTRACT WORK:
Where this is done by the Main Contractor check its accuracy and obtain his approval before proceeding with the work.

160.000 SITE MODIFICATIONS:
Do not make site modifications to assemblies without authorisation.
Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions.
Ensure that modifications made comply with any type test certificate obtained for arrangement of components.

170.000 STANDARDS AND REGULATIONS:
Provide all materials and works in accordance with the appropriate British Standard or Code of Practice and where no BS or CP is applicable the Agreement Certificate for the particular item.
Comply with all statutory instruments and regulations, and local byelaws relating to the area of the site current at

- the date of tender.

Comply with the requirements of the Local Authority Building Inspector.
Comply with all relevant requirements included in the Main Contract Preliminaries Section

- regarding Statutory Obligations.

Notify all authorities in accordance with their regulations and obtain any required approvals for the installation.

- Where no specific design, performance or installation standards are quoted the following shall apply.
  CIBSE, Commissioning Codes.
  CIBSE Code for Lighting.
  CIBSE, Technical Reports.
  CIBSE, Technical Memoranda.
- Ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.
- Supply plant and equipment to achieve the specified design conditions and to provide stable control.

171.000 STANDARDS AND REGULATIONS:
Provide all materials and works in accordance with the appropriate British Standard or Code of Practice and where no BS or CP is applicable the Agreement Certificate for the particular item.

Comply with all statutory instruments and regulations, relating to the area of the site current at
- The date of tender.

Comply with the requirements of the Local Authority Building Inspector.
Comply with all Statutory Obligations arising from current legislation and regulations, together with other requirements, including, but not limited to, the following:-

- Statutory Obligations
  - Health and Safety at Work etc Act 1974
  - Management of Health & Safety at Work Regulations 1999
  - The Working Time Regulations 1998
  - Building Regulations 2013 and current amendments
  - Public Health Acts
  - Electricity Acts
  - Electricity at Work Regulations 1989
  - Clean Air Act 1993
  - The Control of Pollution Act 1974 and Amendment Acts
  - The Workplace (Health, Safety and Welfare) Regulations 1992
  - The Construction (Design and Management) Regulations 2015 The Construction (Design and Management) Regulations 2007
  - The Health and Safety (Display Screen Equipment) Regulations 1992
  - The Control of Substances Hazardous to Health (COSHH) Regulations 2002
  - The Control of Substances Hazardous to Health (Amendment) Regulations 2003
  - The Provision and Use of Work Equipment Regulations 1998
  - Personal Protective Equipment at Work Regulations 1992
  - The Construction (General Provisions) Regulations 1961
  - The Lifting Operations and Lifting Equipment Regulations 1998
  - Other relevant Safety Regulations
- Public Utility Company and/or Statutory Authority regulations, specifications, and requirements.
- Other Requirements
  - British Standards and Codes of Practice.
  - BS 7671 - Requirements for Electrical Installations (IEE Wiring Regulations).
  - BS EN 50110.
  - Insurance Company Requirements.
  - LDSA Fire Safety Guides.
  - IEC Standards.
- Notify all authorities in accordance with their regulations and obtain any required approvals for the installation.
- Where no specific design, performance or installation standards are quoted the following shall apply.
  - BS-EN 12 464-1:2011
  - CIBSE Code for Lighting.
  - CIBSE Technical Memoranda.
- Ensure all equipment and systems are designed and installed in accordance with the relevant standards and that operational compatibility exists between the systems and any other system installed at the same location.
- Supply plant and equipment to achieve the specified design conditions and to provide stable control.

180.000 TYPE TESTS:
Provide certificates of verification of type tests. Ensure that drawings and other documents forming part of certificate are available prior to any order being placed.

190.000 TEST CERTIFICATES:
Where testing specific to the project is required, ensure test certificates include

Project title.
Details and date of test.
Instruments used, serial numbers, calibration dates.
Signature of those witnessing test.
Contractor's name.

Specific location of the item in the Works.

200.000 INSPECTION AND TESTS - ON OR OFF-SITE:
Submit schedules showing those parts of the Works for which inspections and tests are required in the specifications, to substantiate conformity with the Specification and for which records are required to be maintained.
Should any alternative item be proposed which does not carry appropriate certification, ensure independent testing is carried out at no expense to the Employer to confirm compliance.
Where required, provide formal method statements supported by risk assessments detailing the procedures for carrying-out on site tests. Agree in advance with all parties procedures for inspections and tests including periods of notice.
Where a test indicates non-compliance with the Specification submit immediately details of the non-compliance and proposals for corrective action.
Arrange access for personnel who require to be in attendance, to manufacturer's or other off site premises when any inspections and tests carried out.
Attendance or otherwise of the supervisory personnel during specified inspections or tests will not reduce the obligations or restrictions of the Contract.
Carry out all tests required by legislation under the direction of a competent person.

210.000 INSPECTIONS AND TEST RECORDS:
Prepare a set of drawings and/or report sheets to record accurately the test and inspection information including the following.

Plant identification, section and installation under test.
Manufacturer's reference number.
Date, time, duration of test, weather conditions.
Test results with itemised readings including records of all other checks and tests.

Maintain records of all specified inspections and tests performed including third party and works test certificates.
Include in records, as appropriate, details of the element, item, batch or lot, the nature, number and date of the inspections and tests, the number and type of deficiencies found, any corrective action taken and other relevant particulars.
Maintain all records on site for inspection. On completion of the Works, include copies in the operating and maintenance manuals.
Submit copies of records within one week of request.

220.000 TESTING AND COMMISSIONING OF SERVICES:
Agree with the Contractor a programme for pre-commissioning checks, setting to work, commissioning and performance testing, and allow for all costs incurred.
Where required, provide formal method statements supported by risk assessments detailing all commissioning procedures.
Give notice to the Contractor and CA and state any requirements for the attendance and co-operation of others.

- Not less than fourteen working days.

Provide all necessary facilities to enable tests to be witnessed and inspections carried out either on site or at manufacturer's works.
The CA will only witness test proceedings, confirm recorded results and determine if the specified requirements have been satisfied.
If following test or inspection any plant or part thereof is shown to be defective or not conforming to the specification the CA will reject such defective parts by written notice, within reasonable time, indicating area of dispute.

- Appoint an "approved engineer", to supervise the whole of the testing, commissioning, performance testing and instruction of client's staff.

Provide all specialised personnel (including manufacturer's representatives) and co-ordinate their activities.
Test all equipment, material and systems as detailed in Sections. If an inspection or test fails, repeat the procedure, until satisfactory results are obtained.

- Complete all tests before any paint, cladding or similar materials are applied or before services are concealed.
- Ensure all requirements such as cleanliness, protection from harmful external and internal elements etc. are provided prior to commencement of commissioning.

- Following satisfactory completion of testing and when the installations are in a safe and satisfactory condition, set to work, regulate and adjust, as necessary, to meet the specified design requirements.
- Provide all necessary instruments and recorders to monitor systems during commissioning and performance testing.
- Provide test equipment subject to a quality assurance procedure complying with BS EN ISO 10012.
- Do not start performance testing, including system demonstration, system proving or environmental and capacity testing, until commissioning of the system is completed to the satisfaction of the CA.

Maintain on site full records of all commissioning and performance testing, cross referenced to system components and on completion of the Works include a copy in each Operating and Maintenance Manual.
Provide all certification documents for approval by the CA before any system is offered for final acceptance.

- Gas, fuel oil, electricity and water for testing and commissioning will be provided by
  - The main contractor.

230.000 COMMISSIONING PROCEDURES:
Observe the following requirements when commissioning the Engineering Services.

- Progressive static testing will be witnessed by the CA when work is presented for testing. This will include:
  - Insulation resistance tests.
  - Earth fault loop impedance tests.
  - Earth continuity tests.

  Pre-commissioning examination and testing to ensure that each system or item of equipment is complete, in a safe condition and all notices are displayed. Completion for operational purposes implies the bulk of snagging has been offered to the CA and that remedial work has been completed. All fans, pumps etc. tested for operation, polarity, phase sequence and impedance etc.

  Finalise commissioning programme, taking into account site progress and availability of related services, with CA and Contractor and agree access required for controls etc.

240.000 OPERATIONAL DEMONSTRATION:
Provide a written statement to the CA confirming that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.
Demonstrate to the CA that all system components are operating correctly, and the completely integrated installation will function in accordance with the specified performance requirements.

250.000 OUTSTANDING ACCEPTANCE TESTS:
Any items which have failed their acceptance tests or where such tests are delayed by the client are to be listed and dates agreed, during the defects liability period when reasonable demands for consumer requirements are available.

260.000 SYSTEMS USED BEFORE PRACTICAL COMPLETION:
Systems may not, without the prior written approval of the CA be used before Practical Completion.
Systems to be used before practical completion for the benefit of the Contractor and/or Subcontractor must have all defective consumable elements (including lamps and tubes) replaced by new not more than seven days prior to Practical Completion.
No system shall be put into use prior to handover to the employer, except for testing and commissioning, unless in accordance with the following procedure:
Following the receipt of written instructions, the Subcontractor shall operate designated parts of the Subcontract Works, provided that such operation is practicable and does not prejudice the Subcontractor's responsibilities and obligations under the Subcontract.
Additionally and with adjustment to the Subcontract sum, the Subcontractor, shall if instructed, provide:

- comprehensive insurance including indirect loss for any plant being operated
- maintenance of the installation
- re-instatement of the installation to as new condition prior to handover to the Employer

- allow the defects liability period to commence on handover.

300.000 OPERATION OF SYSTEMS BEFORE THE PRODUCTION OF DRAWINGS AND/OR OPERATING AND MAINTENANCE MANUALS:
Provide attendance, at no expense to the Employer, to put into service, operate 24 hours a day and maintain the systems to the Employer's requirements, including the provision of suitable competent labour, in the event that the Record Drawings and/or Maintenance Manuals are not available when the Works would, in the opinion of the CA, otherwise qualify for Practical Completion.
In the event of the Subcontractor failing to provide this service satisfactorily the Employer shall be entitled to make his own arrangements and recover the full cost through the Contract.

310.000 INSPECTION BY EMPLOYER'S INSURANCE COMPANY:
Where indicated in the Work Sections items are to be inspected by a competent person acting for the Employer's Insurance Company appointed under the provisions of the Factories Act or other relevant legislation. The installations concerned shall satisfy the Insurance Company's requirements in all respects.
Agree a programme for inspection and certification of specified equipment.
Inform the CA when equipment is to be ready for examination.
The Employer will place an order with the Insurance Company. Details and nature of the order will be provided to all interested parties.
Provide all detailed drawings etc. of the equipment to enable the Insurance Company to approve design before manufacture.
Arrange for the attendance of the Insurance Company's Engineer/Surveyor at each stage of manufacture and installation and provide all necessary access and facilities for inspecting and testing as may be required.
No plant which is subject to inspection will be accepted on behalf of the employer until a satisfactory certificate has been received by the Employer from the Insurance Company.
All Insurance Company charges for examination and approval of drawing, inspection of works during construction and inspection and certification of the completed work will be paid by
- The Employer.

BS APPENDIX

BS 7671:2008
Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition including all current ammendments.

BS EN ISO 10012:2003
Measurement management systems. Requirements for measurement processes and measuring equipment

A34 SECURITY/SAFETY/PROTECTION

110.000 MAIN CONTRACT PRELIMINARIES:
- Security/safety/protection

Applies to the whole of the Works, including this Subcontract. Comply with the requirements stated therein insofar as they relate or apply to the Subcontract Works, and co-operate with and assist the Main Contractor in complying with them generally.

115.000 CDM REGULATIONS:
Comply with the requirements of the CDM Regulations by
- adhering to the rules of the Pre-Construction Information and Construction Phase Plan.
- reporting accidents, injuries or dangerous occurrences to the main contractor.
- providing the main contractor with appropriate input to the health and safety plan, including risk assessments, and to the health and safety file.
- providing the main contractor with information on the subcontract works which might affect the health or safety of any person.

120.000 DELIVERY:
Provide an adequate and safe protection for all materials and products during transport to site.
- Deliver all tubes, conduit, trunking and associated equipment with open ends effectively plugged, capped or sealed.
- Deliver all ductwork, tubes, conduit, trunking and associated equipment with open ends effectively plugged, capped or sealed.

130.000 HANDLING:
Offload and transport about the Works all materials and products as recommended by manufacturers.

140.000 STORAGE:
Store all materials and products as recommended by manufacturers.
- Provide sufficient, safe and secure storage for all materials and products.
- Provide racks to prevent distortion for storage of conduits, pipes and similar materials.
- Store all fittings, accessories and sundry items in clean bins or bagged and stowed in racks and maintained under suitable weatherproof cover.

150.000 PROTECTION OF SUBCONTRACT WORKS:
Check regularly the protection provided after installation of equipment and inform the Main Contractor if inadequate.
- Install items such as grilles, diffusers, lighting fittings, switches, accessories etc. as near to completion as practicable.
- Only install filter media when the plant items concerned are being commissioned and tested.
- Leave plant and equipment in a ready to paint condition where specified as part of the Works or to be carried out by others.
- Paint parts liable to corrosion immediately after removal of any temporary protection.
- Replace material, plant or equipment where deterioration or damage has occurred prior to handover.

151.000 PROTECTION OF SUBCONTRACT WORKS:
Provide adequate and safe protection for all materials and products after installation.
- Ensure all items are protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others.
- Protect during erection all easily damaged materials with hardboard covers or heavy duty polythene sheet. Such items include but are not limited to
  - control panels,
  - switchboards,
  - distribution boards,
- Protect all finished items from damage and paint splashes.
- Install items such as grilles, diffusers, lighting fittings, switches, accessories etc. as near to completion as practicable.

- Only install filter media when the plant items concerned are being commissioned and tested.
- Cover all plant items with polythene sheeting except when being worked upon.
- Cap all open ends of pipes, ducts, conduit and trunking etc except when being worked upon.
- Leave plant and equipment in a ready to paint condition where specified as part of the Works or to be carried out by others.
- Paint parts liable to corrosion immediately after removal of any temporary protection.
- Replace material, plant or equipment where deterioration or damage has occurred prior to handover.

160.000 IDENTIFICATION:
Where appropriate, ensure that materials, plant and equipment bear the brand name, serial/batch number and any other data required to identify their nature in relation to the Works.

170.000 ROTATING PLANT:
Immediately prior to Practical Completion adjust, ease and lubricate moving parts as necessary to ensure easy and efficient operation.

- Ensure that, whenever necessary, temporary supplies are provided to enable motive plant items delivered and/or installed to be run at regular intervals to avoid damage or deterioration.
- Ensure that rotating plant is hand-turned periodically if temporary supplies are not available.

A37 OPERATION/MAINTENANCE OF THE FINISHED BUILDING

101.000 SUBMISSION OF RECORD DOCUMENTS:
To satisfy the provisions of the Health and Safety at Work Act the Employer will not accept handover of the installations until full and adequate information concerning the installations is in the possession of his operating and maintenance staff.
Provide Record Documents - being part of the Works - prior, and as a prerequisite, to Practical Completion to the satisfaction of the CA.
Prepare manuals in draft as the Works progress and make suitable arrangements where the Works are subject to Partial Possession or Sectional Completion.

- Submit draft Manual to the Services Engineer for comment **no less than 2 weeks** prior to commissioning.
- Prepare two temporary Manuals with provisional record drawings and preliminary performance data available at commencement of commissioning to enable Employer's staff to familiarise themselves with the installation. These should be of the same format as the final Manuals with temporary insertions for items which cannot be finalized until the installations are commissioned and performance tested.
- Provide the CA with copies of the **final** Manual prior to Practical Completion **no less than 2 weeks prior**.
- Prepare and submit two copies of a “Building User Guide” as described in section A37.155 below, submit a draft copy to the Design Team for comment **no less than 2 weeks prior** to hand-over.

102.000 SUBMISSION OF DOCUMENTS FOR HEALTH AND SAFETY FILE:
To satisfy the provisions of the Health and Safety at Work Act the Employer will not accept handover of the installations until full and adequate information concerning the installations is in the possession of his operating and maintenance staff.
Provide Record Documents - being part of the Works - prior, and as a prerequisite, to Practical Completion to the satisfaction of the CA.
Prepare manuals in draft as the Works progress and make suitable arrangements where the Works are subject to Partial Possession or Sectional Completion.

- Submit draft Record Documents to the CA for comment **no less than 2 weeks** prior to commissioning.
- Prepare two temporary Manuals with provisional record drawings and preliminary performance data available at commencement of commissioning to enable Employer's staff to familiarise themselves with the installation. These should be of the same format as the final Manuals with temporary insertions for items which cannot be finalised until the installations are commissioned and performance tested.
- Provide the CA with copies of the final Manual prior to Practical Completion **no less than 2 weeks prior**.
- Prepare electrical record drawings in accordance with BS EN 61082-1.

111.000 RECORD DOCUMENTS:
Provide the system records and full documentation as required in the appropriate standard.

- Standard
  - BS EN 50131-1 - Intruder alarm systems.
  - BS 5839 - Fire detection and alarms in buildings.
  - BS 6701 - Telecommunications equipment and telecommunications cabling.
  - BS EN 62305 - Protection against lightning.
  - BS 7671 - Requirements for electrical installations (IEE Wiring regulations).

Provide

- Record Drawings, Schematics and Schedules
- Operating and Maintenance Manuals.
- Blank maintenance logs
- Log book

- Ensure Record Documents clearly record the arrangements of the various sections of the Works as actually installed and identify and locate all component parts.
- Ensure Record Documents make it possible to comprehend the extent and purpose of the Works and the method of operation thereof.

- Ensure Record Documents set out the extent to which maintenance and servicing is required and how, in detail, it should be executed.
- Ensure Record Documents provide sufficient, readily accessible and proper information to enable spares and replacements to be ordered.
- Correlate record documents so that the terminology and the references used are consistent with those used in the physical identification of the component parts of the installations.
- Demonstrate as required throughout the execution of the Works that complete and accurate records are being maintained and that the record documents are being progressively compiled as the work on site proceeds.
- Ensure the building log book contains the information outlined in Section 3.2 of the Building Regulations Part L2A: 2013, Conservation of fuel and power in buildings other than dwellings.

120.000 RECORD DRAWINGS AND SCHEDULES:
Prepare Record Drawings and Schedules to a scale not less than 1:50 from the "As Installed Drawings" maintained on site as the Works progress. Endorse all such documents 'RECORD DRAWINGS'. Where agreed with the Services Engineer and the CA certain detailed information may be provided in schedule form. Prepare electrical drawings in accordance with BS EN 61082-1.
Provide reduced scale copies for inclusion in the operating and maintenance manuals as detailed in clause A37.150.000.
Record Drawings and Schedules must include, but are not limited to:

- Location, including level if buried, of Utility Service connections, including those provided by the appropriate Authority, indicating points of origin and termination, size and material of service, pressure and/or other relevant information.
- Disposition and depth of all underground systems.
- Schematic drawings of each system indicating principal items of plant, equipment, zoning, means of isolation, etc. in sufficient detail to make it possible to comprehend the system operation and the inter-connections between various systems.
- Details of the principles of application of automatic controls and instrumentation.
- Identification of all terminals/cables etc. by size/type and duty/rating as recorded from the approved commissioning results.
- Ensure routes indicate if cable/conduit is surface mounted, concealed in wall chase, in floor screed, cast in-situ, above false ceiling etc.
- Details of co-ordination of wiring and connections with cable core identification, notation of fire alarm, security, control and instrumentation and similar systems provided as part of the Works.
- Details to show inter-connections between the Works and equipment or systems provided by others to which wiring and connections are carried out as part of the Works.
- Manufacturers' drawings of equipment indicating
- general arrangement and assembly of component parts which may require servicing.
- internal wiring diagrams together with sufficient physical arrangement details to locate and identify component parts.
- schedules as required to locate, reference and provide details of ratings and duty of all items incorporated into the Works together with all fixed and variable equipment settings established during commissioning.
- For each programmable control item, schedules indicating for each input and output point connected, full data in respect of that point including reference, type of input/output, connected equipment reference, set values of temperature or pressure etc., set values of start/stop/speed change times, alarm priority, control specification reference and any other such parameters as are applicable.

Each spare input and output point including reference, type of input/output and space for future entry of appropriate parameters as listed above.

- Logic flow diagrams for each individual control or monitoring specification and for each building services engineering system to illustrate the logical basis of the software design.
- Schedules setting out details of all initial values of user-defined variables, text statements for alarm messages etc.

130.000 PLANT ROOM AND SWITCH ROOM DRAWINGS, SCHEDULES AND SCHEMATICS:
Provide good quality plant and switch room drawings, schedules and schematics.
Hang the following in each plant room and switch room, any other appropriate location or where directed by the Services Engineer or the CA.

- Schematic drawings of circuit layouts showing identification and duties of equipment, numbers and locations, controls and circuits.
- Schedules in the form of printed sheets showing the number, type, location, application/service and symbol, and normal operating position of each means of isolation.
- Control schematics.
- Location of all plant and equipment items including plans and elevations of main switchgear showing physical disposition of switches.
- First aid instructions for treatment of persons after electrical shock.
- All other items required under Statutory or other regulations.
- Location of all incoming service isolating and metering facilities.
- Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
- Prepare electrical drawings in accordance with BS EN 61082-1.

Protect surface of drawings by

- pressure lamination

145.000 OPERATING AND MAINTENANCE MANUAL FORMAT:

The operating and maintenance manuals shall be prepared in the following format:

- PC based word processing software tool.

150.000 OPERATING AND MAINTENANCE MANUALS:

The operating and maintenance manuals must include:

- A full description of each of the systems installed, written to ensure that the Employer's staff fully understand the scope and facilities provided.
- A description of the mode of operation of all systems including services capacity and restrictions.
- Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
- Details of how to re-commission so that complex plant services within the building can be re-commissioned by an engineer without any historic knowledge of the systems.
- Full size copies of "As Built" record drawings

Legend of all colour-coded services.

- Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and performance figures. Each item must have a unique number cross-referenced to the record and diagrammatic drawings and schedules.
- The name, address and telephone number 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.
- A copy of all Test Certificates, Inspection and Test Records, Commissioning and Performance Test Records (including, but not limited to, electrical circuit tests, corrosion tests, type tests, start and commissioning tests) for the installations and plant, equipment, valves, etc., used in the installations.
- A copy of all manufacturers' guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
- Copies of Insurance & Inspecting Authority Certificates and Reports.
- 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 change-overs and/or precautions necessary for the care of apparatus subject to seasonal disuse.
- Detailed recommendations for the preventative maintenance frequency and procedures which should be adopted by the Employer to ensure the most efficient operation of the systems.
- Details of regular tests to be carried out (e.g. water cooling towers etc.)
- Details of procedures to maintain plant in safe working conditions.
- Details of the disposal requirements for all items in the works.
- 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.
- A list of any special tools needed for maintenance cross referenced to the particular item for which required.
- Procedures for fault finding.
- Emergency procedures, including telephone numbers for emergency services.
- Back-up copies of any system software.
- Instructions for the creation of control procedure routines and graphic diagrams.
- Details of the software revision for all programmes provided.
- Two back-up copies of all software items, as commissioned.
- Copies of relevant HSE/CIBSE/IET Guidance notes etc.
- Contractual and legal information including but not limited to details of local and public authority consents; details of design team, consultants, installation contractors and associated subcontractors; start date for installation, date of practical completion and expiry date for the defects liability period; details of warranties for plant and systems including expiry dates, addresses and telephone numbers.

155.000 BUILDING USER GUIDE:

The Building User Guide must include the following information:

101. Building Services Information
    - General User – Information on heating, cooling and ventilation in the building and how these can be adjusted, e.g. thermostat location and use, implications of covering heating outlets with files, bags etc., and use of lifts.
    - Caretaker – As above, plus a non-technical summary of the operation and maintenance of the building systems (including BMS if installed) and an overview of controls.

102. Emergency Information
    - General User – Include information on the location of fire exits, muster points, alarm systems and fire fighting systems.
    - Caretaker – As above, plus details of location and nature of emergency and firefighting systems. Nearest emergency services, location of first aid equipment.

103. Energy & Environmental Strategy

    This should give owners and occupiers information on energy-efficient features and strategies relating to the building, and also provide an overview of the reasons for their use, e.g. economic and environmental savings. Information could include:
    - General User – Information on the operation of innovative features such as automatic blinds, lighting systems etc., and guidance on the impacts of strategies covering window opening and the use of blinds, lighting and heating controls.
    - Caretaker – As above, plus information on airtightness and solar gain (e.g. the impact of leaving windows/doors open in an air conditioned office, or use of blinds in winter with respect to solar gain); energy targets and benchmarks for the building type, information on monitoring such as the metering and sub-metering strategy, and how to read, record and present meter readings.

104. Water Use
    - General User – details of water saving features and their use and benefits, e.g. aerating taps, low flush toilets, leak detection, metering etc
    - Caretaker – As above, plus details of main components (including controls) and operation. Recommendations for system maintenance and its importance, e.g. risk of legionella.

105. Materials & Waste Policy
    - General User – Information on the location of recyclable materials storage areas and how to use them appropriately.
    - Caretaker – As above, plus information on recycling, including recyclable building/office/fit out components, waste storage and disposal requirements; examples of Waste Management Strategies and any cleaning/maintenance requirements for particular materials and finishes.

106. General

    Where further technical detail may be required by the Caretaker Team or manager there should be references to the appropriate sections in the Operation and Maintenance Manual.

160.000 PRESENTATION OF THE OPERATING AND MAINTENANCE MANUALS:

- Encase the Manuals in A4 size, plastic-covered, loose leaf, four ring binders with hard covers, each indexed, divided and appropriately cover- titled. Fold drawings larger than A4 and include in the binder so that they may be unfolded without being detached from the rings.

180.000 RECOMMENDED TOOLS:

Before practical completion submit to the CA a schedule of tools and portable instruments as called for in individual Sections and any others that the Subcontractor recommends should be obtained and kept in stock by the Employer for maintenance of the services installations included in the Subcontract. Time scale

- 4 Weeks before

State against each item the manufacturer's current price, including packaging and delivery to site. Identify those items which are additional to those specified for inclusion in individual Sections.

181.000 SUPPLY OF TOOLS:

Provide all tools detailed within individual Sections.

- Submit to the CA a quotation, priced in detail, for the initial supply to the Employer of the additional tools identified under clause A37.180.000.

Time scale

- Within 2 weeks of request

190.000 TRAINING OF EMPLOYER'S STAFF:

Before practical completion explain and demonstrate the purpose, function and operation of the installations including all items and procedures listed in the Operation and Maintenance Manual:

- to the Employer's maintenance staff.

Training:

- Include for the training of 2 people
- Include for not less than 2 operating days for this purpose and demonstrate the safe day to day running and maintenance of all systems, plant and equipment.
- Provide training for the operation of the controls, monitoring or BMS installations for one or more of the following levels of operator.
  - Basic operator
  - Intermediate operator
    - Ensure that the operator is also trained for testing and routine inspection of sensors and actuators.
  - Advanced operator
  - Ensure that each trained operator signs a training acceptance certificate(s).
  - Provide appropriate reference and training manuals for the operator.
  - Include for training operating staff (no) 2
- Include for not less than indicated number of operating days for this purpose and demonstrate the safe day to day running and maintenance of all systems, plant and equipment.

200.000 READING OF METERS:

Record readings of all water, gas, and electricity meters immediately on completion of the Works and forward, via the Main Contractor, to the CA.

210.000 OBLIGATIONS DURING DEFECTS LIABILITY PERIOD:

Prepare and submit records of failures or malfunctions of any part of the Subcontract Works during the Defects Liability Period, together with details of remedial action taken, subsequent re-testing and the results.

Notify the Main Contractor of damage, failures or malfunctions to the Subcontract Works demonstrably caused by incorrect operation of the installations, vandalism or other actions by a third party.

Inform the CA, via the Main Contractor, in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of a Final Certificate.

BS APPENDIX

BS 6701:2004
Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance

BS 7671:2008
Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition

BS EN 50131-1:2006
Alarm systems. Intrusion and hold-up systems. Part 1 System requirements

BS EN 61082-1:2006
Preparation of documents used in electrotechnology. Part 1 Rule

C20 DEMOLITION AND STRIP-OUT

PART 1 SYSTEM OBJECTIVES

100.030 SYSTEM DESCRIPTION

100.031 Site wide
The electrical installation in affected areas is to be stripped out in its entirety back to the local distribution board. The existing distribution board itself is to be retained and re-used. The existing system comprises of lighting services, small power. All servers and existing IT equipment feeding areas outside of the scope of works is to be kept live for the entirety of the project. The existing fire alarm circuits are to be retained and reconfigured to suit the new layout (see drawing E-2800).

As part of this scheme the Electrical sub-contractor will be required to isolate, make safe and remove all existing services within the areas to be refurbished.

Whenever the stripping out of and/or alteration of existing services are required as part of the project the Electrical Sub-contractor shall include allowances for the following:

- Liaison with the Contract Manager / Client Representative to determine and review all live services connection which will become redundant as part of these works.

- Liaison with the Contract Manager / Client Representative to determine and review all live services connection which required to remain live during works.

- The isolation making safe and disconnection of the redundant live services and equipment.

- Removal from site and safe disposal of all redundant plant and equipment no longer required including treatment of asbestos and contaminated redundant services.

- Review of refurbishment asbestos survey undertaken by the main contract and all other site wide asbestos registers to understand extent of asbestos contamination.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO C20

300.000 GENERAL

300.010 STRIPPING OUT SERVICES:
- Type - services that become redundant or superfluous as a result of the works, such as lighting, power supplies, sockets, circuit wiring etc.
- Requirements - existing services such as relocated or modified circuits will require re-wiring where practically possible. Jointing of cables will not be accepted.

300.020 STRIPPING OUT FITTINGS AND FINISHES:
- Type - all electrical fittings and accessories as described above.
- Requirements - generally items that have been stripped out are to be disposed of in accordance to regulations and local authority requirements, or as directed by the CA.

300.040 INCIDENTAL MINOR REPAIRS TO RE-USED MATERIALS OR COMPONENTS:
- Type – distribution boards

Requirements - Where existing distribution boards (outside of the project area) are to have incoming MICC sub-mains replaced or added, the Electrical Sub-Contractor is to carry out any necessary repairs to internal cover plates, phase barriers, neutral and earth bars to ensure that the board is compliant with the latest regulations.

V90 ELECTRICAL INSTALLATION (SELF CONTAINED SPECIFICATION)

100.000 SYSTEM DETAILS

100.010 SYSTEM DESCRIPTION

SECTION 1 - GENERAL ELECTRICAL INSTALLATION CLAUSES

INTRODUCTION

This section details the general technical requirements associated with the electrical installation and shall be read in conjunction with all other sections of this document. The Electrical Contractor shall comply with the requirements detailed herein.

The project comprises of a fit out of fourth floor offices with new LED lighting and new small power and data circuits and fire alarm modifications to suit the new fit out layout.

To facilitate rapid and equitable evaluation of the return tenders, the Electrical Sub-Contractors are asked to present the tender costs requested following the Tender Summary as set out in Appendix 2 to this specification.

Commissioning shall be in compliance with CIBSE commissioning codes, in particular Code L applies for the lighting installation.

GENERAL ELECTRICAL REQUIREMENTS

The whole of the works shall be carried out and tested in accordance with the 17th Edition of the IET Wiring Regulations, together with relevant British Standards and Codes of Practices, and statutory regulations.

All materials are to be new and of a type and rating matched to the duty of which they are selected. Manufacturers of all equipment are subject to the approval of the Electrical Services Engineer.

All articles materials and workmanship shall be in accordance with British/European standards, where such exists. In addition, the works shall be undertaken in accordance with the following: -

- Regulations and requirements of the local Electricity and Utility Company.
- Local Authority Bylaws.
- Health and Safety Executive regulations and guidance note.
- Electricity at Work Regulations.
- British Standards specifications and Codes of Practices.
- The Building Regulations.
- CDM Regulations.
- The installation shall be installed tested and commissioned to the entire satisfaction of the Contract Administrator.
- All record drawings, operating and maintenance manuals, test and commissioning certificates must be issued prior to the issue of the certificate of practical completion for the works.

The installation of the electrical services shall be in accordance with recommendations given by the Chartered Institution of Building Services Engineers (CIBSE), the Institution of Engineering and Technology (IET) and shall accord with the criteria set out below:

- The tender drawings and electrical services specification.
- The functional requirements and conditions as defined elsewhere in this document.
- Ease of access to equipment with minimum disruption to the user. In particular the location of all equipment requiring routine maintenance should be located in areas where maintenance personnel can access and work without restriction and danger.
- Safety from fire electrical shock and other hazards.

DRAWINGS
The Electrical Sub-Contractor is to provide Working Drawings for review and approval by the Design Team prior to any installation works commencing. This shall include elevations of all walls with more than 2no. electrical outlets, trunking or accessories on them.

The Mechanical Sub-Contractor shall manage the production of Co-ordination Drawings for the ceiling voids throughout the project area – refer Clause A31.313.000 above. Other contributors shall be the Electrical Services Sub-Contractor and the structural/steelwork sub-contractor. Co-ordination drawings shall be submitted for review and approval prior any installation works being undertaken in the relevant areas.

The Electrical Sub-Contractor shall assist with the co-ordination drawings by providing accurate and detailed information on all electrical services and items within, or protruding within, the ceiling voids, and shall price accordingly in the Tender Summary attached as Appendix 2 to this specification.

ASSESSMENT OF GENERAL CHARACTERISTICS
The characteristics of supply at the main incoming connection position has been assumed as follows:

- The system is defined as TNC-S.
- Nominal voltage 400/230V +10%/-6% @ 50Hz +/- 1%
- Nominal frequency 50Hz.

Commissioning shall be in compliance with CIBSE commissioning codes, in particular Code L applies for the lighting installation.

BUILDING DETAILS
For full details refer to Architects Drawings / BIM Model.
UNDER NO CIRCUMSTANCES MUST ANY EQUIPMENT BE POSITIONED ON THE OUTSIDE OF THE BUILDING FACADE WITHOUT AGREEING ITS LOCATION AND APPEARANCE WITH THE ARCHITECT.

MAINTENANCE OF SERVICES
Allow for the provision, erection, connection and subsequent removal of any cable or fittings necessary or required to maintain existing services in the event of any disconnection being made necessary due to or by means of the above work. In connection with the installation of new main switchgear and alterations to existing supplies, allow for any working out of normal hours which may be necessary.

It should be noted that the existing electrical supplies to the project area i.e existing buildings shall be kept live to minimise site wide disruption in line with the architects phasing drawings.

Details of services which need to be maintained and restrictions on working periods in relation to alterations are given in the relevant sections of this Specification.

No disconnections of supplies shall take place without prior arrangement with both the Engineer and the Employer.

PROTECTION AGAINST ELECTRIC SHOCK
a) The 17th Edition of the IEE Wiring Regulations allows alternative methods of protection against electric shock. For the purpose of this Specification, the protective measure shall be automatic disconnection of the supply as outlined in clause 411 whereby: -

   i. Basic Protection is by insulation of live parts or by barriers or enclosures.

   ii. Fault Protection is provided by protective earthing, protective equipotential bonding and automatic disconnection of the supply.

b) Where other protective measures are to be incorporated in the installation these shall be as specifically outlined in subsequent clauses.

PROTECTION AGAINST THERMAL EFFECTS

Attention is drawn to Chapter 42 of the Wiring Regulations, which outlines measures to be taken in respect of protection against thermal effects.

PROTECTION AGAINST OVERCURRENT

a) With the exception of electric motors and associated circuits, circuit protection against overload and short circuit current shall be provided by a single device.

b) The overload and short circuit characteristics of each device together with circuit impedance shall satisfy the Wiring Regulations in respect of overload and short circuit protection, discrimination and circuit disconnection times in the event of earth fault conditions. Ensure that no alterations, howsoever caused, will negate this co-ordination procedure.

EARTHING

a) The point of entry of a supply cable into a building or area shall be classified as the commencement of an Electrical Installation. At the incoming termination of the cable the gland box or other means of terminating the cable shall be insulated from the main switch or panel. For SWA cables, this shall be achieved by means of a gland with internal earth and an insulated adaptor. For other types of supply cables, the method for insulating the termination from the main switch or panel is described in the particular clauses. In cases where the installation is supplied from an Electricity Board's cable, meter tails shall be enclosed in suitably sized PVC trunking, or in the case of smaller installations, employing metering devices suitable for direct connection of tails, metal trunking shall be used.

   The purpose of insulating the main cable termination from the main switch or panel is to enable the effectiveness of the external earth to be tested prior to the installation being energised. From the earthing point on the main cable termination, an earthing conductor shall be taken to a main earthing terminal or bar.

b) Supply and install an earthing terminal or bar, adjacent to the supply point, to facilitate the connection of circuit protective conductors and main protective bonding conductors in accordance with Regulation 542.4

   The main earthing conductor shall comply with Regulation 542.3 and in the situation of a typical LV supply shall be looped via the earthing terminal to the earthing bar of the main distribution switchpanel.

c) Main protective bonding conductors shall be provided as outlined in Regulations 411.3.1 2 and 544. This shall include all outgoing heating and hot water circuits in the boiler house, main ductwork runs emanating from the ventilation plantroom, dry risers etc. Fixings shall be made to pipes utilising proprietary pipe bonds. For steam mains a tag shall be brazed onto the pipe and the final connection made in copper tape.

d) Local supplementary equipotential bonding shall be provided to particular locations of increased shock risk as outlined in Part 7 of the IEE Wiring Regulations or as additionally required elsewhere in this specification. These shall be in accordance with the standards given in clause 415.2 and Chapter 54 and as outlined below:-

   i. For the purpose of this specification large kitchens with stainless steel work surfaces are considered to be a location of increased shock risk.

   ii. Bond between pipes, taps, bath, towel rails, radiators, extraneous conductive parts and the circuit protective conductors of all circuits feeding equipment in the location.

   iii. Accessible metallic structural parts are also to be bonded, noting that window frames etc. are not considered to be extraneous conductive parts unless they are connected to metallic structural parts.

   iv. Primary grids of all suspended ceilings.

v. On all low temperature radiators and convectors (excluding steel panel radiators) the main element and all sections not mechanically bonded to the main element are to be cross-bonded.

vi. Where metallic raised floors are present in these locations they shall also be supplementary bonded. Providing the continuity between tiles and jacks is maintained this will be limited to bonding at selected random points. If continuity between elements of the floor system cannot be maintained then each element will require bonding.

vii. Supplementary bonding conductors are to be enclosed in conduit throughout their entire length. They shall leave the conduit system via a flex outlet plate or, if located in ceiling/roof voids, via a conduit box with one way fitted with a stuffing gland.

viii. Any other supplementary bonding found necessary shall be covered by a Provisional Sum.

e) At switchpanels and other metallic electrical enclosures, reliance shall not be placed on the enclosure to form part of the protective conductor. Earthing tags or clamps and continuity conductors in conjunction with a suitable earthing bar shall be employed.

f) For the purpose of this Specification, conduit and/or trunking systems shall not be relied upon to form the protective conductor. Earth continuity or protective conductors shall be installed for each final circuit, which shall comply with Regulation 543.

g) The resistance between any point of the conduit/trunking installation and the local distribution board shall not exceed 0.1 Ohm. Conduits shall be earthed by means of earth continuity sockets to the distribution gear.

h) Where a Lightning Protection system forms part of the scheme such systems are to be connected to the building earthing system at the main earth bar. The Electrical Contractor will be responsible for advising the Supply Authority of this requirement and provide any information requested by the Supply Authority.

i) Where floorboxes are present for desks and are supplied by a underfloor busbar, the busbar must have a clean earth bypassing the protective device directly to the earth bar thus eliminating any nuisance tripping due to leakage current from IT circuits.

SEGREGATION OF SERVICES

Services shall be segregated as outlined in clause 528. For the purposes of this specification the method of segregation is to ensure Band 1 and Band 2 circuits are not contained in the same wiring system except where one of the following applies:

i. The cables are installed on cable tray where physical separation is provided by a partition.
ii. The cables are insulated for their system voltage and installed in a separate compartment
iii. Of a cable ducting or cable trunking system.
iv. A separate conduit, trunking or ducting systems is employed.

The requirements given in clause 548 for proximity to other services shall be complied with.

Underground services shall be spaced in accordance with the recommendations of the National Joint Utilities Group.

WIRING SYSTEMS

a) Details of wiring systems are given in later sections and are summarised as follows:

i. Mains supplies

- External: XLPE/SWA/PVC multi-core copper to BS6724 IEC60502.
- Internal: XLPE/SWA/LSF multi-core copper to BS6724 IEC60502.

ii. Lighting and power – Multi-core LSF/Cu BS60228 6242B cables in tray, and in conduits for

drops to accessories

iii. Fire alarms – soft skin type FP200+ with red LSF sheath, but FP400 for the power supply to the fire alarm panel.
iv. Call systems, alarms and other LV systems - single or multicore LSF/Cu cables.

v. External lighting – XLPE/SWA/PVC multi-core copper to BS6724 IEC60502 ducted underground, or Multicore (T&E) LSF/Cu BS7211 6242B or single core LSF/Cu BS7211 6491B cables in conduit drops where mounted to the building perimeter.

vi. Specialist Systems (security/PA/access control/etc.) – as recommended by specialist installer

SIZING OF FINAL CIRCUITS
The sizing of final circuit cables shall be as detailed in the Distribution Board Schedules attached as Appendix 4 to this specification.

WIRING OF PLANT AND EQUIPMENT
a) Equipment shall be wired in accordance with manufacturer's approved connection diagrams. Ensure that the drawings have been approved before associated wiring commences.

b) Where cable connections are made into equipment, a numbered marker sleeve shall be fitted to each cable core, which shall correspond to the manufacturers wiring diagram.

c) Ensure that all wiring connections are correctly made before any equipment is set to work.

d) All wiring installations will be carried out using colours as defined by BS 7671 17th Edition (incorporating all current amendments).

This includes harmonised wiring colours, with modifications as detailed below:-

i. Single phase circuits will be wired using Brown (Live), Blue (Neutral) and Green/Yellow (Earth).

ii. 3 phase circuits will use Brown (for all three Live conductors), Blue (Neutral) and Green/Yellow (Earth).

iii. Where a multi-core cable, utilising phase colours Brown, Black and Grey needs to be used, phase conductors are to be sleeved with suitable heat shrink material in the appropriate colour, with permanent sleeved phase markers, L1, L2 and L3.

iv. Where cable connections are made into distribution boards, Motor Control Centres, isolators, starters, motors, BMS panels and the like, numbered marker sleeves shall be fitted to each cable core, which shall correspond to the distribution board schedule and to the following convention:

Way 1, Phase 1 – 1/L1

Way 1, Phase 2 – 1/L2

Way 1, Neutral 1 – 1/N1

Way 1, Neutral 2 – 1/N2

Way 1, Earth 1 – 1/E1

Way 1, Earth 2 – 1/E2

Ring main conductors should additionally be identified to distinguish between the two legs, i.e. Leg A: 1/L1A, 1/N1A, 1E1A and Leg B: 1/L1B, 1/N1B and 1/E1B.

v. Any distribution boards, switchpanels or other items of electrical equipment which has mixed versions of the old and new wiring systems must contain adequate warning notices, suitably sized in Yellow/Black, with the following warning as a minimum: -

CAUTION

THIS INSTALLATION HAS WIRING COLOURS TO TWO VERSIONS OF BS 7671

GREAT CARE SHOULD BE TAKEN BEFORE UNDERTAKING EXTENSION, ALTERATION OR REPAIR THAT ALL CONDUCTORS ARE CORRECTLY IDENTIFIED

vi. Any further labelling or suitable warning measures deemed necessary to make the status of all conductors clear must also be included.

vii. Phase rotation shall be corrected at the motor drive only.

e) Cable tails to terminals shall be of sufficient length and be neatly dressed and arranged to prevent development of tension in the cable or on the terminations.

CONDUIT AND ACCESSORIES

a) Metal Conduit

i. Steel conduit and accessories shall be heavy gauge welded to BS 4568. The finish shall be galvanised Class 4 or stainless steel as directed.

ii. Conduits shall be threaded to butt closely together in couplings and sockets. Except at running couplings, threads shall not be exposed and these shall be cleaned, primed and painted immediately after installation.

iii. Where the conduit finish is damaged during installation, the conduit shall be cleaned and painted with zinc-rich paint.

iv. All conduit drops in chases in plastered walls shall be painted with red oxide paint before plaster is applied.

v. All accessories used shall be of the cast iron type, i.e. no pressed steel accessories will be accepted.

vi. All conduit drops in chases shall have a coupler inserted in the run 300mm from ceiling level.

vii. In plantrooms and external locations all conduit box lids shall be fitted with gaskets.

viii. All conduit located in escape routes must be fixed by fire resistant/metal saddles.

b) Plastic Conduit

i. Plastic conduit shall be LSZH, and shall comply with BS 4607 and BS 6099, high impact white where applicable, and shall be installed in accordance with the manufacturer's recommendations.

ii. Care must be taken to ensure that all joints are glued correctly.

iii. All saddles must be sliding fit and expansion joints shall be inserted at 6m intervals on straight runs. Where conduit is exposed, a silicone grease or other suitable compound shall be applied to the expansion joint to prevent the ingress of moisture.

iv. In extremely cold weather the PVC conduit shall be slightly warmed before use in accordance with the manufacturer's recommendations.

v. Proprietary Steel or brass insert clips shall be fitted where luminaries are suspended from circular boxes to ensure that the weight of the luminaries is carried by the structure rather than the conduit box.

vi. All conduit located in escape routes must be fixed by fire resistant/metal saddles.

c) General

i. Concealed conduits shall be arranged on a 'loop-in' system so that all draw in points for cables are accessible at finished surfaces. No elbows or tees shall be used.

ii. Connections to accessory boxes on a concealed installation shall be with brass bush, metal coupling and serrated washer. For surfaces installation, flanged couplers with lead washers shall be used.

iii. Conduits on exposed surfaces shall be fixed at intervals not exceeding 1200mm, also within 300mm of floors, ceilings and boxes at each side of every bend. Fixing of conduits shall be as follows: -

Type of Installation	Method of Fixing
Wall chases or floor screed	Crampets or ordinary saddles
Ceiling, roof or floor voids	Spacer bar saddles
Surface mounted on ceiling	Spacer bar saddles
Surface mounted on walls	Distance saddles.

iv. The number of single core 600/1000 Volt grade cable drawn in at each conduit shall be as set out in the 17th Edition of the IEE Regulations. The minimum conduit size shall be 20mm diameter.

v. The conduit system shall be complete and tested before any cabling is drawn in.

vi. Provision for drainage of condensation shall be provided in accordance with the IEE Regulations.

vii. No conduit shall be installed in floor screeds, unless specifically stated.

viii. Chasing of walls must be carried out in accordance with the Structural Engineer's recommendations where appropriate. Under no circumstances shall horizontal chases exceed 500mm in length. Back to back chasing is also not permitted.

ix. Wherever reasonably possible all conduit, and containment in general, is to be concealed within the fabric of the building. Any exposed containment is to be highlighted to the design team prior to installation to validate if acceptable.

x. Surface galvanised steel conduit will be acceptable for installation fixed to blockwork walls within the changing areas.

FLEXIBLE CONDUIT

a) Where metal conduit is specified, flexible conduit shall be of the interlocked steel tape type with a PVC sheath to BS 731. Terminations shall be by means of compression glands.

b) Where Plastic conduit is specified, reinforced flexible PVC conduit shall be employed, having a double wall and intermediate helical wire reinforcement.

c) An appropriately sized, insulated circuit protective conductor shall be drawn into the tubing and connected to earth terminals at each end.

CABLE TRUNKING

a) For general purpose, cable trunking shall conform to BS-EN 50085 Part 1. The gauge of the trunking shall be 1.2mm up to and including 150 x 50mm, all other sizes up to and including 150 x 150mm shall be 1.6mm thick sheet steel. Where larger trunking is specified, the gauge of the trunking shall be detailed elsewhere in the Specification or on the accompanying drawings.

b) Trunking shall be properly aligned and covers closely butted and secured.

c) Manufacturers' standard accessories, e.g. bends, tees, etc., shall be employed throughout. Bends, tees etc. shall be of the gusset or radius types.

d) Sections of trunking shall be bolted together by sleeve couplings and local tinned copper supplementary bonding connectors. Where trunking with a painted finish is specified, the surface of the trunking shall be scraped clean at all jointing pieces and beneath earth bonding studs.

e) Multi-compartment trunking shall have welded internal fillets, and properly manufactured crossovers at junctions.

f) Manufacturers proprietary cable retaining straps shall be provided at 750mm intervals wherever the cover is not on top.

g) For the support of cables, metal pin racks shall be fixed at 2m intervals inside vertical trunking installed to guard against undue mechanical strain.

h) Where trunking passes through floors, ceilings and walls, the cover shall be cut and fixed to project 75mm either side of the obstruction. When the structure is made good, this section of cover will not be removable. Internal fire resisting barriers shall also be fitted.

i) Conduits shall be connected to the trunking by earthing sockets and male hexagon brass bushes. Insulated, single core earth continuity conductors shall be fitted.

j) Where multi-compartment trunking is specified, the Contractor shall fix printed labels to each compartment side wall at 3m intervals to denote the use of the compartment.

k) Where PVC trunking is specified, items (a), (d), (e), (g), and (i) above shall not apply.

l) Where PVC trunking is specified:

   i. Fixings shall comply with the manufacturer's recommendations.

   ii. The manufacturer's accessories shall be used, i.e. bridging pieces, fillets etc.

   iii. Where Site manufactured corners and bends are necessary the Contractor shall use mitre blocks made by the trunking manufacturer especially for this purpose.

   iv. Internal couplings shall be used

CABLE TRAY

a) Cable trays shall be constructed of galvanised mild steel or stainless steel as specified of minimum 18 SWG thickness, and shall be of the type and make specified in the particular clauses.

b) Standard accessories shall be used at each change in direction. However, where necessary, site cutting is permitted provided that all edges are cleaned up and painted before erection.

c) A minimum space between the building structure and tray of 50mm shall be allowed.

d) Cable tray shall be supplied and installed where more than two wire armoured or MICC cables share a common route.

e) Cables shall be fixed to the tray using proprietary straps, saddles or cleats as appropriate, at intervals specified in the IEE Wiring Regulations for the type and size of cable.

f) Spacing of tray supports shall be in accordance with the manufacturer's recommendations.

LADDER RACKING

a) All cable ladder racking shall be of the hot dip galvanised extra heavy-duty type to BS 729 or stainless steel as specified. The cable ladder rack system must be continuous and manufacturers bends, tees, couplers, etc., must be used throughout. Tinned copper earth continuity connections shall be installed across all joints.

b) The racking shall be supported at the intervals necessary to prevent excessive deflection of the racking, as advised by the manufacturers. In addition to this, no supports shall be installed to centres greater than 2 metres. Where fixing centres are greater than this, allowance shall be made for the supply and installation of the necessary bracket work to reduce the fixing centres.

c) Where racking risers up walls, it shall be fixed to 'unistrut' channel at 1500mm centres. The channel shall be fixed to the wall using 'rawlbolts' or similar.

d) All vertical suspension ties shall be galvanised threaded rod 10mm diameter. Where tees are secured to brackets and supports, vibration proof lock nuts shall be used.

e) Where cable ladder racks or other supported systems pass through walls, floors and other fire barriers, fire stopping shall be installed. The fire stopping shall be equal to the fire rating of the barrier.

FIXINGS AND FABRICATIONS

a) All steel screws, nuts, bolts and washers used for fixing ferrous materials to the building structure shall be sherardized. Non-ferrous fixings shall be employed when fixing non-ferrous materials.

b) Fixings to brickwork shall not be made in the mortar joint.

c) When fixing to structural steelwork, clamp-on devices shall be used unless otherwise approved.

d) Proprietary fixing devices shall be used throughout, e.g. Rawlbolts, Rawlplugs, Plastiplugs etc.

e) Fixings inside dry partitions shall be by wood screws to timber blocks glued, using impact adhesive, to an internal face of the partition. Instruct the Builder on size and location of these timber blocks. Where necessary, provide extension rings for accessory boxes so that the edge of the box is just recessed.

f) All steelwork fabrications prepared shall be wire brushed to removal all scale and rust, treated with zinc chromate and painted with two coats of a rust inhibiting lead free primer.

g) All steelwork fabrications, cut-outs, etc., shall be smoothed free from all burrs or rough edges, and protection against abrasion to cables added where appropriate.

h) No welding to building steelwork or structures shall be permitted without the written consent of the Engineer.

i) Screws or studding shall, after installation, be reduced in length so that no more than two threads are exposed. All cut ends shall be treated with an approved rust inhibiting primer.

j) Where conduits, trunkings, cable tray or ladder racking crosses building expansion joints measures shall be taken to cater for expansion and movement in the wiring system. All such measures shall be agreed with the Engineer.

WIRING GRADE CABLES FOR CONDUIT OR TRUNKING

a) For general wiring, the cable shall be 600/1000 Volt grade, single core, stranded copper with LSZH insulation complying with BS 6004 or BS 6346.

b) Where LSZH cables are specified in plantrooms, they shall be of the high temperature specification for operating at temperatures up to 90°C. Where higher heat resisting grades of insulation are specified, silicone rubber insulated cables to BS 6007 shall be employed where the temperatures will not exceed 150°C. Such cables shall be identified throughout their length. For higher temperatures, cables shall have varnished glass-fibre insulation.

c) During installation, the cables shall be combed to facilitate drawing in and future replacement.

d) Inside trunking, cables forming final sub-circuits shall be tied together at 2m intervals to ease identification. The use of PVC self-adhesive insulating tape will not be permitted for this purpose.

e) Cables shall be installed without joints.

f) Live conductors of lighting circuits shall be taken direct to switches (where applicable), whilst associated neutral conductors shall be looped at lighting points, unless 4-terminal ceiling roses are specified in the detailed Technical Clauses of this Specification.

g) Cables shall be colour coded in accordance with the IEE Regulations.

h) In addition to phase identification, the cores of cables connecting control gear, thermostats, valves etc. shall be fitted with identification sleeves bearing the same markings as the terminals of the apparatus to which they are connected.

FLEXIBLE CORDS

a) Cords shall be to BS 6141 300/300 Volt or 300/500 Volt insulated and of conductor cross-section 0.5mm sq. or greater.
b) For connections to terminals of lampholders and heaters, cores shall be glass-fibre insulated glass braid/varnish sheathed for a service temperature of 150°C to BS 6500.
c) For applications where the temperature does not exceed 60°C, cords shall have PVC insulation and sheath.

PIRELLI GENERAL FP200 CABLE

a) Where specified, FP200+ fire resistant cables to IEC 331 shall be employed.

b) They shall be installed in accordance with the manufacturer's recommendations.

c) During installation, the cables shall be drawn from the cable drums to prevent 'kinking' and shall be dressed by hand only.

d) The radius of any bend measured to the inside of the cable shall not be less than six times the overall diameter of the cable.

e) Cables shall be fixed using suitable single hole or Universal fixing band finished in white PVC. Fixings centres shall be in accordance with the IEE Wiring Regulations.

f) The cables shall be terminated in a Plastube Ltd range or, similar and approved, of integrally glanded and shrouded boxes for use with FP200+ cables, complete with seal, shroud and compression ring, unless otherwise specified in the detailed sections of this Specification.

g) Insulating sleeves shall be colour coded in accordance with the IEE Wiring Regulations or cores identified as stated in Clause 2-14 (h).

h) No cable joints will be allowed.

i) Where cables pass through walls, floors, ceilings, etc., they shall be protected by fibre or PVC sleeves which shall be fire stopped after installation using a proprietary foam.

j) Additional mechanical protection shall be provided for these cables where they are run on the surface of a wall within 1 metre of the floor by means of a conduit or capping as specified.

k) FP200 cable shall not be used on circuits operating in excess of extra low voltage and shall only be employed where detailed in the particular clauses.

LOW VOLTAGE POWER CABLES

a) Low voltage Power Cables shall generally be wire armoured to BS 6346, BS 5467 or BS 6724 as detailed elsewhere in this Specification.

b) Cables shall be fixed to tray or direct to a surface using cable cleats. The intervals for fixing shall be as stated in the IEE Regulations or as stated by the cable manufacturer where no regulation applies. Where fixed to cable trays, power cables having an overall diameter of 10mm or less may be strapped to the tray using PVC covered metal strip of appropriate colour fixed using brass pins and nuts.

c) At all terminations, the sheath and armour shall be secured by brass compression glands and of a type suitable for both cable and location. The glands shall be complete with both earthing tag and plastic shroud. Connections to the earthing tag shall be by brass nuts and bolts. At the point of termination for SWA cables feeding any equipotential zone, the cable shall terminate in a Prysmian type BW gland with integral earth and 481AA insulated adaptor.) Any underground jointing of PVC SWA cables required shall be achieved using proprietary resin joint kits.

e) Cores shall be phased out. Either coloured core insulation or coloured sleeve markers shall identify the phases.

f) Cables buried in the ground shall be in a trench 700mm deep with 100mm of sand laid in the bottom, the cable laid on the sand then covered with 150mm of sand. Interlocked arched based cable protection covers stamped 'Electric Cables' shall be placed over the full length of the route then backfilled with sifted earth, free from rocks and stones well rammed, and 200mm below finished ground level a 100mm wide PVC tape with the letters 'Electric Cables' stamped or printed overall, shall be laid the full length of the route and the ground the reinstated to existing ground level.

NOTE: Where groups of cables are installed in a common trench, cable protection covers are to be of sufficient width to cover all cables. This may be achieved by using two or three rows of narrow tiles if required.

Cable markers, concrete block type, with inset label stating size and type of cables(s) and function(s), shall be placed in the route at a maximum of 50 metres apart, and at each change of direction with a minimum of two markers per route, and, at entry to a building a pillar type marker giving the same information. The markers shall be block and pillar type 'Electric Cable' markers as H.J. Baldwin Ltd with 'Traffolyte', or similar and approved.

The Electrical Contractor shall provide all covers, markers, tapes, etc. The laying of sand, covers, tapes, concrete and markers shall be by the Main Contractor but the Electrical Contractor shall ensure and be responsible for the compliance with requirements. Where a direct contract exists the Electrical Contractor shall be responsible for all provision and installation.

Prior to the cable(s) being laid the Engineer shall be informed and arrangements made for an inspection to be made at each stage.

g) Where cables are to be buried in water logged ground or have to cross streams, then cables with a polyethylene sheath shall be employed and shall comply with BSEM 60 898. The extent of any such cabling is detailed elsewhere in this specification or on the associated drawings.

h) Where multi-core cables are employed, each core shall be numbered and numbered markers at each end shall identify the terminal number of the equipment to which the core is to be connected.

i) Below the armour clamp of all terminations, a non-corrosive identification band shall be fitted giving details of the type and size of cable in 5mm stamped letters and figures.

j) Where power cables pass through walls or floors they shall pass through properly formed openings which shall be fire stopped after installation using a proprietary foam.

k) Where power cables are laid in a common trench with other services, particularly communication cables. There shall be a minimum separation of at least 300mm between these services.

DISTRIBUTION BOARDS

a) The existing distribution board is to be retained and re-used.

b) Each neutral and earth terminal shall be numbered to correspond with the outgoing way. Critchley type cable markers are to be fitted to live, neutral and earth conductors appropriate to the way numbers.

c) Insulating barriers shall be provided to prevent contact with live parts. Phase barriers shall be fitted where applicable.

d) The existing distribution boards shall be complete with type written circuit charts securely fixed, in a translucent holder, to the inside of the hinged cover. Charts shall give details of equipment controlled, cable size and fuse rating where applicable.

e) An identifying traffolyte label shall be screwed into the external face of the cover. A traffolyte label shall be fitted to the inside face of the cover to indicate the following: -

i. The size, type and origin of the sub-main cable.
ii. The rating of the devices protecting the cable.
iii. The nominal voltage (Uo).
iv. The prospective short circuit current (Ip) present at the distribution board.
v. The earth fault loop impedance (Ze) external to the distribution board.
vi. The estimated maximum demand (kVA).
vii. Type of earthing

f) Fuse links shall comply with BS 88, Class Q1, having a fusing factor not exceeding 1.5.

g) Miniature circuit breakers shall comply with BS 60898, and of a category to suit the short circuit rating specified.

h) ELCB protection shall be provided to socket outlets where specified.

WIRING ACCESSORIES

a) All 13 Amp socket outlets shall be of the switched type complying with BS 1363.

b) Fused connection units to BS 4662 shall have neon lamps. Fuses shall be to BS 1362 and retained by holders which are captive at the faceplate or secured by screws. Suitably rated fuses shall be fitted.

c) Sheet metal accessory boxes to BS 4662 shall be employed in all dry locations where accessories are to be recessed. All accessory boxes shall be fitted with earth terminals, an adjustable fixing lug to allow levelling of the outlet plate and rubber grommets where PVC insulated and sheathed cables are employed.

The Electrical Contractor shall earth as necessary all metal boxes. Where two accessories are to be recessed and mounted side by side, dual type outlet boxes shall be used. For surface mounted units, boxes appropriate to the system of wiring shall be employed.

In all recessed installations, accessory boxes are to be flush with the finished surface with a tolerance of up to 5mm. In this respect particular care is required in relation to dry lining installations and stud partitioning. In such cases special deep boxes are to be employed as manufactured by Messrs Hooper Limited or equal.

The minimum depth for accessory boxes shall be 35mm.

d) Cooker points where specified on the drawings shall consist of a flush mounting 45 Amp double pole switch to BS 4177 engraved 'Cooker', complete with a red neon indicator, together with a connector unit to BS 5733 at lower level. The Electrical Contractor shall wire between these two items.

e) Where shaver outlets are specified, they shall be dual voltage type and suitable for use in bathrooms and comply with BS 3335, Part 1 and 2/IEC742.

f) Ceiling roses to BS5733 shall generally be of the 4 terminal loop-in type, having facilities for earthing and cord grip.

g) Lighting switches to BS 3676, Part 1, shall be of the grid or plate type as indicated in the Particular Clauses. Where grid assemblies are specified, the switches shall be 15/20 Amp rated. The metal grid in all assemblies shall have an earth connection and protective link onto the mounting box.

In instances where more than one phase is present at switch positions, segregation of phases is to be achieved either by using separate enclosures or combined enclosures incorporating phase barriers.

h) In all cases, fused connection units and isolating or control switches are to be engraved to indicate their purpose. Lettering is to be 4mm high and coloured black unless otherwise stated.

i) Where 13 Amp sockets with non-standard pins are specified they shall be supplied complete with one plug top per outlet.

LUMINAIRES

a) Luminaires shall be supplied and installed as per the schedule in Appendix 3, and shall be complete with lamps/light engines, controllers/diffusers, gasket seals, glassware, control gear, terminal blocks etc. All luminaires shall comply with relevant BS EN and shall be CE certified.

b) Luminaires on suspended ceilings or other accessible arrangements shall be wired in heat resistant LSZH flex from plug-in ceiling roses or marshalling boxes (lighting control modules). Luminaires on brickwork or other inaccessible arrangements shall be hard wired from the containment system.

c) Luminaires with tube suspensions shall be fitted with non-rigid joints of the ball and socket type. In this instance, an earthing connection independent of the ball joint shall be provided.

d) For tungsten luminaires that are hard wired, cables shall terminate within the conduit box, the final connection being made in heat resistant flexible cable connected to hard wiring with porcelain connectors.

e) For fluorescent luminaires that are hard wired, connections may be made directly to the terminal block although care should be taken to ensure that wiring does not come into contact with the surface of control gear.

f) All fluorescent luminaires intended for dimming should be fully compatible with the dimming equipment specified. Allow for liaising between the luminaire and dimming equipment manufacturers and ensure that any special manufacturer's requirements are met.

g) In case where recessed Tungsten luminaires are specified, manufacturer's heat resisting flexible cable should not be removed for the purpose of extending. Extension of cables shall be achieved using in-line plugs and sockets and a suitable length of heat resisting flexible cable.

h) Where emergency lighting conversion packs are specified, the conversion is to include fitting the mains healthy LED in a suitable visible position on the luminaire body.

TESTS

a) Conduits and cables shall be tested during the progress of the work before their concealment as follows:

i. Continuity of protective conductors and equipotential bond of conduit, metal sheaths etc.

ii. Continuity of current carrying conductors.

b) Immediately prior to completion and in the presence of the Engineer or Clerk of Works carry out the initial inspection and testing detailed in Part 6 of the 17th Edition of the Wiring Regulations.

Test results are to be documented on test charts containing the following information for each circuit: -

i. Design current (Ib).

ii. Earth loop impedance (Ze) at furthest point.

iii. Line neutral impedance at furthest point.

iv. Loop resistance (R1 + R2).

v. Continuity of ring final circuit conductors.

vi. Insulation resistance readings.

vii. Polarity test.

viii. RCD test where applicable.

In addition to the aforementioned information, each chart shall contain details of the external characteristics appertaining to the distribution board.

c) Following successful inspection and testing, a copy of the Inspection Test Certificates shall be forwarded to the Engineer within 4 days of the tests being completed, or at Practical completion whichever is the sooner. Note that the Engineer will not accept the installation as practically complete until a Test/Completion Certificate is presented, reviewed and signed off.

IDENTIFICATION, NOTICES AND DOCUMENTATION

a) Labels shall be provided to indicate the purpose of switchgear and control gear, unless there is no possibility of confusion. Labels shall be manufactured from Traffolyte and be bolted to equipment, unless otherwise specified.

b) Distribution board schedules and 'As fitted' drawings shall contain such information as is required to satisfy Clause 514-3 of the Regulations. In addition 'As fitted' drawings shall detail conduit runs giving sizes.

c) Operation/maintenance manuals shall contain the following items:

i. Print of each 'As fitted' drawings.

ii. Circuit Chart for each Distribution Board.

iii. Test Chart for each Distribution Board.

iv. Fire Alarm System Design, Installation and Commissioning Certificates as per Appendix H to BS 5839-1:2013.

v. Alarm Systems Test Certificates.

vi. Emergency Lighting Test Certificate/Record Sheet. (Where self-contained luminaries are employed one sheet will be required for each luminaire).

vii. NICEIC/IEE Test Certificate.

viii. NICEIC/IEE Completion Certificate.

ix. A schedule of manufacturers along with catalogue numbers of all equipment used.

x. Operation/Maintenance Instructions for all specialist equipment, provided in a hard backed ring binder or lever arch files, suitably labelled.

d) The quantity of 'As fitted' drawings required and Operation/Maintenance manuals shall be as set out in Section One of this Specification.

Note: All of the above documents and labels should be available at the time of testing.

e) Supply and fit such notices as may be required by Regulations 514-08 to 514-13 inclusive.

SECTION 2 – SPECIFIC ELECTRICAL INSTALLATION CLAUSES

INTRODUCTION
This Section of the Electrical Services Specification details the particular technical requirements of this project and the extent of work to be carried out by the Electrical Sub-Contractor to serve the proposed new development and refurbishment of the existing building.

Where the requirements of this section conflict with previous sections, then this section shall take precedence.

To facilitate rapid and equitable evaluation of the return tenders, the Electrical Sub- Contractors are asked to present the tender costs requested as per the tender analysis as set out later within this specification(Appendix2).

BREEAM
This project is NOT registered with the BRE Energy Assessment Method scheme.

TENDER DRAWINGS
The tender drawings accompanying this specification are for tender purposes only and show the detailed requirements of the Client, relevant to the electrical services installations.

The Electrical Sub-Contractor shall be responsible for the supply, installation, testing and commissioning, and co-ordination of services, and for working drawings, record drawings and "As-Fitted" drawings, together with a concise maintenance and operation manual, and Building Log Book for the electrical installation at the end of the project. For further information regarding the above, refer to the Main Contract Preliminaries and Preliminaries of this Specification.
The tender drawings show the detailed principles to be applied to the electrical engineering services. Where trunking routes, cable routes, etc. are shown on the tender drawings, these are typical and indicative of the major service routes and the Electrical Sub-Contractor shall allow for any necessary bends and diversions to allow for the structure of the building and co-ordinating the installation with other services and trades.

The detailed information provided on the tender drawings is to provide a minimum quality standard against which the Electrical Sub-Contractor is to provide a compliant bid. The Electrical Sub-Contractor is welcome to propose alternatives of equal or better quality and performance, but it lies with the Electrical Sub-Contractor to prove that such alternatives are indeed of equal or better quality and performance. The design team, acting on behalf of the Client, is not obliged to accept or approve any proposed alternatives. Alternatives of an equal or better quality will only be considered insofar there is a financial advantage to the Client in selecting the alternatives.

It should be clearly understood that minor modifications to the building layout may be required, and as such, the Electrical Sub-Contractor shall allow for the reasonable relocation of electrical equipment to suit the final design.
The Electrical Sub-Contractor shall base his tender upon information given in this Electrical Services Specification, tender drawings and information from the Main Contract Tenderers. If any information from these sources conflicts or is ambiguous the Electrical Tenderer shall raise a query in good time during the tender period or include for the more onerous option.

The Electrical Sub-Contractor shall allow in his Tender for participation in the production of co-

ordination drawings, under the leadership of the Mechanical Sub-Contractor. The Main Contractor and all other Sub-Contractors and Specialists shall also participate in this exercise.

SYSTEMS OF WIRING

The Electrical Sub-Contractor shall install systems of wiring in accordance with the following methods unless specifically indicated to the contrary: -

Main and Sub-Mains Distribution: -

- Multi-Core Copper XLPE insulated/LSZH/SWA/LSZH sheathed to BS6724 IEC60502 600/1000V internally run cables laid on galvanised steel cable basket or on galvanised cable tray.
- Multi-Core Copper XLPE insulated/PVC/SWA/PVC sheathed to BS6724 IEC60502 600/1000V externally run cables run in underground ducts.

External Lighting and Plant: -

- Multicore LSZH BS7211 insulated 6242B twin & earth cables installed in accordance with BS7671:2008 Section 522 in galvanised conduit direct through the wall behind each fitting;
- multi-Core Copper XLPE insulated/PVC/SWA/PVC sheathed to BS6724 IEC60502 600/1000V cables drawn in underground cable ducts below floor slabs and externally.

Wiring within Plant rooms, Switch rooms and similar areas: -

- Single core LSZH insulated 450/750V BS7211 6491B cables drawn in heavy duty galvanised steel conduit and trunking (each final circuit to have separate CPC).

Final Circuits: -

- Multicore LSZH BS7211 insulated 6242B twin & earth cables installed in accordance with BS7671:2008 Section 522 in galvanised conduit direct through the wall behind each fitting;
- multi-Core Copper XLPE insulated/PVC/SWA/PVC sheathed to BS6724 IEC60502 600/1000V cables drawn in underground cable ducts below floor slabs and externally.

Fire alarm Installation

Soft Skin fire resistance cabling fixed by metallic fixings and installed strictly in accordance with the cable manufacturers published recommendations.

Pirelli FP200+ - red sheath for loop wiring and other ELV
Pirelli FP400 – red sheath for mains LV wiring of supply to the fire alarm panel

BS5839-1:2013 standard performance

Voice and Data Cabling

- Category 6, 4 core UTP cable to the client requirements.

Access Control Cabling

- To specialist suppliers requirements, but LSZH

All Accessories, Cabling etc. to be installed flush within the fabric of the building where possible in café, storage, WC and circulation spaces, except where located in dado trunking. In plant areas, equipment storage and Caretaker areas, the installation shall be surface. All main and sub-mains cables shall be terminated utilising brass compression glands. For indoor application BW type glands shall be used. For outdoor applications CW type glands shall be used, but these shall be installed bottom entry only.

When terminating onto distribution boards, gland plates or trunking, bond from an earthing stud to the cable gland earthing ring to the distribution board casing/gland plate/trunking and also cross bond onto the distribution board/panel earth bar using LSZH/Copper conductors of at least half the cross sectional area of the cable phase conductor. All cables shall be terminated using cable glands of the correct type and size.

Low voltage main/sub-main distribution armoured cables shall be XLPE insulated, single wire armoured and LSZH sheath overall 600/1000 volt grade with stranded copper conductors to BS 5467

and BS 6360. Cables shall be installed in continuous lengths. THROUGH JOINTS SHALL NOT BE USED.

Cables used for connection to external equipment such as external condensers shall have an overall polyethylene sheath in lieu of an LSZH sheath, thus making them impervious to the ingress of moisture when installed in ducts, or buried in the ground.

All cable cores shall be ferruled at the main LV switch panel and distribution board before connection. The ferrule legend shall be identical with that of the core termination stud. Identification markers shall be Z type as typically manufactured by Messrs. Critchley.

All cables shall be marked at each end using universal carrier strip (12 digit) with K type markers as typically manufactured by Messrs. Critchley. The cable marker description shall be agreed in schedule form with the Employer's Agent prior to installation.

CABLE SUPPORT AND CONTAINMENT SYSTEMS
This Section of the Electrical Services Specification details the particular installation requirements for trunking, basket and conduit and is to be read in conjunction with the other sections of his document and associated tender drawings.

•It lies with the Electrical Sub-Contractor to ensure that the electrical containment services remain fully co-ordinated with all other services and structures during installation, especially at the ceiling pinch-points where changes in soffit levels drastically reduce the available space.
•All secondary containment requirements are to be established by the Electrical Sub-Contractor as part of the Tendering process, and shall duly be included for within the Tender Price. No claims for additional containment will be entertained unless there has been a change to the overall layout of the building and it can be documented that the containment allowed for is now insufficient.
•Electrical primary service distribution routes are to be confined to the ceiling voids, services bulkheads, risers and plant rooms. It is the Electrical Sub-Contractor's responsibility to liaise with all other trades in respect to positions of the cable containment systems installed within the ceiling voids and services bulkheads. Containment runs are to be kept simple and accessible, and where possible run in conjunction with the mechanical services to reduce the number of access points. The electrical, mechanical shall be carefully coordinated to ensure ease of access to both.
•All necessary cable support systems shall be supplied and installed such that cables are supported continuously over their entire run lengths. Cable cleats, if used, shall be of the correct diameter/size for the cables being fixed.
•All builders work details shall be provided by the Electrical Sub-Contractor.
•All trunking and cable baskets shall be fully cross bonded for electrical continuity.
•The Electrical Sub-Contractor shall establish any containment requirements of their Specialist Sub-Contractors and allow associated costs within the tender submission.
•The Electrical Sub-Contractor shall ensure that all conduits, cable trays, baskets, trunking, cable ducts etc. have a minimum of 25% spare capacity and shall wherever necessary provide additional equipment to maintain this spare capacity.
•Secondary containment shall comprise of the same form of primary containment but of a reduced size. The use of flexible conduits shall not be acceptable unless otherwise agreed with the Engineer.
•Containment systems and sizes for the Structured Cabling system shall take into account the bend radius of the data cables.
Number of data cables installed within a conduit or flexible conduit shall be in strict accordance with the following criteria: -·

Up to 2 data cables - 20mm conduit
Up to 3 data cables - 25mm conduit
4 or more data cables - cable basket or trunking systems to be utilised.

•All forms of containment shall be installed in a consistent fashion throughout the development. Orientation of containment trunking and cable baskets shall be the same throughout the installation in an upright position so that cables are fully supported by the base of the containment system.

•Primary and secondary containment systems shall be installed and arranged in a manner that shall assist future maintenance and addition of additional circuits. Containments systems installed need to be fit for purpose and accessible once all other systems are in place, therefore careful coordination with other services must to be included.
•Where services are exposed due to the nature of the surrounding finishes, the electrical services support systems shall be installed in a neat and tidy fashion; wherever possible, the services shall be installed such that they are out of sight but still accessible.

Support and Fixings
The Electrical Sub-Contractor shall supply and install, complete with all necessary support steelwork, the brackets and suspension threaded rod to support the electrical installations defined.
•Mechanical services and their supports shall not be used for the purpose of supporting the electrical services, and vice versa.
•The drilling of structural steelwork shall not be permitted and therefore the fixing of support steelwork, frames, services etc., shall be by means of proprietary suspension fixings such as Unistrut or similar.
•Where drop rods are used these shall be galvanised and of suitable diameter (minimum 8mm) to bear the loading of the systems supported. It is not permissible to bend drop rods to suit the rake of the roof. Where fixing at an angle is required, the correct manufacturer's proprietary angle brackets shall be used. Therefore all threaded rod shall be suspended vertically from fixing.

Trunking, Tray and Cable Basket
The Electrical Sub-Contractor shall supply and install a completely new cable containment system within the project area.
•Proprietary fittings for cable basket, tray and trunking shall be used throughout. No bends shall be fabricated on site by the Electrical Sub-Contractor.
•The primary services containment route is generally indicated on the drawings. The containment shall consist of a number of separate runs of trunking, cable tray and cable basket generally for the following services: -

- Main and sub-mains cabling
- Low voltage power and lighting
- Emergency Lighting.
- Fire alarm cabling.
- Category 6 Structured cabling.
- Extra low voltage circuits

•The Electrical Sub-Contractor shall be responsible for supporting the cable basket and cable trunking from the building structure with purpose made unistrut brackets. All brackets shall be approved by the Engineer and where run on floor slabs shall support the tray and trunking on a distance of no less than 100mm from the slab.
•All cable trays shall be mild steel medium duty return flange type BS1449 Part 1 and shall be hot dip galvanised to BS 729. It is the Electrical Sub-Contractor's responsibility to fully co-ordinate his works with other trades to ensure clashes of services do not result.
•All trunking shall be of Class 3 category of the medium duty galvanised type with return lip, fitted with tinned copper earth continuity links and cable retaining straps. All additional cable basket, tray and trunking requirements necessary for a complete installation shall be included and priced for by the Electrical Sub-Contractor. This shall include cable tray and trunking required by the Specialist Sub-Contractors.
•Allowance shall be made for fitting fire barriers to all trunking where this passes through fire compartment walls and floors. Where rock wool is used for fire barrier installations, this shall be installed in such a manner as to eliminate any air gaps around cables inside trunking. Therefore backing sheets on rock wool strips shall need to be removed and the rock wool flux shall be used only to pack out inside the trunking.
•All cable basket, tray and trunking shall be supported at the intervals recommended by the manufacturer.

Conduit Installation
All conduits, where required, shall be high impact LSZH plastic conduit concealed in the building

fabric and voids to give a flush installation, or neatly and plumb surface installed in areas such as plant rooms and storage areas.
•No pressed steel type couplings or accessories shall be allowed.
•Conduits shall not be installed in floor screeds without prior permission from the Structural and Services Engineers.
•Different systems shall not share common conduits. Utility power wiring shall not be contained within conduits which contain lighting wiring. Therefore segregation of all systems shall be maintained throughout conduit systems.
•Generally, conduit runs and routes are not shown on the drawings. It shall be the Electrical Sub-Contractors responsibility to supply and install all conduit networks as necessary to connect from trunking, distribution boards, equipment cabinets etc., to provide a fully enclosed wiring system to all accessories and outlets, and luminaires where required (e.g. external building-mounted). This shall include conduit systems for Specialist Sub-Contractors.
•Where conduits are installed for use by specialist installers, the Electrical Sub-Contractor shall provide draw wires for the same.
•The Electrical Sub-Contractor shall be responsible for the co-ordination and establishment of conduit routes to avoid clashes with installations being carried out by other trades.

WIRING ACCESSORIES, MOUNTING HEIGHTS & LABELLING

Wiring Accessories
Wiring accessories shall be white plastic (with Equality Act compliant rockers or inserts where applicable) where the installation is flush, and surface metal clad accessories where the installation is surface. Metal clad accessories only shall be used in plant room areas. Wiring accessories shall be Equality Act compliant where applicable.

The same manufacturer shall be used throughout the project for all wiring accessories, except where no such equivalent exists, then one of equal quality shall be used from another manufacturer.

Mounting Heights
Unless directed otherwise by the project Architect, the following mounting heights will apply: -

Light switches - 1200mm to top

13A Socket outlets on walls - 450mm to underside - General

13A flush Socket Outlets over worktops - maximum 1200mm to top above floor, but generally 200mm to underside from worktop level

Cooker control & outlet – control plate 1200mm AFL to top, minimum 100mm (to edge) clear of cooker space but co-ordinated with wall tiles (where applicable), outlet at 600mm AFL to top centred behind cooker

Data and Power flush outlets above desks - maximum 1200mm AFL to top above floor, but generally 200mm to underside from desktop level

Dado trunking: generally 50mm to underside above worktop, where mounted above worktop (reviewable against window sill heights); at whiteboards the trunking will be vertical and the outlets mounted appropriately herein

Isolating switches for local extract fans - 100mm to top below ceiling; for cooker extract hoods in Food DT at 1800mm AFL to top.

Power to white goods and similar – fused spur at 1200mm AFL to top, with **unswitched** socket at 600mm AFL to top directly below spur, or centred behind appliance where spur is not over appliance.

Break glass units - 1200mm to top

Sounders - 2200mm to underside or 50mm below ceiling to top if ceiling less than 2300mm

The Electrical Sub-Contractor shall allow for liaison with the Architect, Mechanical Services and specialist Sub-Contractors prior to marking out, verify positions and heights and provide drawings, sketches or co-ordinated ceiling plans as necessary (see Section 1 Drawings above).

All drawings and elevations must be approved prior to installation.

Labelling and Cable Identification

General
The Electrical Sub-Contractor shall provide and install a comprehensive system of labelling for the electrical installations.
•All format/wording on the labels shall be agreed with the Engineer prior to obtaining/printing the labels.

Compliance with Standards
All equipment and materials must comply with the most recent issues and revisions of all relevant British Standards current at the time of tender, and/or such other recognised standards as may be stated in the attached data sheets.

The following are certain of the applicable British Standards.

BS1710 Specification of pipelines and services

BS7671 17th Edition IEE Wiring Regulations

Main Equipment
Labels on main items of equipment, switchboards, contactors, distribution boards, isolators, control switches etc., shall be engraved Traffolyte and secured by means of screw fixings not self adhesive.
•Laminated plastic labels shall have engraving black on white for all circuits.
•Information to be given on the labels shall include the equipment numbers as shown on the drawings, designation of outgoing cables and origin of incoming cables, source of supply, cable size, capacity of switch and rating of fuse in switch.
•Provide warning labels where voltages of more than 230V are present. These labels shall be securely fixed laminated plastic black text on yellow background.

Distribution Boards
All switchgear and distribution boards shall have circuit and descriptive notice labels on the front cover as described later within this Specification. The descriptive label shall also include the source of the feed, the capacity of the switch and the rating of the protective device and the cable size / type supplying the switchgear/distribution board.
•Outgoing circuit information shall be in the form of a typed circuit chart securely fixed inside the distribution board to the door in a suitable plastic wallet.
•All cables in distribution boards shall have slip on type cable markers identifying the circuit reference. This includes all neutral and earth cables.
•All sub-circuits/final accessories shall be labelled with the name of the distribution from which it is fed including the phase and way number, an example for this would be:-

DBLP04(L/P)1L1

Cables and Earth Bar
Provide all mains and sub-main armoured cables with tagged ferrule markers at 3m spacings along the length of the cable and both ends to identify origin and destination.
•Label all earth cables at both ends. Refer to typical earth bar details given in Section 1.

Lighting switches, sockets, fused spurs, emergency luminaires
The front plate of all electrical accessories and emergency luminaires shall have printed adhesive tape fitted. The label shall be black text on white background. The labels shall give the circuit number as indicated on the distribution board schedules. The Electrical Sub-Contractor shall provide sufficient self adhesive tape for this purpose. The self adhesive tape shall typically be as manufactured by

Brother Industries Ltd. for P-Touch type printers, or equal and approved.

Fire Alarm Installation
All fire alarm devices shall be identified with the loop number, device number and device type (B - break glass/manual call point, S - smoke detector, H - heat detector, I - Input/ Output relay).

The identification shall take the form of clear self adhesive tape with black text.

The Electrical Sub-Contractor shall provide sufficient self adhesive tape for this purpose.

Hidden Services
In the case of services that are to be concealed above ceilings and or floor voids, circular traffolyte or plastic labels to BS colour code shall be secured by screw fixing or riveted to the adjacent false ceiling.
The following ceiling services colour indication shall be used: -

- Yellow: Concealed Power Supply Units
- Magenta: Fire Alarm Detectors and Interfaces
- Black: Smoke/Fire dampers
- Grey: Lighting Control Modules
- Cyan: Disabled Alarm systems

The Electrical Sub-Contractor shall confirm the full extent of concealed services and make due allowance in his tender for all labelling. Colour codes for services not listed above shall be confirmed with the engineer.

Prior to purchasing the above disks the Electrical Sub-Contractor shall liaise with the client to confirm specific colour selection.

Schedule of Labels
Actual distribution board references shall be as agreed with the Employer and Engineer prior to any labelling taking place.

INCOMING LOW VOLTAGE (LV) CABLING
The existing main LV supply is to remain as existing. No works are to be undertaken on the main LV supply.

MAINS LV DISTRIBUTION
Mains LV distribution is to remain as existing.

SUB-MAINS LV DISTRIBUTION
No new sub-mains are required in this installation.
The Electrical Sub-contractor shall ensure that the proposed cable routes have been fully co-ordinated with all other services and trades, and have been reviewed and signed off by the Design Team. The routes shown on the Tender drawings are indicative only, and it lies with the Electrical Sub-Contractor to determine that any proposed routes are viable and appropriate, and do not clash with any other services, or structural and architectural elements.

Where armoured cables are used, an earth tag washer shall be provided with a separate CPC connecting the armour of the cables direct to the earth bar of the item of switchgear. The metal case of the switchgear shall form only the secondary earth.

Main and sub main cables shall run throughout their length generally utilising the ceiling voids. Cable baskets may be utilised for sub-mains cabling, but must be fit for such purpose and fixed or suspended by use of Unistrut and threaded drop rods of at least 10mm diameter, and **not** by gripple wire.

Final circuit wiring of lighting and power services shall be single core LSZH/Cu cables drawn into trunking systems, and into conduits for final drops respectively. Where conduits are installed surface

in plant and equipment storage areas and exposed to view, they shall be of the high impact plastic type.

All necessary cable support systems shall be supplied and installed such that cables are supported continuously over their entire run lengths.

Where cables drop to distribution boards fixed onto walls, they shall be fixed to cable tray. In all cases where cables are run on cable tray and any 'Unistrut' framing they shall be fixed in the following manner: -
For multi-core cables up to and including 10mm diameter – proprietary plastic cable ties (zip-ties).

For multi-core cables greater than 10mm diameter - LSZH covered, perforated aluminium cable strapping, such as 'all round banding" or similar, fixed with pins and nuts. Excessive lengths of pins shall be removed and treated with proprietary corrosion-preventative paint.

For single core cables - LSZH covered, perforated aluminium cable strapping, such as 'all round banding" or similar, fixed with pins and nuts. Excessive lengths of pins shall be removed and treated with proprietary corrosion-preventative paint.

All armoured cables shall be installed on cable tray or basket tray. All fixings shall be spaced in accordance with The Wiring Regulations BS 7671 17th edition with all current amendments.

All cables shall be installed and run such that they are arranged in an orderly manner and to minimise the number of crosses. Where crosses are necessary the cables shall be lifted above each other and supported by a 'Unistrut' or similar bridge piece such that one cable's diameter distance is maintained from adjacent cables.

All cables passing through fire walls will require fire stopping. The Main Contractor shall provide all necessary attendance to the Electrical Sub-Contractor who will instigate this work.

All cables shall terminate in suitably rated isolators either integral to or adjacent to the equipment served.

All cable routes shall be determined and fully coordinated with other services by the Electrical Sub-Contractor.

FINAL MCB DISTRIBUTION BOARDS

General Performances
MCB distribution boards shall comply with the relevant parts of BSEN60439 and phase identification to BS7671.
Final MCB distribution boards shall be assembled from standard manufacturer components.

For compliance with Building Regulations, any single piece of plant with a normal operating rating of 10kW or more must be separately sub-metered. Should any plant be fed direct from the main LV switchpanel, then the size of the main LV switchpanel must be increased accordingly to ensure that there are at least three (3) full spare TP ways available for future expansion.

Combined MCB/RCDs (RCBOs) of single phase type having the following characteristics: -

•Manufactured and tested to BSEN61009.
•A breaking capacity of 10kA to BSEN60898.
•A or AC classification.
•30mA sensitivities.
•Permanent non adjustable and non removable earth fault protection.
•A width of no more than one outgoing way where the neutral is unswitched.
•Automatic protection against reverse polarity.
•Automatic disconnection in the event of a lost neutral.
•Be able to accept auxiliary contacts, under voltage release or shunt trip.
•Combined MCB/RCDs (RCBOs) of three phase type providing protection, disconnection and isolation of all live conductors including the neutral.

Sub-metering
Separate sub meters shall be installed to the following areas/plant:

- Any single piece of mechanical plant with an electrical load rating of 10kW or more

Distribution boards that are not split load shall be sub-metered at source.

The Electrical contractor shall include for sub metering to each individual office and shall liaise with CBC FM who have arranged for the meter installation.

TP/N MCB Distribution Boards
As stated above.

EARTHING AND BONDING
The Electrical Sub-Contractor shall allow for the entire new installation (extension and refurbished areas) to be earthed and bonded complying strictly with the 17th Edition IEE Wiring Regulations, BS 7430: Part 1 1998, and as follows: -

Individual CPC's shall be installed in all new final circuits and sub-circuits, connected individually to the earth bar of the relevant distribution board. Supplementary bonding to all items including pipework to showers and sinks. Minimum size of bonding cables shall be related to the size of the incoming service cable. Earth bonding shall be carried out to all other incoming services, all hot and cold water services, ventilation ductwork, structural steel works and suspended ceiling grids.

In addition all "flow and return" heating and water services pipework shall be bonded.

All connections to the relevant pipework etc shall be made with clamps complying with British Standards. All necessary and applicable notices/labels in respect of the system shall be provided for by the Electrical Sub-Contractor.

Supplementary Bonding
All supplementary bonding to be carried out in minimum 4mm² single LSZH/Cu cables. The supplementary bonding conductor to low level pipe work, etc., shall be taken from an adjacent socket outlet or similar and shall be connected to the pipe work, sink top, etc., via a flex outlet plate fixed as close as possible. Cables shall not simply stick out of plaster.
Alternatively, where surface conduit is local to the bonding point, the cable may exit the conduit system via a 3 way circular conduit box with one way fitted with a brass stuffing gland.

Where a supplementary bonding point is within 1 metre of an electrical outlet (i.e. socket or connection unit), the bonding conductor shall be taken back to the local circuit earth.

All galvanised trunking shall have copper bonding strips fixed across each joint.

All galvanised cable trays, cable baskets and ladder racks where not continuous shall be bonded across breaks.

All cable support steelwork shall be bonded to the rest of the earthing system.

Circuit protective conductors shall be installed from the earth bar of the individual distribution board for each outgoing circuit from that board.

Conduit and/or trunking must not be used as a circuit protective conductor.

Continuity testing of all earthing systems shall be carried out and the tests recorded.

Sample tests at random shall be applied to duct systems, pipework etc., and across metallised pipe cladding. Measured values must be less than 0.1 Ohms.

Wherever possible, bonding shall be carried out to pipe work, etc above suspended ceilings.
The Electrical Sub-Contractor shall allow for all necessary supplementary bonding within the plant rooms of new mechanical plant and equipment.

GENERAL INTERNAL LIGHTING INSTALLATION

General
The Electrical Sub-Contractor shall supply, install, test and commission a complete lighting and emergency lighting installation, with manual and automatic controls as detailed in the following clauses, material & specialist schedule (Appendix 1), associated tender drawings and Luminaire Schedule (Appendix 3).

The internal lighting installation has been designed in collaboration with the architect, and luminaires carefully selected to meet both the aesthetic and technical requirements.

Internal Lighting
The internal lighting installation is generally configured in a uniform manner and coordinated with the mechanical services layout. However, as minor changes to the room layouts may result from design development, the Electrical Sub-Contractor shall make due allowance within the tender submission price for the reasonable relocation and reconfiguring of the internal lighting installation to suit revised architectural layouts. Full coordination of all services including lighting is to be undertaken when mechanical and electrical sub-contractors are appointed.

The new lighting installation will consist of low energy high efficiency LED luminaires, in order to meet the building energy model (SBEM) requirements for compliance with Building Regulations Part L2A 2013. Luminaires will be recessed in areas fitted with modular grid ceilings and plasterboard ceilings, and suspended in areas with high ceiling or where small areas with high light levels are required. The luminaires listed in the Luminaire Schedule must be used for tender pricing. Any alternative fittings proposed must be reviewed before any approval can be given. Any alternative fittings proposed must have a colour rendering index (CRI) of at least 80 for all applications, and generally a CRI to match that of the specified fittings.

All luminaires shall be supplied complete with light engines. All bulkhead or downlight luminaires shall have a correlated colour temperature (CCT) corresponding to the modular luminaires. The correlated colour temperature will be 4000K for internal luminaires. Externally, luminaires shall have a CCT of 3000K, or as specified in the luminaire schedule – generally a warm colour of light, to reduce the environmental impact.
All alternative fluorescent luminaires including compact source types, shall have high power factor correction and shall be complete with high frequency (minimum 30,000 Hz) fully electronic control gear to maximise lamp life and optimise energy saving.

Lighting throughout will be provided in accordance with the BS-EN 12464-1 (2011), CIBSE Code for Interior Lighting, DfES Building Bulletin 90.

The lighting installation is designed to optimise the internal environment and appearance, whilst minimising energy consumption and maintenance activities. High efficiency (minimum 30,000 Hz), low energy control gear will be provided in all cases to satisfy the scheme's low energy requirement, should a fluorescent alternative scheme be accepted.

Ensure that no fittings are damaged/spoiled by decoration, finishes, other trades etc. Any damaged luminaires shall be replaced at no cost to the Employer such that the installation is new at the day of handover.

For the suspended luminaires in the stair areas, cable drops from the ceiling to the luminaires shall be kept to a minimum, and shall be carried out in white LSZH multi-core flex tied neatly to the suspension wires in a systematic manner, any controls wiring drops must also be with white sheath.

Manufacturer's requirements for fixing, mounting and wiring shall be adhered to in all cases. The Electrical Sub-Contractor shall establish the various types of ceiling systems being used and shall allow for installing the luminaries accordingly, including the correct type of finishing seals/gaskets/ flanges are provided.

Where luminaires are recessed mounted directly onto ceiling tiles the Main Contractor shall provide a plywood pattress behind the ceiling tiles to spread the weight of the luminaires to the 'tee' bar. Where modular luminaires are recessed in suspended ceilings, additional support wires shall be provided to the T-bar system at a minimum of 2 of the corners of the opening in which the fitting will lay.

The Electrical Sub-Contractor shall, where appropriate, inform the manufacturer of the various forms of suspended ceiling type to ensure that the correct type of seal, gaskets, flanges are provided. It shall be the Electrical Sub-Contractors responsibility to ensure that each luminaire is suitable for installation in its intended location. Note that the modular luminaires to be recessed in plasterboard ceilings will require either a different fixing arrangement to those in grid ceilings, or a specific plasterboard mounting frame.

Care shall be taken to co-ordinate carefully with the Main Contractor and the Mechanical Sub-Contractor, all luminaires, sensors etc that are ceiling mounted and require cutting of the ceiling tiles or plasterboard.

Final connections to luminaires in accessible suspended ceiling areas shall be by means of pre-made “plug and play” modular wiring with Wieland type connectors from lighting control modules. Wieland T-pieces to enable daisy-chaining are permissible.

Lighting control modules shall be located local to the area controlled, and the location shall be co-ordinated with structural, mechanical and construction (eg. fire barrier) elements. Drawings showing the proposed locations shall be submitted to the CA and the BSD Electrical Services Engineer for approval at least 2 weeks prior to any first fix wiring installation for the lighting commences.

Luminaire details shown on the tender drawings represent those that are of an acceptable quality in terms of their appearance, longevity, performance, and quality of construction. Deviation from these shall not be permitted unless agreed in writing with the BSD Engineer and the Employer. Requests for deviation from the specified shall be backed up by lighting calculations showing that the proposed luminaires provide a lighting quality at least equal to that of the specified luminaires, and will pass the building energy model (SBEM). The Electrical Sub-Contractor shall also include for providing 1 No. sample of each of the alternative luminaires proposed, for consideration by the Engineer and the Architect. This procedure shall be completed early in the contract period to ensure delivery of all luminaires to suit the main contract programme.

Lighting Controls

Where multi-gang switches are detailed with more than 1 Phase at the switch, then suitable proprietary phase barriers and "Danger 400 Volts" labels shall be fitted to maintain segregation. Where extract fans are detailed then double pole light switches shall be used to switch the fans on or off.

There are different types of lighting control strategies in the new building and these are detailed within the following clauses and associated tender drawings. The Electrical Sub-Contractor shall be responsible for the supply, installation, testing and commissioning of all systems to give a fully functioning installation, and shall liaise with the lighting control supplier for final wiring and connection detail.

Generally lighting all areas will be controlled by means of local two-way centre Off retractable light switches. In circulation and low traffic areas (e.g. store rooms, WCs) automatic presence detection lighting controls shall be used.
The detectors shall switch the lights off if no movement is sensed for a pre-set period of 15 minutes (both for Manual on/Auto off and Auto on/Auto off systems). Automatic lighting controls shall be selected so as to avoid nuisance switching. Day light dimming will be used in cellular offices for the window row of luminaires.

Within store rooms and WCs, recessed presence detection switches with 360° 6m detection range shall be used. All presence detection switches, including the microwave type, shall have integral daylight sensing capabilities.

All detectors shall be positioned to ensure their optimum performance is achieved. The positions shown on the tender drawings are indicative only and it rests upon the Electrical Sub-Contractor and his selected lighting control specialist to develop the scheme for optimum performance.

The Electrical Sub-Contractor shall supply and install all light switches. These shall be 10 Amp rated grid switch type with coloured moulded rockers for Equality Act compliance. In surface installation areas such as plantrooms and switchrooms, surface metal clad grid switches shall be used. Where lighting control modules are used, low voltage DC drops in Cat6 or Belden type cable to switch positions shall be used, and such switches are therefore not required to be 10A rated.

All switches in plantroom areas shall be complete with surface mounting boxes to suit the area of installation and unless stated otherwise switches shall be mounted at 1200mm to top above finished floor level.

Automatic lighting controls shall not be employed in areas where inadvertent switching off of the lights could result in a dangerous situation – switchroom's etc.

Demonstration
Upon completion of the lighting control system the Contractor shall allow for the Specialist to commission in the presence of the Electrical Engineer, and to demonstrate and instruct to the Client's staff.

EMERGENCY LIGHTING INSTALLATION
The Electrical Sub-Contractor shall supply, install, test and commission a complete system of emergency lighting throughout the area of works. The emergency lighting shall comprise of standalone LED luminaires interfaced into the existing site wide battery back up system.

The installation and associated equipment (illuminated exit signage) shall comply in full with the requirements of BS 5266 and BS EN 1838, the relevant requirements of the local Fire Officer, and Building Control.

The category of emergency lighting shall be NM3. Emergency lighting shall be provided to all defined and undefined escape routes throughout the development.

Each emergency luminaire shall have a visible LED to indicate its condition.
Care shall be taken to ensure that the spacing between the emergency light fittings shall comply fully with BS5266 and the Manufacturers Recommendations.

Emergency lighting units shall be tested via test key switches installed in a grid arrangement adjacent the new distribution boards. The key switch shall control the circuit live supply only.

Each luminaire will require a test sheet on completion, and shall be identified with its unique number on the test sheet. Where required by the Local Authority and Fire Officer to enable the use of spaces out of hours by the public, self-contained, maintained emergency exit signage will be provided to supplement the general emergency lighting installation.

UTILITY POWER AND FIXED EQUIPMENT

General

The Electrical Sub-Contractor shall supply, install, test and commission a comprehensive utility power installation within the refurbishment and new extension. All outlets, sockets, switchgear, protective devices and ancillary equipment shall be provided by the Electrical Sub-Contractor as necessary. Laying out of all outlets, power supplies and ancillary equipment shall be coordinated with other engineering services and furniture to the satisfaction of the Architect and Main Contractor by the Electrical Sub-Contractor.

The number of power outlets shown on the drawings have been arrived at by the design team based on reviews with the Employer, and is subject to final review by the Design Team and end users prior to installation works commencing. In addition to these power outlets and power supplies, the Electrical Sub-Contractor shall make due allowance for supplies to specialist services equipment, mechanical services and final connections, as necessary, to provide a full and complete installation.

The Electrical Sub-Contractor shall make due allowance within the tender submission for coordinating all power, voice and data outlets, and power to specialist equipment, in order to provide a fully coordinated installation.

All socket outlets that will be used for mains powered portable equipment (indoors or outdoors) shall be protected by a RCBO with 30mA or less sensitivity. General power ring main circuits shall similarly be protected by a RCBO with 30mA sensitivity installed within the distribution boards.

All socket outlets shall be positioned as far away as possible from sinks to reduce the risk that electrically powered equipment is placed in water.

Small power circuits shall be installed to minimise interference to computers caused by electrical faults or failures and to be immune to harmonic currents created by electronically controlled loads. Circuits serving such socket outlets shall incorporate a high integrity dual earth and shall be wired in accordance with BS 7671 17th Edition IEE Wiring Regulations.

Final sub-circuits where used to power computer or other equipment containing mains filters shall be limited to a maximum number of socket outlets (8 No.) such that protective devices are operated within the manufacturer’s maximum permissible value of standing earth leakage current.

Floor boxes are to be allowed for in the new office areas as shown on the tender drawings. These shall be connected into an underfloor busbar system with a dual earth arrangement as BS7671.

Accessories will generally be of white plastic finish, with Equality Act compliant color contrast of rockers or surrounds where applicable (eg. where mounted in dado trunking). Where accessories may be subject to mechanical damage, e.g. Cleaner's Cupboards, equipment stores and plantrooms, metal clad accessories shall be used. Weatherproof accessories shall be used for external/wet areas where appropriate.

At all final MCB distribution board locations, a twin RCBO protected metal clad switched socket outlet shall be provided for routine maintenance purposes.

Local supplies from fused connection units will also be included for all items requiring connection e.g. electric water heaters, Access control, fire alarm systems, etc. With the exception of the fire alarm these will be wired from local utility power circuits.

Wiring accessories shall be installed at a suitable height and in a location away from wet areas.

All Category 6 RJ45 faceplates shall be provided by the Electrical Sub-Contractor. Back boxes for Category 6 outlets shall be a minimum of 32mm deep.

All sockets, spurs and switches to be labelled with circuit references, fused spurs additionally to be labelled with the equipment supplied (eg. “Water Heater”).

Locations of all equipment shall be agreed prior to any first fix works. All wiring accessories shall be a minimum of 300mm from central heating radiators, insofar possible.

Socket outlets positioned within an arms length of sink units will not be permitted.

The Electrical Sub-Contractor shall allow for close liaison with the Mechanical Sub-Contractor and Main Contractor regarding co-ordination of all outlets.

Cleaner's Sockets
Adequate provision should be made in circulation areas, to permit the use of cleaning equipment. General cleaners socket outlets shall be provided at 15m centres in all circulation spaces. Socket outlets shall be single switched socket outlets protected by a combined 30mA/20ms RCBO installed within the local distribution board. Cleaner's sockets shall be on dedicated circuits, and these circuits shall not be used to provide power to other equipment other than water coolers. Cleaners sockets in tenant areas are to be lockable

Electrical supplies for ICT equipment
Consideration shall be given to high integrity earthing for power circuits feeding ICT equipment, as required by BS 7671 17th Edition IEE Wiring Regulations.

Controls for fixed equipment
All fixed equipment shall be controlled by an isolating switch located either on the equipment or within two metres of the normal operating position, and accessible to the operator.

Fixed Equipment Power Supplies
As a minimum the Electrical Sub-Contractor shall allow to provide local power supplies to the following equipment: -

Disabled toilet alarm systems
Automatic opening doors
Ventilation extract and supply air fans.
Comfort cooling condensers and fan coil units
Local water heaters/water boilers
Local water chillers
Mechanical plant control panels and interfaces.
Mechanical cooling plant from control panel.

The Electrical Sub-Contractor is to include for all mains power wiring for mechanical plant and equipment – this includes all power wiring from the distribution board, Mechanical Services Panel or BMS control panel to local isolators and on to final connection onto the individual piece of equipment or plant. All controls wiring (ELV or signalling at LV) is to be carried out by the Mechanical Sub-Contractor or his appointed controls specialist.

Where equipment is permanently installed or where there is a possibility of equipment theft, switched double pole 13A spur outlets shall be used in preference to switched socket outlets. The spur outlet shall incorporate a red neon lamp indicating when the to the equipment is live.

CATEGORY 6 STRUCTURED CABLING SYSTEM
The Electrical Sub-Contractor is to supply, install and test a Category 6 structured cabling system to the building, as shown on the tender drawings. The Electrical Sub-Contractor may undertake the installation work himself, but the testing must be undertaken by a reputable IT specialist. The Electrical Sub-Contractor may elect to sub-contract out the installation works, in which case a shortlist of three (3) proposed specialists must be submitted for approval.

The structured cabling system shall consist of all passive equipment including cabinet and patch panels to accommodate new structured wiring, containment, field wiring and final connection face plates. A fibre connection to the existing facilities network will be required.

The Employer will provide and procure the active ICT equipment separately (file servers, UPS, IPS routers, switches, receivers), the Electrical Contractor is to provide a fully tested and functional

structured wiring network covering the building as described in this specification and detailed on the drawings.

The structured wiring installation will serve and support both data and telecommunications systems.

The structured cabling system shall be compliant with ISO/IEC 11801 and EN 50173, the European equivalent of 11801. The Contractor shall ensure both that Category 5 compliant components are used and that the system, end to end, is Category 6 compliant.

The structured cabling system, when used in conjunction with equipment, shall meet the appropriate emission and immunity standards.

The structured cabling system shall support all applications classes up to and including class D, including for FDDI, FOIRL, IEEE 802.3 Ethernet 10BaseT, IEEE 802.3u fast Ethernet 100BaseTX and 100BaseT4, IEEE 802.12 fast Ethernet 100baseVG Any LAN, IEEE 802.5 Token ring at 16 Mbps, ATM OC-3c at 155 Mbps, TP-PMD at 100 Mbps, CCITT V24/RS 232, RS 422, RS 485, and CCITT X25.

The structured cabling system shall also support all applications classes covered in the latest fully ratified ISO/IEC 11801 and EN 50173. Eg. Gigabit Ethernet, 622 ATM, 2.5 Gigabit.

Services to be supported include, but are not limited to:

- General computer data
- Local area network devices
- PCs
- Printers
- Wireless LAN connections
- Voice over IP (VoIP)
- video over IP
- CCTV
- Cat 6 UTP horizontal wiring (star) from patch panels to and including final RJ45 outlets
- Basket containment with matting on main distribution routes within corridors, risers and plant rooms, concealed conduit containment should be provided from main distribution baskets to final outlet boxes and CCTV. Utilise existing where applicable.
- Supply and installation of a fibre-optic link from new building to the existing systems nearest connection point.

The following provides a general brief outline of the works involved with respect to the structured cabling installation:

Generally, the works shall comprise, but not be limited to, the following:

- A clean earth connection shall be required at the cabinet location, and shall be provided by the Electrical Sub-Contractor if not already installed.
- Power will be retained at the cabinet location, and will be provided by the Electrical Sub-Contractor.
- Supply and installation of final distribution wiring from cabinets to individual RJ45 socket outlets as required.
- Supply and installation of RJ45 data socket outlets as indicated on the drawings, and connection to patch racks within the cabinets.

All containment shall be provided by the Electrical Sub-Contractor and will include basket tray in the ceiling/riser voids, dado trunking, floor containment and conduits where required.

This will include the following:

1. Cable baskets in ceiling voids and service ducts interconnecting all rooms/areas.
2. Underfloor containment system in the fourth floor offices.

Dado trunking back boxes shall be installed to the proposed positions, and shall be provided by the Electrical Sub-Contractor. All boxes shall be sized to facilitate Category 6 cabling.

The structured cabling system shall be Category 6 UTP with low smoke zero halogen sheaths.
All voice/data cabling shall be terminated into RJ45 wall/floor outlets out on the floor areas and terminated onto RJ454 patch panels within the designated distribution cabinet.
The Electrical Sub-Contractor shall include for liaison between the Voice and Data Specialist Contractor and the Client's IT Representative.

Cabling System
The Electrical Sub-Contractor's Specialist Data Cabling Contractor shall supply, install and test a structured cabling system throughout the building as indicated on the tender drawings.

The Electrical Sub-Contractor shall ensure that the generic cabling system conforms to the relevant cabling standards. For guaranteed performance and support, the generic cabling system will be supplied through a reputable manufacturer and installed by the Contractor in accordance with the implementation practices detailed by the cable system manufacturer.

Generally the structured cabling system shall be hierarchical star topology utilising Category 6 Low Smoke Zero Halogen (LSZH) copper cables in the horizontal subsystem. The design of the cabling system shall allow maximum flexibility.

All outlet quantities and cabinet locations shall be as shown on the tender drawings.

Comms Room
There is to be a maximum distance of 90 metres for cable runs from data cabinets to any room.

Cabinets
The Electrical Sub-Contractor shall liaise with CBC to ensure that the main server cabinet in the server room is of adequate size to suit their requirements. A wall mounted equipment cabinet shall be required for the building, containing rack assembly with power and patch racks and patching leads. This patch cabinet will be located within the cupboard shown on the tender drawings. The cabinet dimensions shall be 42U high, 800mm wide x 1000mm deep, suitable for rack-mounted patch racks, fibre patch racks and network switches.

System Documentation
The Electrical Sub-Contractor shall provide documentation of the "as-built" cabling infrastructure including updated schematics and floor plans, identification of access points and termination panels, and details of the alternate routing.

The system shall produce all the "as installed" information and include a software package to maintain connection records and administer the system post completion for moves, additions and changes to all items connected to the structured cabling system.

Installation and Testing
The system shall be installed and commissioned in accordance with the manufacturers' guidelines.

Full testing as specified in the standards shall be carried out for all new elements of the structured cabling system, to ensure the total system is fully compliant with the standards. In particular the Contractor shall carry out Time Domain Reflectometry (TDR) tests on all floor wiring that is provided.

Documentation of all test reports must also be provided identifying wall box outlets and Comms cabinets they are associated with.

In addition Optical Time Domain Reflectometry (OTDR) tests shall be required on all fibre cables that are installed. Documentation of all test reports must be provided identifying which fibre cable runs they are associated with.

General Data Network

The provision and distribution of outlets is set out in the tender drawings.

Compliance with Standards

1. All equipment and materials must comply with the most recent issues and revisions of all relevant British Standards current at the time of tender, and/or such other recognised standards as may be stated.
2. The design of the structured cabling system shall comply with the requirements of BS EN 50173.
3. The Quality Assurance provisions applied to the installation shall be compliant with BS EN 50174 – 1
4. Installation practices shall be generally compliant with BS EN 50174-2 and shall be wholly compliant with the installation practices laid down by the system manufacturer of choice.
5. Installation practices shall also meet all applicable local and national codes, standards and ordinances.
6. Where a conflict exists between these standards, it is the responsibility of the contractor to detail these conflicts to the client prior to installation commencing.

Cabling Containment System

The Electrical Sub-Contractor shall supply and install a dedicated IT basket containment system for the structured cabling system as detailed on the drawings. The containment shall consist of a cable basket tray installed within the ceiling voids and dedicated compartment of the dado trunking.

All containment will follow the pre-defined routes, which will be detailed on working drawings to be provided by the Contractor.

Category 6 Horizontal Cabling

The horizontal voice/data distribution cables shall be 4-pair Category 6 unscreened twisted pair cable with low smoke, zero halogen sheaths. All cable runs should be continuous and joint free between termination points.

All cables should be cut to the correct length. Excessive lengths in machine rooms and closets will not be accepted as properly terminated. Tight 90-Degree bends are not permissible; a minimum radius of 75mm should be used during pulling with an after install radius of no less than 45mm.

Cables should be secured every 2m Cable Ties and other tie-wraps should not be cinched excessively tight. Cables should be free to move along their length through the tied point.

Staples should not be used to secure cables.

Cables should be free of tension along the entire route.
Cables bundles should be no more than 25 cables.

Where passing through walls protective sleeves should be used.

Where passing through fire barriers the protective sleeve should be metallic conduit and sealed with flame retardant material such as plybrico or fire retardant expander foam with a flame retardant silicon seal.

The use of mullet unit cables of a ‘shot-gun’ construction shall not be permitted.

The cables shall be terminated to the TIA/EIA T568B wiring/colour scheme.

Patch Panels

The patch panelling shall be managed with unshuttered RJ45’s to a maximum of 24 ports in each 1U segment. Each segment shall be wired to 568B specification. The panel shall be terminated using industry standard IDC tooling.

The user patch panel port printed circuit board (PCB) and the outlet PCB will utilise PCB’s from the same manufacturer to ensure complete system compatibility.

Port labelling and identification shall be by way of a printed slide label or adhesive label.

A 1U horizontal cable management strip shall be installed above and after every 48-patch panel ports (2U segment).

RJ45 Outlets
All data outlets shall be a RJ45 presentation wired to 258A specification and must be a shuttered modular outlet.

All outlets shall be terminated in dado trunking or flush mounted back boxes. Port labelling and identification shall be done by the way of a printed sliding label or adhesive label.
Each module will have a colour coded tie down clip on the rear and use industry standard IDC tooling.

Labelling
All cables shall be permanently labelled at both ends as well as on the user patch panel and the RJ45 outlet. Prior to any works taking place, the Client shall agree the labelling scheme.

Testing
1. Testing of the system (patch rack to final RJ45 outlet) shall be the responsibility of the Electrical Sub- Contractor.
2. All circuits within the system are to be fully tested to comply with the transmission parameters of ANSI/EIA/TIA 568-A5. Any circuits not in full compliance will be brought into compliance by the Electrical Sub-Contractor at no cost to the Client.
3. All testers used to verify system performance shall be TSB67 Level IIE compliant and calibrated as required by the manufacturer. The client shall reserve the right to inspect any or all calibration certificates.

Documentation
1. The Electrical Sub-Contractor shall provide the following documentation: -
2. As installed drawings noting the location of all floor outlets and their circuit identifier, all cable runs to be marked on these drawings.
    - Cabinet layout drawings.
    - Full cross connect patching schedule.
    - Evidence of compliance testing in the form of Summary test results in hard copy for all installed cables. The contractor should also supply full test results in electronic format.

Warranty
It is a requirement that the wiring is covered by a 25 Year warranty. No other warranties will be acceptable.

It is a requirement that the site is inspected by the manufacturer of the structured cabling system, to ensure compliance with good working practice and any mandatory installation requirements of that manufacturer. The inspection shall take place prior to the issue of a warranty certificate.

The Electrical Sub-Contractor shall notify the client of the time and date of the site inspection, to confirm compliance with the mandatory installation practices and required standards, giving them opportunity to attend.

Room Points
Termination in rooms should be in double RJ45 sockets.

All sockets should be labelled with the corresponding number to the closet end termination point.

Data Point Positioning
All data points are to be either housed within the floor boxes or ceiling void for CCTV as highlighted on the tender drawings.

Normally all trunking should be white UPVC, if necessary with color-contrasting central panels for DDA compliance. Any non-standard areas will be noted in the appropriate tenders or quotation requests.

Basket trunking should be used in all ceiling void runs. All metallic Trunking, Basket and Sleeves should be earth bonded in compliance with IET wiring regulations.

TELEPHONE INSTALLATIONS
Any telephone points required will be part of the structured cabling system as described above, for a Voice over Internet Protocol (VoIP) installation. The Employer will provide the necessary VoIP racks and equipment prior to starting on site and outside of the contract.

FIRE ALARM SYSTEM
The system shall be an extension to the existing installation including new devices and wiring.

Scope
To **design**, supply, install, test and commission modifications to the existing Analogue Addressable Fire Alarm Control System in accordance with the details specified herein, in accordance with the building's Fire Risk Assessment and in accordance with the supplied design intent drawings. The modified fire alarm installation shall be a Category L2 compliant system, as a minimum. The installation in the project area shall comply with BS5839-1:2013 and BS-EN54-23:2013, and it lies with the Electrical Sub-Contractor to determine what, if any, mitigation factors can be applied to reduce the requirement for visual alarm devices (VADs), by consultation with the building manager and their Fire Strategy specialist. It should be noted that any additional sounders and beacons that may be required by Building Control or the Fire Officer at any time during the construction stage will be at the risk of, and for the cost of, the Electrical Sub-Contractor.

The existing fire alarm system is to be retained with additional loops for ceiling void detection where necessary. Loops are to be extended to cater for additional devices.

The fire alarm system shall be designed, installed, tested and commissioned by a fully BAFE accredited company, acting as a specialist sub-contractor to the Electrical Contractor. This specialist sub-contractor shall also demonstrate the use and operation of the system to the building manager as part of the hand-over process.

This Specialist Sub-Contractor shall produce working drawings for the system including layout drawings, cause/effect schedules, wiring schematics, installation details, etc. The Specialist Sub-Contractor shall further provide audibility calculations based on the sound output of the particular devices included in his quotation, undertake a design compliance review of the final scheme, and provide system documentation and As Built drawings for the O&M Manual.

The system shall include all materials, equipment and wiring required to install the new Fire Detection and Alarm System. The system shall include but not be limited to sensors, call points, audible and visual alarm devices, and relays (interfaces). The fire alarm system must also include a link to the sites existing site wide fire alarm system.

The installation shall include the laying of all cables required for connection of the detection, alarm indicating and other devices along with connections to the power supply as appropriate to the design. All cabling shall conform to the requirements and recommendations of the Fire Alarm Control Panel manufacturer. Any openings /chasings in walls, ceilings or floors shall be made good.

The complete fire alarm system shall be zoned to the recommendations set out in BS 5839 Part 1 2013, the Fire Risk Assessment and the requirements of the Local Fire Authority. Fire alarm zones shall be arranged so that the indications of the fire alarm system can be rapidly related to the layout of the building. A laminated zoning chart shall be provided, in duplicate, as part of the hand-over documentation.

The fire alarm system shall be such that the system can be easily extended to incorporate additional manual call points, automatic detectors and alarm sounders which may be needed in the event of additional partition walls being erected. The fire alarm protocol shall be such that the system may be extendible site wide.

The system must be networked into the existing site wide system.

Cause and Effect Schedule
The Electrical Sub-Contractor, or his appointed specialist sub-contractor, shall develop and submit a Cause and Effect Schedule for the fire alarm installation. This schedule shall be submitted via the Design Team to Building Control and the Fire Officer for review and comment as part of the approvals process for the design of the fire alarm installation. No installation works shall commence until the Cause and Effect Schedule has been approved by Building Control and the Fire Officer.

Ceiling Voids
Voids 800mm or greater shall require automatic fire detection unless otherwise agreed with Building Control and Client insurers. For tender purposes, there are no ceiling voids of 800mm or more.

Compliance with Standards
All equipment and materials must comply with the most recent issues and revisions of all relevant British Standards current at the time of tender, and/or such other recognised standards as may be stated in the attached data sheets.

The following are certain of the applicable British Standards, current editions apply:

BS 800 Specification for radio interference limits and measurements for household appliances, portable tools and other electrical equipment causing similar types of interference.
BS 3116 Automatic fire alarm systems in buildings.

BS 5445 Specification for components of automatic fire detection systems

BS 5588 Fire precautions in the design and construction of buildings

BS 5839 Fire detection and alarm systems in buildings

BS 6207 Mineral insulated cable.

FIRE ALARM CIRCUITS
Circuit Design

Detection circuits shall be capable of providing, as a minimum requirement, monitoring of open and short circuits, together with monitoring of the removal of detector heads.

Circuits shall be arranged such that the removal of any detector does not impair the correct operation of any other detector or call point.

Electronic sounders shall be loop driven.

The Electrical Sub-Contractor shall note the maximum number of devices the fire alarm detection loop can accommodate.

Each detection loop shall not exceed 1000 metres using 1.5mm² fire resistant cable.

Circuit Wiring
All wiring associated with the new extension to the fire alarm system shall be carried out using fire resisting pliable red sheathed cables manufactured to BS 7629 and should meet the PH120 classification in accordance with EN 50200 clipped direct or installed on dedicated cable tray/basket.

All alarm and detection circuits shall be carried out using cables specified in the equipment schedule. Fire alarm cables shall have a red sheath except where specified to the contrary. The Fire Alarm Specialist shall confirm prior to submission of costs that the cabling system specified is compatible with their equipment in full compliance with BS 5839-1: 2013 and BS-EN 54-23:2013.

All cabling shall be recessed/concealed wherever possible to provide a flush installation, or clipped direct where the cables cannot be hidden. Where two or more cables share a common route they shall be installed on cable tray or basket. Fire alarm cabling shall not share containment with any other system.

All cabling and accessory boxes shall be concealed and flush fitting in a similar manner to the general electrical installation in those areas. Wiring in plantrooms, storage areas and risers may hence be surface fixed.

Where multiple cable runs share a common route above suspended ceilings, they shall be fixed to galvanised medium duty cable basket (utilising the same general routes as electrical containment within this building). These minor cable ways are not shown on the drawings, but shall nevertheless be allowed for within the tender price.

A full wiring diagram and cause-and-effect chart shall be provided by the fire alarm specialist or the Electrical Sub-Contractor for approval to the Engineer prior to commencing any cabling.

The extent of the fire alarm system shall be fully recorded on the as fitted drawings, including the sequence of wiring of the fire alarm equipment and their individual address numbers.

Ancillary Services
Ancillary services as defined in BS 5839 Part 1: 2013 shall not derive power from the fire alarm system supply.

All ancillary equipment necessary to make the fire alarm system a complete functioning system in full compliance with BS 5839: 2013 and BS-EN54: 2013 shall be included by the Electrical Sub-Contractor at tender stage, including end of line resistors, zone isolators, battery packs, power supplies, etc.

FIRE DETECTORS AND SOUNDERS

Manual Call Points
Fire Alarm Manual call points shall be provided to all areas in accordance with BS 5839 Part 2.

Manual call points shall be of the steady-pressure break glass type manufactured to BS 5839 Part 2 and installed to BS 5839 Part 1. All units shall be equipped with a test key facility and test indicator.

All manual call points shall comprise a red finish corrosion resistant unit with cover engraved "Fire Break Glass" and be provided with protective polycarbonate covers to prevent accidential damage.

All manual call points shall comply with BS-EN 54-11 single action type A version, though in some areas clear protective hinged covers may be required to effectively make the call points of Type B. All manual call points shall be mounted at 1200mm above finished floor level to top of enclosure. Wherever possible, fire alarm break glass call points shall be located such that they are less likely to be prone to malicious operation.

Automatic Detection Devices

Detection devices consist of smoke detectors, heat detectors. The following automatic detection devices shall be utilised: -

- Optical/heat detector - (detects smoke from a slow burning fire and/or heat from an intense fire producing little smoke).
- Heat detector - (for steamy and dusty environments e.g. boiler rooms, kitchens, laundries etc...)
- Where an automatic detector is located within ceiling voids and/or in a room which is normally kept locked, a remote LED indicator unit shall be provided on the ceiling directly below or outside the door of the room. The LED lamp shall illuminate in the event of the associated automatic detector operating.

Exact siting of all devices shall be agreed on site, particularly for smoke detectors on ceiling adjacent to light fittings, ventilation diffusers, etc. to ensure they are not in direct air flows.

Where detectors are fixed to suspended ceiling, a plywood backing sheet shall be provide by the Builder to prevent the tiles sagging.

Heat Detectors

All heat detectors shall be of the fixed temperature type complying with BS 5445 Part 5 and generally set to operate at a nominal temperature of 90°C. All heat detectors shall be compatible with the control equipment. Detectors shall have an individual addressable base with built in LED alarm indicator and output circuit for remote LED alarm indicator.

All detectors shall fit a common base, and be provided with a labelling/interlocking system to avoid incorrect reinsertion of the wrong device into the base.

The Electrical Sub-Contractor shall allow for labelling all detectors with self adhesive legend on the detector base bearing an identification reference as agreed with the Client and the Engineer. All labels shall be painted over with clear varnish to prevent peeling.

Smoke Detectors

Smoke detectors shall be of the ionisation or optical type as indicated on the drawings. They shall comply with the requirements of BS 5445 Part 7 and shall respond to the relevant test fires as prescribed in BS 5445 Part 9. They shall further be capable of giving pre-warning alarm under interrogation from the main control panel. All detectors shall fit a common base and be provided with a labelling/interlocking system to avoid incorrect reinsertion of the wrong device into the base. All detectors shall have an individually addressable base with built in LED alarm indicator and output circuit for remote LED. The detectors shall be of the S-Quad range compatible with the Vigilon panel.

The Electrical Sub-Contractor shall allow for labelling all detectors with self adhesive legend on the detector base bearing an identification reference as agreed with the Client and the Engineer. All labels shall be painted over with clear varnish to prevent peeling.

Audible Warnings

The buildings existing automated PA system is to be utilised, the client is to reconfigure this post contract

Audio and visual alarm indicators shall be provided to aid people with hearing difficulties being present within the building.

Wall mounted combined sounder beacons shall be provided in all circulation spaces, toilets, workshops, public accessed and licensed areas as a minimum.

The fixing of sounders shall be to BESA boxes in flush areas or directly mounted in surface plant areas.

However well a system is designed there can be no guarantee of audibility levels prior to installation and fitting out. Once the system is operating in its normal environmental conditions, audibility tests will be carried out and additional sounders installed if required. Any such possible extra devices shall be at the risk, and cost, of the Electrical Sub-Contractor.

Visual Alarm Devices – VADs (formerly Flashing Beacons)

Visual Alarm Devices (VADs) of the S-Quad range shall be provided in compliance with BS-EN54-23:2013 (Appendix F to BS5839-1:2013). The Electrical Sub-Contractor, or his fire alarm specialist, shall provide all the required calculations to back up the proposed VAD layout, to the satisfaction of Building Control and the local Fire Officer.

Mitigation of VAD requirements may be possible through the buildings Fire Evacuation Strategy, and it lies with the Electrical Sub-Contractor and his specialist to liaise with the building manager to establish any such possibilities. If no liaison has taken place, then the VAD installation must at hand-over be fully compliant with the requirements of BS-EN54-23:2013.

Zone Isolators

Zone isolators for the protection of the detection loop cables shall be required. These units are designed to electrically isolate sections of the fire alarm detection loop in fault conditions as defined by BS 5839-1: 2013.

Zone isolators shall be required wherever cables enter or leave a fire zone and every 20 devices within each fire zone. Loop and zone addresses will be provided on the drawings to aid with zoning of fire alarm detection equipment. Allow for necessary liaison with the Design Team to establish final locations of the zone isolators and for labelling the same on site and on the record drawings.

Door Retaining Units

Door retaining units will be door mounted of the electromagnetic type, and will be provided and installed by the Electrical Sub Contractor, together with the power supply unit, remote release button. The Electrical Sub-Contractor shall allow for all power supplies, wiring, final connection, interfacing etc. to produce a fully working system.

Cabling shall generally be in 2.5mm² LSF/Cu singles in conduit to minimise voltage drop.

Final connection shall be taken via flush conduit to a junction box immediately above the frame connecting to terminal strip therein, and then in 3-core flex of CSA to suit the equipment selected via a stuffing gland immediately above the frame to the over door closer.

Power supply units with 24V DC output (1 for each floor where door retainers are shown) to feed the door magnets, sized for the number of doors shown plus an allowance of 50% for future will be free issued for fixture by the Electrical Sub-Contractor. The fire alarm interface units shall be configured to switch the 24V DC output. Fire door retainers shall be wired on a zonal basis with separate addressable outputs for each zone.

OTHER SYSTEMS

Addressable interfaces

Provide loop driven addressable interface units for connection to other systems. Make final connection to these other systems and commission links as part of the overall testing.

Fire alarm interface relays shall be supplied, installed and commissioned in particular for the following systems: -

- HVAC panels - isolate all supply air mechanical services plant.
- Automatic doors - failsafe "open" on activation of alarm system to provide free egress

- Door access control - failsafe "open" on activation of fire alarm system
- Automatic barriers and doors - failsafe "open" on activation of fire alarm system
- MCC Panel
- Fire Shutters
- AR Containers

In all cases the Electrical Sub-Contractor shall make final connection to these systems following full and detailed liaison with the relevant system manufacturer.

The Electrical Sub-Contractor shall allow for key isolate facilities on the main fire alarm panel to prevent ancillary devices and outputs operating on routine test.

All interface units are to be provided with any necessary 230V 50Hz SP & N supplies with local isolation being provided, by the use of double poled un-switched, fused, neon indicated fused connection units.

All power supplies for interface units are to be from the same phase regardless of their location within the Building.

Interface units installed adjacent to HVAC control panel are to be wired as part of the fire alarm loop(s) installed in that particular area. The Electrical Sub-Contractor shall ensure that the maximum number of interface units installed per loop is not exceeded.

Interface units in plant rooms shall be installed as close as possible to the HVAC control panel. Wiring from the interface units to the HVAC control panel shall be carried out by the Electrical Sub-Contractor.

During the tender/contract period The Electrical Sub-Contractor shall co-ordinate with the Mechanical Sub-Contractor/controls specialist to ensure he and all other parties are fully aware of installation and technical details associated with the interface of fire alarm equipment with the HVAC plant/control equipment.

Details of power supplies are to be as requested by the fire alarm system manufacturer / supplier. Local isolators to interface units are to be labelled 'Interface Reference No Isolator'.

It shall be the responsibility of the Electrical Sub-Contractor to identify the types and quantities of all interface units required, in compliance with the intended system.

CONTROL AND INDICATING EQUIPMENT

A new fully analogue addressable fire alarm control panel shall be installed by the Electrical Sub-Contractor. The new proposed fire alarm panel shall be recessed using a proprietary back box to match the depth of wall available. The fire alarm panel shall be located in the entrance lobby. All fire alarm wiring shall emanate from this panel location.

All control and indicating equipment shall comply with BS 3116 Part 4, be compatible with the specified fire alarm system and shall provide all fault and alarm conditions detailed in BS 5839 Part 1-2013. The panel shall comply with BS-EN54, and should be capable of supporting four loops. The panel shall be connected to an auto-dialler unit, as described above.

The control panel shall be provided with means of clearly indicating the origin of fire calls and shall identify power supply, system and zone circuit faults as minimum requirements. Controls for silence alarm, re-setting, lamp testing, fire station isolate and zone evacuate shall be provided via a key enable switch or alternative means of protection.

The system shall be capable of controlling ancillary devices and shall be provided with at least one spare changeover auxiliary relay.

The main control panel shall be located in the main entrance lobby as shown on the tender drawings. The charger and battery unit shall be located in the rear of the recessed fire alarm panel.

All control and indication equipment shall support detection devices shall be of the "Open Protocol" type to allow ongoing maintenance and reprogramming by any authorised agent.

The system shall also be capable of supporting slave indicator panels and other peripheral devices such as printers etc.

ANCILLARY SERVICES

Addressable interfaces
Provide loop driven addressable interface units for connection to other systems. Make final connection to these other systems and commission links as part of the overall testing.

Fire alarm interface relays shall be supplied, installed and commissioned in particular for the following systems: -

- HVAC panels - isolate all supply air mechanical services plant.
- Gas solenoid valve.
- Kitchen canopy ventilation system – isolate all supply and extract air mechanical services plant
- Automatic doors - failsafe "open" on activation of alarm system to provide free egress
- Door access control - failsafe "open" on activation of fire alarm system
- Fire door holders - failsafe "off" on activation of fire alarm system (ie. magnets release, doors close)
- Automatic barriers and doors - failsafe "open" on activation of fire alarm system
- MCC Panel
- Fire Shutters

In all cases the Electrical Sub-Contractor shall make final connection to these systems following full and detailed liaison with the relevant system manufacturer.

The Electrical Sub-Contractor shall allow for key isolate facilities on the main fire alarm panel to prevent ancillary devices and outputs operating on routine test.

All interface units are to be provided with any necessary 230V 50Hz SP & N supplies with local isolation being provided, by the use of double pole un-switched, neon indicated fused connection units (spurs).

All power supplies for interface units are to be from the same phase regardless of their location within the Building.

Interface units installed adjacent to HVAC control panel are to be wired as part of the fire alarm loop(s) installed in that particular area. The Electrical Sub-Contractor shall ensure that the maximum number of interface units installed per loop is not exceeded.

Interface units in plant rooms shall be installed as close as possible to the HVAC control panel. Wiring from the interface units to the HVAC control panel shall be carried out by the Electrical Sub-Contractor.

During the contract period The Electrical Sub-Contractor shall co-ordinate with the Mechanical Sub-Contractor and controls specialist to ensure he and all other relevant parties are fully aware of installation and technical details associated with the interface of fire alarm equipment with the HVAC plant and control equipment.

Details of power supplies are to be as requested by the fire alarm system manufacturer. Local isolators to interface units are to be labelled 'Interface *Reference No.* Isolator'.

It shall be the responsibility of the Electrical Sub-Contractor to identify the types and quantities of all interface units required, in compliance with the intended system.

Contract drawings
The fire alarm system shall be supplied and installed in accordance with relevant drawings listed in the drawing schedule of this Specification. These drawings show the intent of the fire alarm

and detection system, it will be the responsibility of the Electrical Sub-Contractor and his selected Specialist to ensure that the installed system is fully compliant with the appropriate regulations and standards.

Prior to commencing installation the Electrical Sub-Contractor shall supply full wiring diagrams and a cause and effect chart for the system for approval by the Engineer.

Provision of drawings
The Specialist Supplier shall be employed to provide system wiring diagrams. Two copies of each drawing shall be forwarded to the Engineer for comment.

Following approval, six copies of the drawings shall be issued for construction purposes via the Main Contractor.

Installation, operation and maintenance manuals
The Specialist Supplier shall be employed to prepare four copies of installation, operation and maintenance instructions which are to be forwarded to the Engineer one month prior to handover as detailed in the preliminaries.

Operational manuals shall be provided for each phase/section of the works.

Standard instruction sheets may be included for components and units, but sufficient other information must be incorporated as necessary to identify and permit full understanding of the characteristics and functions of the system as used for the particular application.

Inspection, testing and commissioning
The Specialist supplier shall be employed by the Electrical Sub-Contractor to provide all equipment, wiring diagrams and to undertake all final testing/commissioning and connecting of the systems.

All equipment is to be tested and inspected to demonstrate compliance with the relevant specifications and standards.

The system shall be fully commissioned and tested in accordance with the stipulations of BS 5839 Part 1: 2013, and upon completion of such tests the Electrical Sub- Contractor/Specialist shall issue a certificate stating compliance with BS 5839 Part 1: 2013, including all items listed in the appendices of the said British Standard where applicable.

As part of the testing regime, the function of the auto-dialler shall be tested.

The Specialist Sub-Contractor shall carry out AUDIBILITY TESTS during witness testing of the system. The specialist shall carry out these tests using a suitable sound level meter. A copy of an up to date calibration certificate for the meter shall also be provided and handed to the Main Contractor. In areas with mechanical handling plant audibility tests shall be carried out both prior to the plant being put into operation and after all the plant is operational.

The Specialist Supplier shall be employed to carry out a full functional test on site and to further demonstrate the same to the Employer, and the employer's representative, on a separate occasion, all as described in Section 2. Note that a fully detailed schedule of all devices and operations shall be provided by the specialist to allow the client's representative to agree all system labelling with him, and all "cause and effect" scenarios.

The Specialist Sub-Contractor shall carry out a full smoke test throughout the development to prove satisfactory activation of the automatic detectors. The Specialist Sub-Contractor shall include for repeating these tests in the presence of the Fire Officer/Client.

The Electrical Sub-Contractor shall ensure that all interfaces onto other systems and ancillary equipment are fully functional to meet stipulated requirements. Therefore commissioning and testing needs to be co-ordinated with these systems.

Once the Electrical Sub-Contractor is satisfied that all of the defined systems are functioning correctly,

the systems shall be offered for complete witness testing by the Main Contractor. At least 2 weeks notice shall be given of the intended dates for witness testing.

Witnessing of Tests
Witness testing shall include:
- Prove the operation of all devices, detectors, call points, ancillary equipment, and sounders.
    - Establish correct display and descriptor comes up on main control panel and repeater for each device, fault condition etc.
- Simulate fault conditions, mains failure and all facilities and operations listed in the specification.
- Audibility tests in all areas.
- All interfaces onto ancillary systems functional and report correctly.
- Any other tests to satisfy the requirements of BS 5839 Part 1: 2013, including continuity check/test of the detection loops, sounder circuits etc.
- Provision and completion of the initial information in a Maintenance Logbook. All devices must be tested 'in the field' and therefore proprietary detector actuating sprays and methods of activating heat detectors shall be utilised. The specialist shall be in attendance during all witness tests.

Adjacent to the new main fire alarm panel at the entrance, colour zone diagrams of the systems shall be installed in glazed frames.

The Specialist and Electrical Sub-Contractor shall allow to demonstrate the system to the users upon completion.

The specialist supplier shall issue a certificate stating that the system has been commissioned and is fully operational. The specialist sub-contractor shall carry out a 'soak' test prior to handover.

Documentation
On completion of commissioning and user training all documentation will have to be collected and handed to the client. This will include: -

- design, installation and commissioning certificates H1, H2 & H3
- cable and insulation resistance test records
- as fitted drawings of the final installation including cable runs in details
- product manuals and user instructions
- verification of the correct functioning of the dial-out monitoring system through the auto-dialler
- system log book
- written list of agreed variations

Special tools
The Electrical Sub-Contractor shall supply any special tools required for operation and testing of the system in sufficient quantity (minimum quantity of 3 for any item).

He shall also provide a full schedule of devices with suggested labelling to the Client/Engineer at an early stage for comment.

Additional notes
Zones to be agreed with Fire Officer. Allow for necessary site adjustment at commissioning stage.
Future maintenance and operating of the system
The fire alarm equipment supplier shall make available to the Client all necessary software, licences, equipment and instructions in simple written format to enable maintenance, testing, reprogramming and extending of the system by either the Client themselves or a trained specialist.

It will not be acceptable under any circumstances for equipment to be provided which can only be operated, maintained or extended by the specialist supplier.

ATTENDANCE ON MECHANICAL SUB-CONTRACTOR
The Electrical Sub-Contractor shall be responsible for the supply, installation and termination of power supplies and associated containment for mechanical equipment as detailed within the tender drawings – from distribution board or mechanical services panel to local isolators. The Mechanical

Sub Contractor shall allow for all final connections from secondary side of isolators to the mechanical plant, and connection onto the mechanical plant terminals. This shall be carried out utilising a flexible conduit and suitable sized LSZH/Cu cables to match the current rating of the incoming cables on the live side of the isolator. **All controls wiring is to be carried out by the Mechanical Sub-Contractor or his controls specialist.**

Liaison with the Mechanical Sub-Contractor throughout the works particularly regarding programme, sequencing of works, supplies required for commissioning, control panel locations, terminal block capacities, routes of services, interface wiring required, etc.

Supplies are required to main items of mechanical plant. In all cases allow for providing an isolating switch adjacent to the item of equipment concerned, and for linking between the isolator and the associated control panel/item of plant using cable/s of equivalent size and type as the incoming feed to the isolator.

In the case of external equipment, provide weatherproof isolators (IP65). In all cases, rigid fixings for isolators shall be provided by the Electrical Sub-Contractor, using additional unistrut framework as required.

Install fire alarm interface (output) modules adjacent to each Mechanical Control Panel. Allow 1m tails for final connection by the Mechanical Sub-Contractor's Controls Wiring Specialist.

The Electrical Sub-Contractor shall provide all containment installations associated with the attendance work installations.

All isolators serving mechanical equipment shall be fitted with a traffolyte label do denote circuit reference, i.e. board ref/way no., and item of equipment serving. Dynotape will not be permitted within these areas. All isolators throughout remaining areas shall be fitted with dynotape labelling to denote the above.

CLIENT STAFF TRAINING

The Electrical Sub-Contractor shall be responsible for training the Client's staff in respect to the operation of the electrical services installation.

As a minimum, the Electrical Sub-Contractor shall be responsible for the preparation and presentation of 1 No.staff training days. Each of these training sessions shall cover all areas of the electrical services installation and shall provide sufficient detail to enable the Client to occupy and operate the building safely.

In particular, the training day shall cover the operational requirements of: -

Mains LV Distribution
Lighting Controls (Manual & Auto)
Emergency Lighting Installation
External Lighting Installation
Utility Power and Fixed Equipment

Fire Alarm Installation
Intruder Alarm
Disabled WC Alarm Installation
CCTV
Access Control

Where appropriate, the Electrical Sub-Contractor shall, at no additional cost to the Client, have his suppliers attend the aforementioned Client training days to provide supplementary information as necessary.

PROVISION OF SPARES, DOCUMENTATION AND LABELLING
The Electrical Sub-Contractor shall supply all necessary spares, as listed below at the end of the project and shall obtain a signed receipt for them: -

10 No. lamps of each type, wattage and colour used on the project (for fluorescent alternatives).

5 No. lamps of each type, wattage and colour used on the project for external lamps used on the project (for fluorescent alternatives).

10 No. spare break glasses for the fire alarm system.

2 No. of any necessary keys or tools needed for equipment provided by the Electrical Sub-Electrical Sub-Contractor.

3 No. spare MCBs in each distribution board (1 No. 10 amp, 1 No. 20 amp and 1 No. 32 amp).

All equipment shall be labelled in compliance with the IET Wiring Regulations, Electricity at Work Regulations, etc. Labels shall generally be traffolyte, fixed to items and equipment by brass pins and nuts. Adhesive will not be permitted for traffolyte labels.

Warning notices against and the treatment of electric shock notices shall be provided and fitted to walls in a clearly readable positions at the following locations: -

- Adjacent to all distribution boards

Where necessary, adhesive labels may be fixed to fused spurs, etc. for such items as extract fans, fire alarm panel, etc. wording of all labels shall be agreed prior to fitting.

The Electrical Sub-Contractor shall supply all necessary installation, record, builders work and as fitted drawings and manuals as required elsewhere in this specification and shall use them to assist in user demonstrations.

A rubber mat shall be provided by the Electrical Sub-Contractor in the electrical switch rooms, full length of the panel and equipment.

Particular attention shall be paid to providing schematic diagrams for systems such as the access control system, magnetic door locks, etc.

The manuals and as fitted drawings shall be available a minimum of one month before the handover for comment by the Contract Administrator and users.

200.000 GENERAL LIGHTING AND POWER

200.010 REGULATIONS
Comply with:
- Requirements for electrical installations (The IEE Wiring Regulations) BS 7671
- Requirements of the electricity supply company.
- Requirements of the regional electricity company.

200.020 ELECTRICITY SUPPLY:
- Liaise with the electricity distribution company, as necessary, to confirm or determine
  - the maximum demand of the installation.

200.030 ARRANGEMENTS OF CIRCUITS:
Divide the installation into separately controlled circuits as described below, further subdividing where necessary to ensure compliance with BS 7671 (The IEE Wiring Regulations).

200.040 INSPECTION AND TEST PROCEDURE:
Comply with BS 7671 (The IEE Wiring Regulations). Provide completion certificates in accordance with BS 7671 (The IEE Wiring Regulations).
- Carry out site testing and inspection and provide test certificates for specialist installations. Record all results and readings. Provide copies of any test and inspection result.

Check correct operation of devices. Confirm interlocks and sequences operate correctly. Provide test equipment and consumables to complete tests and retest any failed installations following corrective measures. Check and confirm correct sequence in multiphase circuits.

200.050 TESTING FIRE ALARM SYSTEM:
Test and complete installation in accordance with BS 7671 (The IEE Wiring Regulations), BS 5839 and appropriate standards. Record all tests.

200.060 IDENTIFICATION - GENERAL:
Apply identification notices in accordance with BS 7671 (The IEE Wiring Regulations) Clause 514 and Appendix 7 to all electrical cables plant and equipment.

Phase colour

Brown, Black, Grey

Fix using materials compatible with the notices and fixing surface.
- Obtain approval prior to manufacture of all notices.
- Provide sample for approval.

Apply identification markers in accordance with BS 7671 (The IEE Wiring Regulations), Clause 514 to all conductor termination points.

Phase marking

L1, L2, L3.

In alterations or additions to an existing installation, identify conductors and terminals as BS 7671 Appendix 7.
- In single phase installations identify conductors and terminals as BS 7671 Appendix 7 and identify all phase terminals L.

200.070 LABELS:
Label all electrical plant and equipment using safety sign 8.A.0044 of BS 5499-5, where voltages above ELV exist.
- Materials
  - Engraved thermosetting plastic laminate.
- Colour
  - Background white
  - Lettering black
- Fixing
  - Adhesive of a type that will not corrode the surface it is affixed to.
- Position safety signs in accordance with BS 5499-10.

200.080 ENGRAVED ACCESSORY PLATES:
Engrave accessory plates and specialist items as shown in the Schedules or on the Drawings
- Use 6mm high letters with engraving coloured red.

200.090 SCHEMATIC DIAGRAMS:
Provide a purpose made schematic diagram permanently fixed showing the connections of the equipment and plant.

200.100 DISTRIBUTION BOARDS IDENTIFICATION:
Identify every outgoing way with a renewable circuit chart in a transparent plastic envelope permanently fitted inside distribution board cover. Clearly indicate in typed script, circuit identification number, cable size, fuse or circuit breaker rating and a description of item supplied and area supplied by circuit.

200.110 CABLE IDENTIFICATION:
Provide all cables, other than final sub-circuit wiring with labels fixed at each end of cable, either side of wall and floor penetrations and at approximately 10m intervals. Ensure labels show reference number of cable.

200.120 UNDERGROUND CABLE IDENTIFICATION:
Identify external underground cable routes by means of approved markers along their length at distances not exceeding 50m and where a change of direction occurs.
- Provide cable markers to clearly indicate the following:
  - reference number of cable.
  - points of termination.
  - type of cable and date installed.
  - operating voltage of cable.
- Provide key to any reference system used at:
  - switchgear.
  - each end of the underground route
- Mark and protect direct buried cables with:
  - plastic tape yellow printed black

200.130 CABLE SHEATH IDENTIFICATION - EXTERNAL:
Identify cable sheaths for various services in accordance with NJUG 7.

200.140 FIXING TO BUILDING FABRIC - PREPARATION:
Mark-out using manufacturer's drawings and templates and fix all items.
Ensure structure and fixings are suitable for items to be fixed. Use largest size of fixing permitted by diameter of hole in item to be fixed.
Provide all assistance to enable any item to be built in by others.

200.150 PLUGS AND SCREWS:
Use plugs of material, size and length, in accordance with the manufacturer's instructions. Use screws to BS 1210. Generally use sherardized steel screws. In damp or exposed situations use brass screws.

200.160 FIXING - WORKMANSHIP:
Drill holes squarely. Use drills of correct size and type. Do not flame-cut holes in metalwork. Comply with manufacturer's instructions for all fixings. Avoid fixing through reinforcement. Do not fix to unsound material.

200.170 FIXING TO THE STRUCTURE:
- Obtain approval to:
  - Cut holes in the structure.
  - Weld to structural steelwork.
  - Use fixings that in any way require penetration or cutting of structural elements

200.180 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENTS - GENERAL REQUIREMENTS:
Protect all equipment and ancillaries against corrosion. Protect ferrous metals with coatings at works. Provide all items for decorative finishing primed to suit base material and finish.

200.190 PAINT MATERIALS:
Apply paints in accordance with manufacturer's instructions and to BS 6150.

200.200 SPECIAL PROTECTIVE FINISHES:
Provide special protective finishes in accordance with manufacturer's instructions.

300.000 CONDUIT AND TRUNKING, LV CABLES AND WIRING - MATERIALS

300.010 STEEL CONDUIT AND FITTINGS:
- Type galvanised
- Application plantroom areas, cast into concrete
- Standard
  - BS EN 61386-21.
- Ends
  - Threaded.
- Size in accordance with BS 7671 (The IEE Wiring Regulations).
- Fittings
  - Use adaptable boxes of 100mm x 100mm x 38mm minimum size.
  - Use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes.
  - Use washers with flanged couplers.
- Protection class/finish BS EN 61386-1, Table 10
  - Class 2 black enamel finish.
  - Class 4 hot dipped galvanized.
- Mounting/support use proprietory saddles and spacers
- Installation
  Use maximum practical lengths to minimise number of joints. Form bends by machine and remove burrs from cut ends.
  Use bends and/or junction boxes at changes of direction. Do not use elbows or tees of any sort without approval.
  Fix securely with boxes fixed independently of conduit.
  Tightly screw all joints to ensure electrical continuity, with no thread showing. Use expansion couplings where conduit crosses movement joints in structure.

300.020 THERMOPLASTIC (PVC) CONDUIT AND FITTINGS:
- Type LSZH
- Manufacturer and reference Marshall Tufflex SupaTube
  - Or approved equivalent.
- Standard - BS EN 61386-21.
- Strength
  - High impact.
- Size in accordance with BS 7671 (The IEE Wiring Regulations).
- Shape
  - Round.
- Colour
  - White.
- Jointing
  - Push fit and solvent welded.
- Fittings
  - Provide boxes with earthing terminal.
  - Provide weatherproof boxes.
- Mounting/support as per amnufacturer's recommendations
- Installation
  Use maximum practical straight lengths to minimise number of joints.
  Use proprietary bends and/or junction boxes at changes of direction. Do not use elbows, tees or site formed bends without approval.
  Fix securely with boxes fixed independently of conduit.
  Form secure joints, using expansion couplings where recommended by manufacturer, and connectors at equipment, terminal fittings, etc.

300.040 THERMOPLASTIC (PVC) SURFACE TRUNKING:
- Manufacturer and reference Marshall Tufflex, Mita, Marco
  - Or approved equivalent.
- Standard

    - BS 4678-4.
    - BS EN 50085
- Type
    - Standard cable trunking.
    - Wall/dado trunking.
- Size in accordance with BS 7671 (The IEE Wiring Regulations).
- Fittings
    - Socket outlet boxes.
    - Bends.
    - Stop ends.
- Strength
    - Medium duty.
- Colour
    - White.
- Mounting/support as per manufacturer's recommendations
- Multi-compartmental trunking
  Provide multi-compartmental trunking with separate compartments for wiring of:
    - Extra low voltage circuits.
    - Communications.
- Installation
  Use proprietary units to form junctions and changes of direction wherever possible.

300.090 FIRE STOPPING OF TRUNKING/DUCTING:
Where trunking or ducting pass through fire resisting floors, ceilings, cavity barriers, etc., seal internally with
- packed rock fibre.
- proprietary intumescent material.

300.100 FLEXIBLE CORDS:
- BASEC certified.
- Standard
    - Sheathed 300/500V 90^0 to BS 6500
    - Thermoplastic (PVC) insulated cord 450/750V to BS 7919

300.110 INSULATED CABLES:
- BASEC certified.
- Type
    - Copper conductors.
    - Single core.
    - Multi-core
    - Armoured.
    - Unarmoured.
    - Sheathed.
        - LSZH.
        - HOFR.
    - Unsheathed.

- Standard
    - 600/1000V to BS 5467.
    - 450/750V to BS 7211.
    - Flat twin and earth to BS 7211.
    - Control 300/500 to BS 7629-1.
    - LSZH 600/1000 to BS 7846.
    - BS 8436 for use in walls, partitions and building voids.
- Cable glands
  Type to BS 6121-5 Annex A
    - A1.
    - BS EN 50262.

- Type
  - Sealed inner and outer sheath.
  - Complete with earthing lug.
  - Electrical bond for metallic sheath.
- Fire performance to BS 5839-1: 2013
  - Standard.

300.130 POLYETHYLENE INSULATED TELECOMMUNICATIONS CABLES:
- BASEC certified.
- Standard

300.150 CABLE JOINTING SUNDRIES:
- Use terminations conforming to BS EN 61238-1. Use tapes to BS 3924 or BS EN 60454.
- Use twist on connection devices to BS EN 60998-2-4

300.152 CABLE CLEATS AND CABLE TIES:
Use cable cleats to BS EN 50368.
Use cable ties to BS IEC 62275.

300.155 INSTALLATION COUPLERS:
- Use only installation couplers approved by cable manufacturers.
- Standard
  - BS 61535.
  - BS 8488-1.
- Rated voltage
  - 230V.
- Current rating
  - as appropriate
- Cable connections
  - Rewirable.
- Degree of protection to BS EN 60529
- Location of installation
  - Readily accessible.
- Earthing
  - With earthing contact.
- Type of cable conduit
  - Rigid.
- Type of terminal
  - Screw-type.
  - Screwless.

300.160 CABLE DUCTS - THERMOPLASTIC (PVC):
Use underground cable duct and fittings to BS 4660, or BS EN 1401-1.

300.180 PERFORATED CABLE TRAY:
Support all cables throughout their length using cable tray, firmly fixed to building fabric.
Ensure cable tray allows for spacing in accordance with BS 7671 for the design current of the cable.
- Standard BS EN 61537
  - Classification

Type
- Return flanged.
- Basket.

Perforations and thickness
- Manufacturer's standard pattern and thickness.

Fittings

Use factory made fittings throughout of same material, type, pattern, finish and thickness as cable tray.

300.190 CABLE CLIPS AND CLEATS:
- Standard BS EN 50368

400.000 CONDUIT AND TRUNKING, LV CABLES AND WIRING - WORKMANSHIP

400.010 INSTALLING CONDUIT IN CONCRETE:
Fix securely to reinforcement and fix boxes to formwork to prevent displacement. Depth of concrete cover not less than indicated for reinforcement.

400.020 INSTALLING TRUNKING:
Remove burrs from cut trunking ends.

400.030 DRAINAGE OF CONDUIT:
Provide drainage outlets at lowest points in conduit installed externally and in locations where condensation may occur.

400.040 APPEARANCE:
Arrange conduit and trunking, plumb where vertical, neatly parallel with other services runs and the structure.

400.050 EXPANSION AND SETTLEMENT JOINTS:
Make provision at expansion and settlement joints for movement. Use manufactured expansion couplings.

400.060 SPACING:
Install conduit, trunking and equipment clear of other services with minimum spacings:
- to steam - 300mm, other services - 150mm and above radiators - 1000mm.

Ensure trunking and conduit is independently supported from building fabric. Obtain approval for supports.

400.070 ACCESS:
Locate covers on top or sides of trunking to allow access to wiring.

400.080 CABLE ROUTES:
- Ensure cable routes are
  - Straight, vertical or horizontal and parallel to walls.
  - In approved locations where exposed to view. Conceal cables wherever possible.
  - Positioned at least 150mm clear of other services. Locate cables running parallel and adjacent to heating pipes below pipes.
- Install
  - Concealed horizontal runs within 150mm of ceiling or between 150 and 300mm of floor.
  - Concealed vertical cable runs to wall switches and outlets in line with accessory.

400.090 CABLE INSTALLATION - GENERAL:
- Do not commence internal cabling until the building is enclosed and weatherproof.
- Install cables neatly and securely, adequately protected against accidental damage, adverse environmental conditions, mechanical stress and deleterious substances.
- Install cables without joints other than at equipment and terminal fittings. Do not use junction boxes without approval.
- Sleeve cables passing through masonry walls with conduit bushed at both ends.
- Do not run cables in spaces where they will be surrounded or covered by insulation.
- Install all data and telecommunications cable in accordance with BS 6701 or BS EN 50174-2.

400.100 PROTECTIVE CONDUCTORS:
Use cable protectors throughout. Do not use conduit or trunking as protective conductors.

400.110 CABLE INSTALLATION - ARMOURED CABLE:
Handle and install carefully to prevent damage to sheath and armouring.
Do not install if cable and ambient temperature are, or have been for the last 24 hours, below 0^0C.

Fit galvanized steel guards where cables are liable to mechanical damage.
Bond armour to equipment and main earthing system.
Make moisture proof connections to apparatus using sealed glands and thermoplastic (PVC) shrouds.

400.120 CABLE INSTALLATION - THERMOPLASTIC (PVC) SHEATHED CABLES:
Do not install cables when temperature is near or below freezing
Do not install in cavities of external walls.
Fit insulating cable glands at entries to equipment.
Terminate cable sheaths within boxes.

400.140 CABLES LAID DIRECTLY IN THE GROUND:
Before laying cables, ensure that bottom of trench is even and free from sharp stones, roots, etc.
Lay cables on a 75mm bed of sand.
Where two or more cables are laid in the same trench, space as BS 7671 (The IEE Wiring Regulations) and ERA reports.
Cover each cable with 150mm of sand overlaid with cable marker tape to BS EN 12613.
- Mark each change in direction of cables with a precast concrete slab, size 300 x 300 x 150mm thick, impressed with 'LV CABLE' and laid level with finished ground level.

400.150 CABLES ENTERING BUILDING(S) FROM BELOW GROUND:
Seal both ends of pipe duct, to a depth of not less than 150mm, with
- an approved non-hardening, non-cracking, water resistant compound.
- a proprietary moulded duct sleeve seal.

400.160 CABLES IN PLASTER:
Cover with galvanized steel channel nailed to background.

400.170 CABLES IN VERTICAL TRUNKING/DUCTS:
Support with pin racks or cleats at each floor level or at 5m vertical centres, whichever is less. Provide and fix heat barriers at not more than 5m centres where fire resisting barriers are not indicated.

400.180 CABLES IN ACCESSIBLE ROOF SPACES:
Cables running across ceiling joists to be fixed to timber battens nailed to joists.

400.190 TESTING BURIED CABLES:
Test continuity and insulation of buried cables immediately before and after back-filling. Test continuity and insulation of buried cables prior to handover.

500.000 LIGHTING AND POWER - PRODUCTS/MATERIALS

500.010 LIGHTING AND POWER SCHEDULES:
- Supply lamps and luminaires as
  - Detailed in the Luminaire Schedule, Appendix 3
- Supply consumer units/distribution boards as
  - described above and detailed in the DB Schedule, Appendix 4
- Supply electrical accessories as
  - described within this specification, refer also Appendix 1

500.030 DISTRIBUTION BOARDS:
- Type split lighting and power, both sub-metered
- Manufacturer and reference Schneider
  - Or approved equivalent.
- Standard - BS EN 60439-3.
- Main control
  - Moulded case circuit breaker
- Metering lighting and power separately sub-metered
- Number of ways
  - one per circuit plus 25% spare

  Permanently label each way to identify circuit and rating.
- Circuit protection

    - Miniature circuit breakers to BS EN 60898-1
        - Type B, C and D as appropriate
        - Short circuit capacity kA 10
        - Rating (A) as appropriate for the circuit load
    - RCCBs additional protection for circuits general small power (not ICT)
        - To BS EN 61008-1 and BS IEC 1008-2-2.
        - Tripping current 30mA
        - Tripping time 40ms
        - Breaking capacity 10kA
        - Overcurrent protection
- Enclosure
    - Degree of protection to BS EN 60529
    - Manufacturer's standard.

500.040 FUSES:
Supply fuses including fuse carrier, bases and associated components to BS EN 60

500.050 ISOLATING SWITCHES:
- Manufacturer and reference MK Electric, MEM, LeGrand
    - Or approved equivalent.
- Standard
  Utilisation category and making capacity to BS EN 60669-1, with earth terminal in enclosure.
- Switch type
    - Rocker bar.
- Rating
    - as appropriate for equipment fed
- Pole configuration
    - DP.
- Ancillaries
    - Neon indicator with red lens.
    - Cord outlet with cord grip.

500.055 SWITCHGEAR ACCESSORIES:
- Provide switchgear accessories.
    - Cylinder locks on hinged doors, with 2 keys for each lock.
    - Insulating mats to BS 921
        - Along full length of switchboard.
        - Width 600mm

500.060 LUMINAIRES:
- Manufacturer and reference, as detailed in the Luminaire Schedule Appendix 3
- Standard
    - BS 4533
    - BS EN 13032-1.
    - BS EN 60598.
    - Provide exit signs to BS 5499-1 and BS 5499-4.
    - BS EN 62031.
- Classification
  BS 4533 or BS EN 60598, Part

Ensure luminaires of same types have same photometric performance.
- Accessories
    - Provide secondary support for all components so they are retained when their primary fixing is released.
    - Incorporate integral photo-cell on luminaires as detailed on the lighting layout drawings

500.080 CONTROL GEAR AND COMPONENTS:
- Standard
    - Provide fluorescent lamp ballasts to

        - BS EN 61347-2-8 and BS EN 60921.
        - BS EN 61347-2-3 and BS EN 60929.
            - Supply thermal protectors for ballasts for tubular fluorescent lamps to BS EN 60730-2-3.
    - Provide discharge lamp ballasts for BS EN 61347-2-9 and BS EN 60923.
- Provide control gear for LED modules to BS EN 61347-2-13.
- Terminals
  Use screw terminals for supply cables and circuit protective conductors, sized to terminate up to three 2.5mm diameter conductors. Provide separate terminal blocks for each incoming circuit.

Ensure control gear and components are suitable for lamp type, wattage and starting characteristics. Comply with BS EN 55015 for interference.

- Remote control gear
  Locate remote control gear in separate lockable cabinet of sheet steel with same degree of protection and finish specified for luminaire.

Comply with manufacturer's recommendations for maximum cable length between gear and lamp.

500.090 LAMPS:

- Standard
    - LED modules

Ensure that lamps of each type are from the same manufacturer.

500.100 LUMINAIRE CONNECTORS:

- Type Wieland and Klik type
- Manufacturer and reference as recommended by luminaire manufacturer
    - Or approved equivalent.
- Rating
    - 10A
- Connector type
    - Ceiling rose to BS 67.
    - 3 pin plug/socket to BS 546.
    - Captive cord grip type/socket (3 or 4 pin), to BS 5733.
    - 4 pin and 6 pin Wieland type to EN1313

500.140 ENCLOSURES FOR ELECTRICAL ACCESSORIES:

- Standard, BS 4662 or BS 5733.
- Pattern
    - Flush.
    - Surface.
    - Panel.
- Mounting
    - Direct to enclosure.
- Material and finish
    - Pressed steel.
    - Impact resistant moulded plastic.
- Coverplate finish
    - Moulded plastic colour white
- Coverplate pattern
    - Surface type.

500.150 LIGHTING SWITCHES:

- Type standard two-position and retractive multi-action
- Application
- Manufacturer and reference MK Electric Aspect range, Legrand Synergy range
    - Or approved equivalent.
- Standard
    - BS EN 60669-1 with earth terminal in enclosure.
    - HBES systems BS EN 50428, with earth terminals in enclosure.
- Switch type

    - Gang multigang
    - Rocker bar
    - Secret key.
    - Dimmer.
    - Press on, press off with dimmer.
- Rating
    - 20A.
- Ancillaries
    - Operating keys.
    - Blank inserts.
    - dark rockers for DDA compliance
- Switch mechanism
    - Snap action microgap.
    - Two position.
    - Return to centre.
- Pole configurations
    - Single pole.
    - 2 way.
    - Intermediate.

500.154 TIME SWITCHES:
- Wire timer and switch circuits to separate terminals.
- Standard - BS EN 60730-2-7.
- Time switch type
    - Synchronous motor 30 hour spring reserve.
- Timer accuracy medium
- Contacts duty
    - Inductive.
- Contacts rating
    - 20A.
- Special programme facilities
    - Solar dial calibrated for site latitude.
    - Contacts manual status advance to next operation.
    - Manual bypass continuous "ON" for each separate switch circuit.
    - Manual bypass continuous "OFF" for each separate switch circuit.
    - Number of "ON" and "OFF" operations two
- Programme repeat cycle
    - 24 hour.
- Provide number of independently programmable contact circuits indicated.

500.156 LUMINAIRE CONNECTORS:
- Rating
    - 6A
- Connector type
    - 3 pin plug/socket to BS 546.
    - Cord grip type plug/socket and screw on retaining cover to BS 5733
        - 3 pin.
        - 4 pin.
    - Wieland plug type to EN1313
        - 4 pin
        - 6 pin
- Fixture
    - Plug-in rose
- Ancillaries
    - Clip-on cover

500.158 ISOLATING SWITCHES:
- Provide isolating switches for fixed appliances, with utilisation category and making capacity to suit circuit loading
- Standard
  - BS EN 60669-2-4.
  - Enclosure box to BS 4662.
  - BS EN 60947-3.
  - HBES systems to BS EN 50428.
- Switch type
  - Rocker bar.
- Rating
  - To suit circuit loading
- Pole configuration
  - DP.
  - Three pole.
  - TPN.
- Ancillaries
  - Cord grip.
  - Cord outlet.
  - Phase barrier
  - Mechanical off indicator.

500.160 SWITCHED FUSE CONNECTION UNITS:
- Manufacturer and reference MK Electric Aspect range, LeGrand Synergy range
  - Or approved equivalent.
- Standard
  - BS 1363-4.
  - Double pole switching.
- Unit type
  - Rocker bar
- Ancillaries
  - Red indicator lamp.
  - Fuses to BS 1362, sized to suit equipment fed
  - Cord outlet and cord grip.

500.170 SOCKET OUTLETS:
- Manufacturer and reference MK Electric Aspect range, LeGrand Synergy range, Wandsworth Classic range (with USB)
  - Or approved equivalent.
- Standard
  - BS 1363-2.
  - BS EN 60309.
  - HBES systems BS EN 50428.
- Type
  - Socket outlet.
  - USB Charger
  - Switched.
  - Rocker bar outboard
  - DP switch.
  - 1 gang.
  - 2 gang.
- Ancillaries
  - RCD, BS 7288
    - Sensitivity
      - 30mA.
  - Plug tops.

500.180 CORD OUTLETS:
- Manufacturer and reference MK Electric Aspect range, LeGrand Synergy range
  - Or approved equivalent.
- Standard - BS 5733.
- Rating to suit equipment fed
- Pole configuration
  - DP.
  - TPN.
- Ancillaries
  - Cord grip.

500.250 ACCESSORIES MOUNTING HEIGHTS:
Provide switches and socket outlets for lighting and other equipment in habitable rooms at appropriate heights between 450mm and 1200mm from finished floor level, in accordance with Building Regulations Approved Document M and BS 8300.

600.000 LIGHTING AND POWER - WORKMANSHIP

600.010 LAMPS AND LUMINAIRES INSTALLATION:
Install luminaires in horizontal plane unless otherwise shown.
Ensure luminaires are clean.
Ensure classification of luminaires is appropriate.
- Install recessed and semi-recessed luminaires as manufacturer's details.
- Install wall mounted luminaires at height
- Support and fixing
  - Support luminaires as recommended by luminaire manufacturer

Do not support luminaires directly from any flammable non-metal or heat sensitive materials.
Ensure suspensions are vertical unless otherwise shown.

600.020 CONNECTIONS TO LUMINAIRES:
Connect circuit wiring to luminaires. Use grommet where cables enter luminaire body.
Connect the earthing terminal of Class 1 luminaires to the circuit protective conductor of the supply circuit.
Clip loose wiring within luminaire, at 300mm intervals.
- Recessed
  - Terminate at plug and socket to BS 546, located not more than 500mm from the access through the ceiling. Use flexible cord from plug to supply terminals of luminaire.
  - Terminate at Wieland type plug and socket for luminaire interconnection and connection to lighting control modules
- Direct fixing

600.030 ELECTRICAL ACCESSORY INSTALLATION:
Provide CPC between earth lug on metal box and accessory except for plastic accessories.
Ensure there is no damage to accessories during installation.
Protect surface mounted accessories from painting. Install front plates of flush mounted accessories after painting.
Align accessories to building finishes. Mount grouped accessories in line, parallel and equidistant.

700.000 MISCELLANEOUS ELECTRICAL EQUIPMENT

700.030 TIME SWITCHES AND PROGRAMMERS:
- Manufacturer and reference Hager, LeGrand, MK Electric, MEM
  - Or approved equivalent.
- Standard - BS EN 60730-2-7.
- Adjustment
  - Manual correction and reset.
- Outputs to control external lighting.

800.000 SPECIALIST SYSTEMS

800.010 EMERGENCY LIGHTING SYSTEM:
- Manufacturer and reference refer to Luminaire Schedule
  - Or approved equivalent.
- Standards
  - BS 5266-1.
  - BS 5266-10.
  - BS EN 50171.
  - BS EN 50172.
  - BS EN 60598-2-22.
  - CIBSE LG 12.
  - the requirements of the Local Authority.
  - manufacturer's instructions.
- Mode of operation
  - Self contained luminaire.
  - Battery powered.
  - Non-maintained operation.
- Type
  - Luminaire.
  - Illuminated sign
- Lamps
  - LED
- Illumination of signs
  Illuminate exit, emergency exit and escape route signs so that they are legible at all times, with
  - Lamps contained within sign.

800.150 FIRE ALARM SYSTEM:
Develop design, supply and install fire alarm system to
- BS 5839-1: 2013 and BS-EN 54-23: 2013

Provide fire alarm system to
- Enhance safety of occupants system to be to Category L2 as a minimum

800.170 FIRE ALARM SYSTEM - DETECTION ZONES:
Indicate the location of zones by
- Specially prepared plan of building.

800.175 FIRE ALARM SYSTEM - ALARM ZONES:
- Indicate the location of zones by
  - As for detection zones.

800.180 FIRE ALARM SYSTEM - STANDBY POWER SUPPLIES:
- Standard
  - BS 5839-1: 2013.
  - BS EN 54-4.
- Standby
  - Mains operated with standby primary battery.

800.190 FIRE ALARM SYSTEM - MANUAL CALL POINTS:
- Standard
  - BS EN 54-11
    - Mode of operation
      - Type A.
- Mounting
  - Flush.
  - Surface.
- Protection against accidental operation by clear hinged cover
- Switch contact

- Make.
- Break.

800.200 FIRE ALARM SYSTEM - HEAT DETECTORS, POINT TYPE:
- Standard
  - BS 5446-2.
  - BS EN 54-5.
- Heat sensitive element
  - Fixed temperature (static) element.
  - Rate-of-rise of temperature and fixed temperature element.
- Temperature setting
  - 65^0C.

800.210 FIRE ALARM SYSTEM - SMOKE DETECTORS:
- Standard
  - BS EN 14604.
  - BS 5446-3.
  - BS EN 54-7.
- Type
  - Point.
  - Sampling.
- Class
  - Ionisation chamber smoke detectors.
  - Optical detectors.
  - Power supply
    - External through loop
  - Interconnection with other devices through loop
  - Alarm silencing at panel

800.220 FIRE ALARM SYSTEM - SOUNDERS:
- Existing PA system to be reconfigured.

800.222 FIRE ALARM SYSTEM - VISIBLE ALARMS:
- Standard
  - BS EN 54-23: 2013.
- Audiovisual alarm unit
- Flashing.
- Xenon.
- Loop powered
  - Analogue addressable.
  - Combined

800.230 FIRE ALARM SYSTEM - RECORD DRAWINGS AND OPERATING INSTRUCTIONS:
Provide instructions on use of installation to person responsible for use of premises. Supply the user with a logbook certificate of installation and commissioning and record drawings in accordance with BS 5839-1: 2013
- Circuit diagrams of fire alarm system.

800.240 EXISTING INSTALLATIONS EARTHING AND BONDING:
Check earth continuity conductors and loop impedance values of existing installation. Report defects and elements not in accordance with BS 7671 (IEE Wiring Regulations 17th Edition) before connecting new or modified installations to existing supply.

800.250 ELECTRICAL INSTALLATION METALWORK:
Bond together all exposed conducting parts with joints of negligible impedance. Carry out work in accordance with BS 7671 (IEE Wiring Regulations 17th Edition) , BS 7430, Electricity Safety Quality and Continuity Regulations and Local Electricity Supply Authority Requirements.

- Comply with the requirements of BS EN 50310.

800.260 EXTERNAL SOCKETS AND EQUIPMENT:
Provide each circuit serving external socket outlets and sockets for external use of equipment with high sensitivity residual current device, earth leakage tripping current not exceeding 30mA.

800.270 PROTECTIVE CONDUCTORS:
- Application circuit protection

Provide protective and equipotential bonding conductors. Size in accordance with BS 7671 (IEE Wiring Regulations 17th Edition).
- Material
  - Copper LSZH to BS 7211.
  - Armouring or sheathing of cables.
  - Protective conductor of multi-core cable.

800.280 EARTH ELECTRODES:
- Application system earth

Test earthing arrangement after installation, and improve to meet regulations if required.

800.320 BUILDING SERVICES:
Bond to protective conductor system, all metallic building services in:-
- Kitchens, bathrooms and shower rooms.
- Boiler houses.
- Plantrooms.
- Wet and damp process areas.

800.330 EQUIPOTENTIAL BONDING:
Provide main and supplementary equipotential bonding conductors in accordance with BS 7671 (IEE Wiring Regulations 17th Edition).

APPENDIX 1 MATERIALS & SPECIALISTS SCHEDULE

The Tenderer shall base his design upon materials and specialists listed below.

Any catalogue references are given for information only and the Tenderer shall ascertain that references agree with descriptions and intent of the systems.

ITEMS	MANUFACTURER
Switchgear - Main LV Panel	Schneider
Meters	Schneider
LV mains cables	Prysmian, Draka
Underfloor busbar	Schneider
Floor boxes	Legrand CB3
Cable Tray	Marshall Tufflex, Legrand, Marco
Cable accessories	Marshall Tufflex, Legrand, Marco
Cable trunking.	Marshall Tufflex, Legrand, Marco
Switch fuses, isolators etc.	MK Electric, Legrand, Eaton MEM
Dado Trunking	Marshall Tufflex, MK Electric, Marco
Cable Basket.	Marshall Tufflex, Legrand, Marco, Pemsa
Conduit	Marshall Tufflex, MK Electric, Pemsa
Flexible Conduit	Marshall Tufflex, MK Electric, Pemsa
Internal lighting & emergency lighting	Hacel, Cooper
Accessories, switches, sockets, fused spurs, etc.	MK Electric Logic Plus, Legrand Synergy, Schneider
Presence Detection switches	CP Electronics, Ex-Or
Modular lighting control	CP Electronics, Ex-Or
Disabled Toilet Alarms systems	MK Electric, Clymac
Data/Network Installation Specialist	MIS, Nortech

APPENDIX 2 TENDER SUMMARY

CLIENT: **Corby Borough Council**

PROJECT: **Corby Cube Fourth Floor Office Fit-Out**

ELECTRICAL SERVICES INSTALLATION COST

1.0	**Preliminaries and Site Set Up:**	
1.1	Preliminaries	£
1.2	Site Set-up	£
1.3	Working Drawings	£
1.4	Co-ordination with other services and trades (including participation in the production of coordination drawings)	£
1.5	Strip out & enabling works	£
	SUB-TOTAL	**£**
2.0	**Wiring Installation & Containment**	
2.1	MCB Distribution Boards	£
2.2	Sub-Main Cabling Installation	£
2.3	Final Circuit Wiring Installation	£
2.4	Containment Installation	£
	SUB-TOTAL	**£**
3.0	**Internal & Emergency Lighting**	
3.1	Lighting & Integral Emergency Lighting	£
3.2	Lighting Controls	£
	SUB-TOTAL	**£**
4.0	**Small Power Accessories**	
4.1	Small Power Accessories Only	£
4.2	E for M Installation, incl. attendance on Mechanical and Controls contractors	£
	SUB-TOTAL	**£**
5.0	**ICT Specialist Installation**	
5.1	Field wiring and outlet plates	£
5.2	Connectivity Survey (WAP-Map)	£
6.0	**Fire Alarm Installation**	
6.1	Fire Alarm system design	£
6.2	Fire Alarm & Detection (Equipment only)	£
6.3	Fire Alarm & Detection Installation	£
6.4	Fire Alarm & Detection Commissioning	£
	SUB-TOTAL	**£**
7.0	**Testing & Commissioning:**	**£**
8.0	**Health & Safety File:**	**£**
9.0	**As-installed Drawings:**	**£**
10.0	**Operating & Maintenance Manuals:**	**£**

ELECTRICAL SUBCONTRACT TOTAL
CARRIED FORWARD TO MAIN CONTRACT PRICING SCHEDULE: £

FINAL TOTAL COST IN WORDS:

SIGNATURE:

COMPANY:

DATE:

APPENDIX 3 LUMINAIRE SCHEDULE

Project Number: **161190**
Project: Corby Cube Fourth Floor Office Fit-Out
Date: 02.12.16

Quantity	Type	Description	Manufacturer	Recommended Type	Cat. No.
	D1	12W 1040lm LED Down light Luminaire	Hacel	Soledo	ID244SLED4121
	D2	17W 2000lm LED Down light Luminaire	Hacel	Soledo	ID244SLED417
	E1	1W LED Emergency Luminaire C/W Open Area Anti-Panic Optic	Cooper	Micropoint	MP2O3H
	E2	1W LED Emergency Luminaire C/W Escape Route Optic	Cooper	Micropoint	MP2E3H
	M1	28W 4020lm LED 600x600mm Modular Recessed Luminaire	Hacel	iMod	IM249SLED4281
	M2	22W 3290lm LED 600x600mm Modular Recessed Luminaire	Hacel	iMod	IM249SLED4221