MRC Laboratory of Molecular Biology

Medical Research Council

The New LMB Building Project

Stage E Report Volume 2
Appendix 2 – Engineering Services

SPECIFICATION FOR ELECTRICAL SERVICES INSTALLATIONS

REVISED STAGE E SCHEME INCLUDING AGREED VE ISSUE
January 2009

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THE NEW LMB BUILDING PROJECT CAMBRIDGE

SPECIFICATION FOR ELECTRICAL SERVICES INSTALLATION

ISSUE 6.0

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ISSUE HISTORY

ISSUE 1.0	-	**1st Issue – Stage E Costing**	-	**23 June 2007**
ISSUE 2.0	-	**Draft Stage E issue** Sections A64, P30, W21 and W30 added. Minor revisions to various sections.	-	**05 July 2007**
ISSUE 3.0	-	**Final Stage E issue** Minor revisions to various sections.	-	**04 December 2007**
ISSUE 4.0	-	**Revised Stage E Design Issue** VE items incorporated as per tracked changes	-	**19 November 2008**
ISSUE 5.0	-	**Revised Stage E Design Issue** Title revised. Generator acoustic specification Revised (Appendix 4)	-	**28 November 2008**
ISSUE 6.0	-	**Revised Stage E Design Issue** Motorised ring main units deleted (section V11), lighting control system intranet browsing facility revised (V21), number of UPS modules revised, UPS design standards revised (V32), CCTV frame record reate revised (W20), Projection provisional sum and procurment note revised (W21), Intruder Alarm system wiring revised (W41).	-	**03 February 2009**

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Contents

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Deleted: 5
Deleted: 63
Deleted: 65
Deleted: 79
Deleted: 101
Deleted: 138
Deleted: 160
Deleted: 164
Deleted: 181
Deleted: 188
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C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE

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Specification Expert - Introduction

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

NOTES FOR TENDERERS

Dependant 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 are 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.

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A64 GENERAL CONDITIONS (SELF CONTAINED SPECIFICATION)

100.000 PROJECT PARTICULARS

100.010 THE PROJECT:

•Particulars of the project as a whole are
•given in Main Contract Preliminaries

100.020 THE EMPLOYER:

Refer to the Main Control Preliminaries.

100.030 THE PURCHASER:

Refer to the Main Control Preliminaries.

100.040 CONTRACT ADMINISTRATOR:

The term Contract Administrator (CA) is used throughout this specification and his duties will be carried out by
Refer to the Main Control Preliminaries.

100.050 PROJECT MANAGER:

Refer to the Main Control Preliminaries.

100.060 THE ARCHITECT:

Refer to the Main Control Preliminaries.

100.070 QUANTITY SURVEYOR:

Refer to the Main Control Preliminaries.

100.080 BUILDING SERVICES COST CONSULTANT:

Refer to the Main Control Preliminaries.

100.090 MECHANICAL SERVICES CONSULTING ENGINEER:

Refer to the Main Control Preliminaries.

100.100 ELECTRICAL SERVICES CONSULTING ENGINEER:

Refer to the Main Control Preliminaries.

100.120 STRUCTURAL ENGINEER:

Refer to the Main Control Preliminaries.

100.130 PLANNING SUPERVISOR:

Refer to the Main Control Preliminaries.

100.140 LANDSCAPE ARCHITECT:

Refer to the Main Control Preliminaries.

100.150 MAIN CONTRACTOR:

Refer to the Main Control Preliminaries.

100.160 EMPLOYER'S SITE STAFF:

Refer to the Main Control Preliminaries.

100.170 DELEGATION:

C0605 The New LMB Building Project A64
Electrical Specification GENERAL CONDITIONS
Revised Stage E Scheme Including Agreed VE

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The CA may delegate certain powers and duties. The CA will indicate the duties and powers of the following:

•Clerk of Works
•Building Services Engineering site staff.

100.180 STATUTORY AUTHORITIES:

•Building Control Refer to the Main Control Preliminaries.
•Fire Officer Refer to the Main Control Preliminaries.
•Environmental Health Refer to the Main Control Preliminaries.
•Drainage Refer to the Main Control Preliminaries.

100.190 UTILITY SERVICE PROVIDERS:

Electricity Supply
•Supplier – EDF Energy
•Manage the provision of a new-metered electricity supply to the site by the supply authority.
•Negotiate with the authority for the provision of a new-metered electricity supply to the site.

Telephone Service
•Provide ducts from the site boundary for connection to all local Telco duct networks and for connection to the local SuperJANET network.

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200.000 DEFINITIONS

200.010 GENERAL:

Where used in the documentation the following definitions shall apply and shall be interpreted as such:
•Works: All services shown on the drawings and described in the specification shall be deemed to be included in the contract.
•Drawings: The tender drawings.
•Elsewhere: Detailed or specified elsewhere in other clauses, sections, shown on the drawings or contained in the specification or conditions of contract.
•Services: Services means the inclusion of one or more system.
•System: 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.
•Design process: All the activities necessary to convert design input into design output
•Review: Give notice and submit details to the CA for his comment and review, which shall be granted in writing only. In the event of the CA not accepting that submitted, resubmit alternative details for review or modify that submitted in accordance with the CA comments. Review of any submittal by the CA shall not mean that the CA is responsible for the correctness of the submittal or its suitability for purpose and does not relieve any contract responsibilities.
•Competent person: A person, by reason of theoretical and practical training or actual experience or both, is competent to perform the task or function or assume the responsibility in question and is authorised to perform such a task or function.
•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.
•Exposed Services: Includes installations outdoors or unprotected within service or occupied areas.
•Terminal Units: Terminal units such as radiators, convectors, fan coil units, induction units, variable or constant volume air boxes and other like equipment.
•Ancillaries: All specified fittings, accessories, inserts, test points, bracketing, terminal equipment connected to and installed in the engineering services system.
•CIBSE: The Chartered Institution of Building Services Engineers
•BSRIA: The Building Services Research and Information Association
•IET: The Institution of Engineering and Technology
•IOP: Institute of Plumbing
•FRS: Fire Research Station
•HSE: Health and Safety Executive

200.020 DEFINITIONS OF TECHNICAL TERMS

The definitions of technical terms associated with the engineering services installations are those included the latest edition of:
•CIBSE - Guides; Commissioning Codes; Technical Memoranda; Building Energy Codes; Lighting Guides; Application Manuals;
•BSRIA - Technical Publications
•BS 7671 Requirements for Electrical Installations (IEE Wiring Regulations)
•British Standards, including Codes of Practice.
•Statutory Acts.

C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE
A64
GENERAL CONDITIONS

Deleted: Stage E Issue

300.000 TENDERING INSTRUCTIONS

300.010 GENERAL:

This section outlines the tendering procedures and requirements.

300.020 SCOPE:

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

300.030 TENDER DOCUMENTS

The tender documents consist of the following:
•Refer to the Main Contract preliminaries.

300.040 PRIVACY OF INFORMATION:

The information contained in the tender documentation shall be treated as private and confidential.

300.050 CHECKING DOCUMENTS:

Check the tender documentation for obvious errors and omissions. Should any such errors or omissions be discovered inform the office issuing the documents immediately in writing in order that a correction may be issued before the date for submission of the tender.

300.060 TENDER ACKNOWLEDGEMENT:

Acknowledge receipt of the tender documentation and confirm submission of a tender in accordance with the instructions to tender.

300.070 PERIOD OF VALIDITY:

Tenders must remain open for consideration (unless previously withdrawn) for a period from the date fixed for submission of tenders of not less than Refer to the Main Contract preliminaries.
The date for possession/commencement is Refer to the Main Contract preliminaries.

300.080 TENDER PROCEDURE:

Tendering procedure is in accordance with the principles of Refer to the Main Contract preliminaries.

300.090 ACCEPTANCE OF INSTRUCTIONS:

The submission of a tender will denote the acceptance of an undertaking to comply with all the clauses contained in the tender documentation unless items of non-compliance are identified as part of the tender submission.

300.100 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.

300.120 INSPECTION OF SUPPLEMENTARY DOCUMENTS:

Supplementary documents relating to the contract are available for inspection prior to the submission of the tender.

No adjustment shall be made in the tender sum or claim for additional monies or an extension of time allowed due to failure to inspect the above documents and to make due allowance for the information contained therein.

300.130 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 Contract Works.
•Inspect any existing installations relevant to the works and study any relevant existing records.
•No claims will be allowed after submission of a tender for lack of information or other reasons which could have been resolved by such a visit to the site.
•Arrangements for visiting the site must be made with prior agreement through:
•The office issuing the tender documentation.

300.140 RETURN OF DRAWINGS AND SPECIFICATIONS:

The complete tender documentation is to be returned to the office of issue when requested should the Tenderer not be successful in their bid.

300.150 ALTERATIONS TO TENDER DOCUMENTS:

No alterations or erasures to the text of any part of the tender documentation shall be permitted. Any tender containing such alterations or erasures may be rejected.

300.160 TENDER ERRORS:

•In the event of a Tenderer discovering a genuine error in their tender after it has been deposited, attention in writing may be drawn to the error and an amendment submitted. The amendment may be accepted if deposited on or before the time fixed for receipt of tenders.
•No adjustment shall be permitted to the sum inserted in the form of tender after the date and time fixed for receipt of tenders.

300.170 UNQUALIFIED TENDERS:

•Other than as part of an alternative offer as described elsewhere, no account will be taken of any qualification or special conditions that a Tenderer may impose on their tender.
•Any tender containing such additional conditions may be rejected.

300.180 ALTERNATIVES:

•Alternative equipment, specialists or methods of carrying out the works in addition to those described in the tender documents may be submitted. Alternative offers shall be indicated on the appropriate document and include:
•Details of the alternative equipment, specialist or method proposed.
•Full technical data for each such alternative together with details of any consequential amendments to the design and/or other parts of the works. Demonstrate compliance with any stated British (or other equivalent recognised International) Standards.
•A detailed breakdown of any omissions or additions to the basic tender sum indicated on the appropriate document.
•The impact of all proposed alternative equipment or materials on Part L compliance including
•The CO_2 Target Emissions Rate.
•The final 'as constructed' CO_2 Buildings Emissions Rate.
•Confirm equivalence in quality, operation and space requirements to those items which have been specified by name. Demonstrate the proposed alternative is fully equivalent to the specified item and identify any constructional, cost, programme, maintenance or other differences
•Include for all necessary measures to ensure alternative manufacturer's equipment and the total installation is equivalent to that specified.

C0605 The New LMB Building Project A64
Electrical Specification GENERAL CONDITIONS
Revised Stage E Scheme Including Agreed VE

Deleted: Stage E Issue

Deleted: Stage E Issue

•The Tenderer shall include the costs necessary for re-sizing and reselection of associated equipment (including pipework, ductwork and cable sizes) resulting from the proposed alternative together with all resulting design and coordination.
•Alternative offers will only be considered if accompanied by a compliant tender.
•No alternatives will be permitted.

300.190 EXCLUSIONS:

If any part(s) of the Works cannot be tendered as defined in the tender documents, the CA must be informed as soon as possible, defining the relevant part(s) and stating the reasons for the inability to tender.

300.195 INTERPRETATION OF THE TENDER DOCUMENTATION:

•Should there be any doubt about the precise meaning of any item for any reason whatsoever, the tenderer must inform the office of issue of the tender documents in writing in order that the correct meaning may be given.
•Any clarification of the meaning or intent shall be issued in writing only and no other means of communication shall be valid. All Tenderers will be notified of any such explanation.
•No liability will be admitted, nor claim allowed, in respect of errors in a tender due to mistakes that should have been rectified in the manner described above.

300.200 PROCUREMENT OF MATERIALS:

Allow for the procurement of materials and equipment from suppliers at such a time, and in such a manner as may be necessary to allow for the completion of the Works in accordance with the contract programme.
Clearly state in the tender submission any foreseen difficulties with delivery periods for selected equipment or proposed alternatives.
•No additional costs resulting from non-compliance will be accepted.

300.201 A LIST OF PROPOSED MANUFACTURERS/SUPPLIERS:

A list of proposed manufacturers/suppliers 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.

300.202 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 demonstrate such compliance
•As part of the tender submission.
•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 alternatives may be selected and shall be submitted to the CA for approval.
•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

300.210 SUBLETTING:

•Where it is proposed to sublet any portion(s) of the Works a schedule must be submitted with the tender.
•The schedule should define such portion(s) and give for each the details of the proposed company.

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310.000 TENDER SUBMISSION

310.010 GENERAL:

This section details the particular tender submission requirements.

310.020 RETURN OF TENDER:

•The tender documentation is to be returned to:
•The tender documentation is to reach the return address not later than:
Refer to the Main Contract preliminaries.

310.030 TENDER SUBMISSION DELIVERABLES:

•To be compliant the tender submission must include the following deliverables as detailed elsewhere:
Refer to the Main Contract preliminaries.

310.031 TENDER STAGE METHOD STATEMENTS:

Method statements must be submitted:
Refer to the Main Contract preliminaries.

Provide the following method statements in addition to those stated elsewhere:
•Health and safety statement to include:
•Management procedures.
•Any significant and unavoidable risks that might arise as a result of executing the Works.
•An outline of the health and safety procedures to be undertaken to safeguard the operatives and of any person who may be affected by the Works.
•A copy of the company's health and safety policy document including risk assessment procedures
•Accident records for the last five years
•Details of any Health and Safety Executive enforcement action
•Details of staff responsible for health and safety on this project with details of their qualifications and duties.
•Management procedures to be adopted for the project.
•Managing and resourcing of design duties and responsibilities including design capability.
•Commissioning and testing procedures and management.
•Quality control management and procedures.
•The method statement must:
•Indicate the quality control programme
•Demonstrate compliance with the contract in regard to materials and workmanship.
•Demonstrate the establishment of standards by means of sample installation and submission of samples prior to installation.
•Statement outlining the management team, stating the definition of each person's role, and the commitment to the project.
•Include the curriculum vitae and references for each of the key personnel that will be used on the project.
•A line management diagram starting at the site supervisors and rising through the management levels.
•Details shall be provided for both site and office based team staff.
•The Tenderer, at his discretion and at the same time, can submit method statements for other parts of the Works.

310.032 PROGRAMME:

Submit with the tender a programme indicating the sequence and timing of the principal parts of the works including periods for planning, design, procurement, installation and commissioning.

C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE
A64
GENERAL CONDITIONS

Deleted: Stage E Issue

310.040 MAINTENANCE CONTRACT:

•Provide a maintenance contract for twelve months, from the date of Practical Completion, as detailed elsewhere

310.050 PROPOSALS FOR ANNUAL MAINTENANCE CONTRACT:

•Submit with the Tender a supplementary proposal for an annual maintenance contract as detailed elsewhere.

310.060 TECHNICAL INFORMATION:

Technical information relating to the tender must be submitted
•With the Tender.

320.000 PRICING AND COSTS

320.010 GENERAL:
This section details particular requirements for the pricing of the tender documentation and cost procedures during the contract.

320.020 BASIS OF CONTRACT:
The contract shall be
Refer to the Main Contract preliminaries.

320.035 SUBMISSION OF PRICED CONTRACT SPECIFICATION:
The priced contract specification must be submitted
Refer to the Main Contract preliminaries.

320.040 SCHEDULE OF RATES:
A schedule of rates must be submitted
Refer to the Main Contract preliminaries.

320.060 PROVISIONAL SUMS:
Include in the contract price the provisional sums detailed in
Refer to the Main Contract preliminaries.

320.070 PRIME COST SUMS:
Refer to the Main Contract preliminaries.

320.080 OVERTIME AND ALLOWANCES:
Refer to the Main Contract preliminaries.

320.090 SUBMISSION OF FINAL ACCOUNT:
Refer to the Main Contract preliminaries.

320.100 INSTRUCTIONS AND VARIATIONS:
Refer to the Main Contract preliminaries.

320.110 DAYWORKS:
Refer to the Main Contract preliminaries.

320.120 DAYWORK PERCENTAGES:
Refer to the Main Contract preliminaries.

320.130 ATTENDANCES:
Refer to the Main Contract preliminaries.

400.000 CONTRACT CONDITIONS

400.010 CONDITIONS OF CONTRACT:
The conditions of the Main Contract are
Refer to Main Contract preliminaries.

400.020 CONDITIONS OF SUB-CONTRACT:
Refer to Main Contract preliminaries.

400.030 ORDER OF PRECEDENCE OF CONTRACT DOCUMENTS:
Refer to Main Contract preliminaries.

400.040 INSURANCES:
Refer to Main Contract preliminaries.

400.050 EMPLOYER/SUB-CONTRACTOR FORM OF AGREEMENT:
Refer to Main Contract preliminaries.

400.060 WARRANTIES:
Refer to Main Contract preliminaries.

400.070 SUB-CONTRACT GUARANTEE BOND:
Refer to Main Contract preliminaries.

400.080 ADDITIONAL DETAILS:
Refer to Main Contract preliminaries.

410.000 PARTICULAR CONDITIONS

410.010 GENERAL:

This section details particular conditions and requirements for the project.

410.020 INFORMATION PROVIDED BY OTHERS:

Instructions, drawings, or other information required to be provided by the CA will be provided in due time upon written request provided always that such information is not requested unreasonably distant from nor unreasonably close to the date upon which it is necessary.
Provide written request to the CA in good time for any information required.

410.030 PROVIDE EVERYTHING NECESSARY:

Provide everything necessary for the proper execution and completion of the contract works to the true intent and meaning of the contract documents.
•Details of construction or materials which have not been referred to in the contract documents but the necessity for which may reasonably be implied or inferred from the said documents or which are usually or essential to the completion of the Works, shall be installed with no additional cost.

410.040 SUPPLY OF INFORMATION:

The CA will provide supplementary information from time to time as may be necessary to enable the completion of the Works in accordance with the contract conditions. Allow for such progressive release of further information by the CA during the course of executing the Works.
In order to facilitate the orderly and timely production of all further information that shall be considered necessary, submit to the CA for approval a programme indicating the progressive release of such information to enable the completion of the Works in accordance with the contract conditions.

410.041 CO-ORDINATION OF TRADES:

Allow for co-ordinating the contract works with the works of other trades and installations which may be on site during the period of the contract.

410.042 CO-OPERATION WITH OTHERS:

Ensure that the contract works integrates with that of others and that full co-operation is maintained during the execution of the Works with that of others.
Co-operate with the Contractor, other subcontractors, suppliers, local authorities and statutory undertakings in the execution of the Works.
In the event of any extra costs being caused by failure to programme and arrange the execution of the Works so that it fully integrates with that of others, the installer of the Works may be liable for any additional costs thereby incurred.

410.050 NOTICE OF OPERATIONS:

Work that requires interruption or interference with the operation of any existing services or buildings shall not be commenced without prior written permission of the CA.

410.060 NOISE AND NUISANCE:

Ensure that the contract works are undertaken with as little noise as possible.
•Ensure no nuisance by noisy working is caused to
•the Employer
•occupants of premises next to the site boundary

Deleted: Stage E Issue

C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE
A64
GENERAL CONDITIONS

Deleted: Stage E Issue

Take all necessary precautions to prevent nuisance from smoke, rubbish and other causes.
Fit all compressors, percussion tools and vehicles with effective silencers of a type recommended by the manufacturers of the equipment.

410.070 SUPPRESSORS:

Ensure all internal combustion engines used in the execution of the contract works are fitted with efficient suppressors in the ignition system in accordance with the recommendations of British Standards so as to prevent electrical interference to radio or television receiving equipment in the vicinity.
All temporary electrical installations, such as motors or the like, shall be prevented from creating such interference and shall be fitted with suppressor equipment in accordance with British Standards and to the satisfaction of the CA.

410.080 PROGRAMME:

Provide a detailed programme(s) clearly illustrating how the overall programme
•Will be achieved within the contract period.
•Demonstrate compliance with the Main Contract programme.
Provide the detailed programme
•within one month of the award of the contract
Due allowance is to be made in the programme(s) for, but not limited to, the following:
•Statutory authority approvals including Building Regulations.
•The latest dates for release of final information required from the CA.
•Required method statements.
•Ordering dates and manufacturing periods. The proposed delivery to site for each item of major plant to be clearly defined.
•The period required for the production, approval and issue of:
•builder's work information
•co-ordinated working drawings
•installation drawings
•manufacturer's drawings.
Allow adequate time for the examination and approval by the CA. Actual activities of production, adjustment, resubmission and review must be identified
•Installation periods for each system
•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.
•Period required for operating the systems, load simulation tests and final adjustment.
•Environmental load testing.
•Period for instructing the Employer training.
•Pre-commissioning, commissioning and performance testing of the engineering services installations.
•The period required and latest dates for the production, approval and issue of record drawings and operating and maintenance instruction manuals.
•Provide programme information as
•critical path network.
•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
•Demonstration to the CA that test instruments and equipment are accurate.

410.090 PROGRESS:

At regular intervals as agreed with the CA provide progress reports during the execution of the contract works in addition to any other similar information required by the contract conditions.

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The reports shall include:
•particulars of materials and equipment on site, or installed
•site labour employed
•progress of the works
•Record progress of the Works weekly on a copy of the programme.
Mark up for inspection and record purposes a set of the latest drawings as the works progress. The progress drawings shall be available for inspection by the CA at any time.

410.100 ORDERING SCHEDULE:

•Prepare an ordering schedule for submission to the CA that shall indicate the following data:
•Item of material or plant
•Manufacturer
•Date of order and reference number
•Acknowledgement of order and reference
•Delivery period quoted
•Date required on site
•Allowable programme float
•Date delivered to site
•Update and modify and submit the ordering schedule on a regular basis as agreed with the CA.
Indicate on the schedule any possible problems and when delivery to site has been achieved.

410.110 CONTINUITY OF THE WORKS:

No undertaking is given that the works will necessarily be able to proceed continuously.
•No claim will be allowed for discontinuity of work due to the necessity to conform to the contract programme.

410.120 DRYING OUT:

Make due allowance in the sequence of the work to provide heat for drying out. This activity shall not relieve any responsibilities to hand over the installation in good order.
The interim period from the time of commencement of use for drying out to the handover shall not be considered as constituting any part of the defect liability period.

410.130 WORKING HOURS:

Working hours shall be
Refer to Main Contract preliminaries.

410.140 ACCESS TO THE SITE:

Access to the site shall be
Refer to Main Contract preliminaries.

410.150 METHOD AND SEQUENCE OF WORK:

Refer to Main Contract preliminaries.

410.160 USE OF THE SITE:

Refer to Main Contract preliminaries.

410.170 WORKING AREA:

Refer to Main Contract preliminaries.

410.180 POLICE REGULATIONS:

Ascertain and comply with any Police regulations or requirements as may affect the contract works.

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410.190 USE OR DISPOSAL OF MATERIALS:

•Remove from the site any rubbish and debris arising out of the execution of the contract works
•on a daily basis.
•Clear all rubbish and any debris arising out of the execution of the contract works to a central area where others will remove it from the site
•on a daily basis.
•Do not discharge any oil, noxious liquids or gases and all water discharged shall be reasonably free from impurities.

410.200 STORAGE:

Weatherproof, safe and secure storage shall be provided for all materials and equipment.
All materials and equipment and materials shall be offloaded, stored and transported in accordance with manufacturer's recommendations.
All electrical equipment and components shall be kept dry and free from dust.
Plug, cap or seal open ends on all ductwork, tubes, conduit, trunking and associated equipment whilst in storage and during transportation to site.
Provide racks to prevent distortion of pipes, conduit and similar materials.

410.210 PROTECTION AND PACKAGING:

All plant, equipment, materials and prefabricated elements of the Works shall be properly packaged and protected against damage during delivery, storage and until fully, finally and properly installed and set to work.
Submit to the CA a method statement on protection proposals for both stored and installed plant, equipment and materials.
Protection shall also include adverse effects of environmental conditions prevalent in the stored and installed location.
Any plant or equipment subject to incorrect storage or inadequate protection will be deemed unacceptable for incorporation into the works and new plant or equipment will be required as a replacement.
Damaged plant, equipment and materials or that suffering from deterioration shall be replaced prior to handover.
All plant, equipment and materials shall be protected against ingress of water and dust, formation of condensation, extremes and rapid changes of temperature, building works and operations of others.
All open ends of pipes, ducts, conduit, and trunking etc shall be capped except when being worked upon.
•After removal of any temporary protection paint parts liable to corrosion.
•Filter media shall only be installed when the plant items concerned are commissioned and tested.
Install items such as grilles, diffusers, light fittings, switches, electrical accessories etc as near to practical completion as practicable.

410.220 CONFIDENTIALITY:

No information related to the contract works shall be given to the press or other media without the written permission of the CA or Employer.

410.230 PHOTOGRAPHS:

Provide progress colour photographs of the contract works. The frequency, location, and photograph size shall be agreed with the CA. All photographs shall be dated and location stated.
The number of prints of all photographs to be submitted to the CA shall be
No unauthorised photographs of the site or the Works or any part thereof shall be taken except with the permission in writing of the CA.
Photographs shall not be published or otherwise circulated without the permission of the CA.
•Provide photographs of all areas in which the Works are to be installed prior to the commencement of the contract works. All photographs are to be numerically identified and cross- referenced to marked up plans showing the position, direction and field of view for the respective photograph.

Deleted: Stage E Issue

•Submit photographs to the CA within TBA weeks of commencement of the contract.
•Photographs shall record the condition of:
•Existing services
•Ceilings
•Carpets
•Wall finishes
•Fixed equipment

410.240 MATERIALS USED:

No acoustic insulation or thermal insulation or sound attenuation materials shall be manufactured with any form of animal hair.
All materials supplied shall be a type that will not support bacteria.
Substances publicised by the Health and Safety Executive, Building Research Establishment, British Standards Institution or other authorities or professional bodies as being deleterious to Health and Safety shall not be incorporated into any part of the Works.
Deleterious materials shall not be utilised on any part of the Works. Deleterious materials include but not limited to:
•halon/CFC's
•asbestos or products containing asbestos
•urea formaldehyde or materials which may release formaldehyde
•materials comprised in whole or part of man-made and/or naturally occurring mineral fibres which have a diameter of 3 microns or less and a length of 200 microns or less or which contain fibres not sealed or otherwise not stabilised to ensure that fibre migration is prevented
•lead where the metal or its corrosion products may be directly ingested, inhaled or absorbed
•polyurethane or polyisocynate foam
•polychlorinated biphenyls (PCBs) or similar compounds
•pentachlorophenol, lindane or tributyltin (TBT) oxide
•extruded polystyrene other than low ozone depletion materials
•any other substances generally known to be deleterious at the time of installation
All jointing materials shall be of a type approved by the respective authority.
Warrant that deleterious materials are not incorporated in the Works.
Notify the CA, in writing, as soon as reasonably practicable of any material designated by the Building Research Establishment, British Standards or codes of practice as deleterious at any time during the contract.

410.250 ADVERTISING:

No form of advertising will be allowed on any part of the site or the Works without written CA approval.

410.260 PATENT RIGHTS:

Indemnify against all claims, costs or expenses in connection with any patented, copy righted or protected articles supplied and used on or in connection with the Works.
•Any payments or royalties payable in one sum or by instalments shall be included in the contract price and paid to whom so ever they may become due.
•In the event of any claim being made in connection with such patented or protected articles, conduct any negotiations or litigation in connection with such claim at own expense.

410.270 BENEFICIAL USE OF INSTALLATIONS:

•Systems shall not be used before practical completion without prior approval of the CA.
•Systems used before practical completion not for the benefit of the Employer must have all defective consumable elements replaced by new including:
•lamps and tubes
•filters
Replacement of consumable elements shall be not more than TBA days prior to practical completion.

C0605 The New LMB Building Project A64
Electrical Specification GENERAL CONDITIONS
Revised Stage E Scheme Including Agreed VE

Deleted: Stage E Issue

•If instructed by the CA operate the installations or any part of them prior to practical completion, provided that such operation is practicable and does not prejudice the responsibilities and obligations under the contract.
•All costs arising from the use of such installations will be reimbursed at rates or where no such rates are applicable at reasonable rates agreed with the CA before commencing operation of the installations.

410.280 DEFECTS LIABILITY:

Liability for making good defects in the Works shall be for a period of 12 months from the date of issue of the certificate of practical completion for the installations.

Deleted: 24

If it is necessary to replace or renew any portion of the contract works as part of liability for defects, the defects liability period in respect of that portion of the contract Works shall be deemed to commence from the date of such replacement or renewal.
The CA may require that new tests be carried out to demonstrate that the plant is continuing to work satisfactorily if the replacement or renewal may affect the efficiency of the Works or any portions thereof.
In the remedying of defects in the contract Works take all necessary precautions to minimise the risk of damage to the buildings, the decorations, the fittings and the equipment.
•In the event of such damage occurring bear the cost of replacement or making good, subject to the proviso of being granted the benefit of any settlement in respect of such damage accepted by the insurers under the insurance policies taken out in accordance with the requirements of the contract.
•Agree with the CA a programme for the carrying out and the completion of any work not finally finished at the time of the contract Works being offered for acceptance and which does not prejudice the issue of a practical completion certificate. This work may be requested to be executed out of normal hours and no additional costs will be accepted for this action.
•Prior to practical completion submit a method statement for the approval of the CA outlining how the defects which arise during the defects liability period will be rectified to ensure that disruption to the use of the building is kept to a practical minimum.
•No additional costs will be accepted for undertaking works executed out of normal hours.
•Prepare and submit records of failures or malfunctions of any part of the contract Works during the defects liability period, together with details of remedial action taken, subsequent re-testing and the results.
•Notify the CA of damage, failures or malfunctions to the contract Works demonstrably caused by incorrect operation of the installations, vandalism or other actions by a third party.
•Inform the CA in writing when all defects are finally rectified so that an inspection may be carried out prior to the issue of a Final Certificate.

410.290 RIGHT OF ACCESS DURING DEFECTS LIABILITY PERIOD:

Right of access will not be unreasonably withheld, at all reasonable working hours and at own risk and expense, to any part of the contract works for the purpose of inspecting the working of the installations or to the records of the working and the performance thereof.
Subject to CA approval, that shall not be unreasonably withheld, undertake any tests considered necessary at own risk and expense.
During the defects liability period and all necessary remedial works and/or rectification of defective materials and equipment liaise closely with the Employer's staff. All such work shall be carried out in such a manner as to avoid or minimise shut-down time and inconvenience to the Employer.

410.300 RATIONALISATION OF COMPONENTS:

Similar items of apparatus and equipment shall be made and provided by the same manufacturer where practicable and corresponding parts of all apparatus and equipment shall be interchangeable to reduce the need for different attention and spares.

410.310 SUPPLY OF COMPUTER HARDWARE AND SOFTWARE:

Obtain on behalf of the end user all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with the software supplier for support and appropriate updating. Ensure that application software is written in compliance with BS 7649.

410.320 FIRE PRECAUTIONS:

Take all reasonable fire precautions in respect of stores, workshops and other installations. Where it is necessary to use any naked flame or welding equipment in executing the contract works and where combustible materials are in use, adequate protection shall be given to other adjacent materials and personnel. Suitable fire extinguishers shall be readily available at the position where such work is proceeding.

410.321 INTERFERENCE WITH TRAFFIC:

Maximum facilities for access and transit shall be provided in all works that may interfere with the traffic on the roads, paths and footways. Should any part of the Works be executed in such a way as to cause unnecessary obstruction to traffic with neglect to remove or remedy the same forthwith when called upon to do so, then any obstruction shall be removed and the costs recovered.

410.330 DAMAGE TO STRUCTURE:

•Exercise due care and attention in carrying out the contract works and be fully responsible for any damage caused to the structure or building finishes.
•Obtain permission from the CA before any holes are cut in floors, walls or steelwork, etc.

410.335 METHOD STATEMENTS:

•Submit method statements to the CA prior to commencement of the contract works for the following work activities
•Each item of work

410.340 INSPECTION BEFORE CONCEALMENT:

Whenever work requiring inspection or testing is subsequently to be concealed give the following the notice to the CA so that inspections may be made or tests witnessed before concealment
• 5 days notice

410.350 EQUIPMENT GUARANTEES:

Plant and equipment guarantees shall commence at the date of practical completion and run for a minimum of 24 months after this date.
Any costs associated with this requirement shall be included in the contract price.

410.360 SITE MODIFICATIONS:

Site modifications to assemblies shall not be made without written approval of the CA.
Where site modifications to assemblies are authorised undertake in accordance with manufacturer's certified drawings and instructions.
Ensure that all modifications undertaken comply with the relevant standards and all test certification obtained.

410.370 DIMENSIONS:

•Where installations are dependent upon site dimensions ensure that these are available before proceeding with the Works.
•Dimensions should not be scaled from drawings.

Deleted: Stage E Issue

C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE
A64
GENERAL CONDITIONS

Deleted: Stage E Issue

•Where dimensions are indicated on drawings check these on site, as appropriate, to ensure building construction tolerances and manufacturing tolerances can be accommodated.
•Equipment should not be ordered or manufactured using dimensions indicated on the Tender drawings.

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430.000 QUALITY

430.010 QUALITY CONTROL:

Prepare and submit to the CA a method statement to indicate fully the quality control programme for the contract works
Time scale
•Within weeks of contract appointment (no)

430.020 WORKMANSHIP AND MATERIALS:

All materials, articles and workmanship shall be of the best quality and execution as detailed in the specification and drawings.
All equipment and materials to be installed shall be new unless otherwise indicated.
All equipment shall be installed in accordance with the manufacturer's written instructions and recommendations.
All materials considered by the CA to be unsound or not in accordance with the specification shall immediately be removed and properly replaced to the satisfaction of the CA at no additional cost. All work carried out imperfectly or with faulty materials must be immediately removed and properly replaced to the satisfaction of the CA at no additional cost.
The manufactured articles specified shall serve as a quality standard.
Where manufactured items are not specified by name submit with the tender all necessary details of proposed articles. The CA shall approve these articles before their use is permitted.

430.030 DEFECTS:

Agree with the CA a system of recording defects that should include
•A reference to identify the defect
•Description of the defect
•Remedial works proposed
•Agreement to remedial works proposed
•Confirmation of defect clearance

C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE
A64
GENERAL CONDITIONS

Deleted: Stage E Issue

500.000 ORGANISATION AND DESIGN MANAGEMENT

500.010 SITE STAFF:

•Refer to the Main Contract preliminaries.
•Employ a competent full-time site based project manager/engineer and supporting team dedicated full time to the project and not involved in the installation of the Works who shall have full authority to act in connection with the contract works.
•Staff of sufficient number and competence in the opinion of the CA, shall be provided as necessary for design, drawing and technical information production, programming and administration to ensure efficient and satisfactory execution of the contract works.
•Provide all necessary superintendence during the execution of the contract works. The said staff shall be in attendance on site during the whole time that work is in progress.
•Employ on the site suitable qualified engineering staff to be in charge of the contract works from commencement to completion. The said staff shall be in attendance on site during the whole time that work is in progress.
•Responsibility for all drawings and technical information production shall be undertaken by a nominated engineer
•Curriculum Vitae shall be submitted with the tender for
•all key staff
•Any change made to the appointment of staff during the contract works shall be agreed with the CA with maximum notice being provided.
•If the CA is of the opinion that any member of the site staff has been guilty of a serious breach of his duties, he may by notice require that person to be replaced within TBA weeks of the notification.

500.020 DESIGN COSTS:

•The costs for undertaking the design activities and production of information during the design stage shall be stated in the tender.
•A letter of intent for the award of the contract will be issued by the Employer to allow immediate commencement of the contract design stage activities.
•Should the contract works not ultimately proceed nor the design be completed due to unforeseeable circumstances then
Refer to Main Contract preliminaries.

500.030 DESIGN MANAGEMENT:

•Employ a design manager throughout the design process who shall have the full authority to make decisions. The design manager shall be suitably qualified to the satisfaction of the CA.
•The design manager shall
•attend all design team meetings as required
•be a participating member of the overall team during the development of the design
•Once construction has commenced the design manager shall be involved until such time as all the production information has been completed and the Works are generally under construction.
•Appoint the appropriate staff and necessary skills to undertake the design activities to the satisfaction of the CA.
•Submit with the tender curriculum vitae of all key design staff.
•Any change made to the appointment of design staff shall be agreed with the CA with maximum notice being provided.
•Throughout the design stage be actively involved with the Employer's design team
•Undertake and prepare any such design information required by other design team members to enable their element of the work to be detailed.
•During the design and production information stages the CA will monitor by such means considered necessary the performance in the development of design and in the production of the detailed design and co-ordination drawings.
•Should any part of the design not meet the required standard of the CA then modify and re-issue such work to the required standard at no additional cost or delay to the programme.

Deleted: Stage E Issue

•On completion of the contract design stage activities and prior to commencing the production information submit to the CA a statement of compliance that the design of the systems will meet the specification design and performance intent.
•Submit a statement to the CA signed by a "competent person" prior to commencement of works on site that the systems can be properly prepared and commissioned and agrees with the intent of the design.

500.040 DESIGN WARRANTY:

•The successful tenderer will be required to complete a form of warranty in favour of the Employer prior to the commencement of the design stage.

C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE
A64
GENERAL CONDITIONS

Deleted: Stage E Issue

510.000 SUBMITTALS AND APPROVALS

510.010 GENERAL:

This section outlines the requirements and procedures for submittals to the CA.

510.020 SUBMITTALS:

Prior to any orders being placed the CA shall review all drawings and manufacturer's details.
Submittals shall be in a clear, definable and easily read format with the specified technical details, notes, performance data and calculations where applicable all in the English language.
Where drawings are to be examined the manufacturer's details shown on the drawings must have been previously approved.
Include all costs for attending meetings associated with the submittal review procedure. Meetings will be held at.
Agree with the CA where samples of materials offered for review are to be sent.
Issue progressively drawings, calculations and submittals as agreed in advance with the CA for review.
All correspondence related to the examination and review procedure shall be directed through the office of the.
The timescale for review or comment or otherwise on all submittals shall be

510.030 SCHEDULE OF DRAWINGS AND SUBMITTALS:

Provide a schedule of all proposed drawings and submittals required for comment. The schedule shall be provided
• weeks from contract appointment - Refer to Main Contract preliminaries.
Indicate as a minimum the following information on the schedule:
•Drawing number and revision number
•Drawing title and service
•Scale
•Latest date required on site and/or for manufacturing purposes
•Date required for final comment
•Date for submission for comment
•Date of commencement of drawing production
The schedule shall be updated as necessary on a regular basis at intervals agreed with the CA during the contract period.
The programme for production of drawings and other submittals should include the necessary time for:
•Submission
•Examination
•Alterations and re-submission in the event of the initial submission not being accepted
•Final issue
Allow adequate time in the programme in order not to cause delays.
The full extent of all submittals shall be indicated in the schedule.
Group submittals for a particular part of the building or building engineering service as agreed with the CA.

510.040 CALCULATIONS:

All calculations must be presented in a logical format and prepared to a recognised and agreed format and be suitably indexed.
All software programs used in the preparation of designs shall be agreed with the CA prior to commencement of design activities. The use of unverified software must be declared and the initial outputs justified by full and complete hand calculations.
Software used in calculating the energy performance of buildings, as required under Part L of the Building Regulations, shall be as approved by DCLG and agreed with CA prior to commencement of use.

Deleted: Stage E Issue

Calculations that are preliminary in nature, i.e. do not form part of the final submittal, are to be referenced independently and clearly indicated 'Preliminary'.
State the methodology, formulae, design criteria, assumptions and all design margins used in the calculations.
Where necessary calculation sheets shall be accompanied by an annotated layout drawing identifying terminals, fittings and the particular sections of ductwork or pipework.
Each calculation sheet, drawing or schedule shall clearly identify the originator, date of production, checker (who signs or initials) and date of check.
The timescale for review or comment or otherwise on all submittals shall be

510.050 EQUIPMENT PERFORMANCE DETAILS:

Details of the equipment selected for inclusion into the Works shall include the following information:
•Plant item description, reference identification and serial number.
•Electrical input rating - kVA, Volts, Phase.
•Operating mode - duty, standby, generator etc.
•Starting characteristics - starter type, current, starts/hour and starting time.
•Performance characteristics - (full load current and power factor).
•Noise level.
•Weight.
The format of the information shall be as agreed with the CA.

510.051 PREPARATION OF DRAWINGS:

Agree with the CA a document numbering system prior to preparing any documents.
All drawings shall be prepared using a computer aided draughting system and the software used to produce drawings shall be approved prior to commencement of drawing production.
Each service shall be represented by a separate layer/overlay, for subsequent easy modification.
Prior to commencement of drawing production agree the sequence of layers, pen colours and sizes.
The medium for transfer of information shall be
AutoCAD drawing files shall be
•DWG
•DXF
Drawing plots shall be "A" size to British Standard, with an agreed logo/title block.
The standard drawing size is to be
•A1
•A0
Scales used on drawings shall be
•selected to convey clearly the proposals

510.060 REVIEW OF SUBMITTALS:

Submittals will be examined for
•compliance in principle with the design intent
Such examination shall not relieve any responsibilities and obligations under the contract.
Examination of any submittal by the CA shall not mean that the CA is responsible for the correctness of the drawing or submittal or its suitability for purpose. These responsibilities shall remain as defined elsewhere and as the contract.
Allow adequate time in the programme for submittals with due allowance for incorporation of comments and resubmission in order not to cause delays.
Each package shall contain all drawings, design calculations, support information, manufacturer's literature, etc necessary to facilitate examination by the CA.
Revised items on drawings shall be clearly indicated and annotated with a revision number/letter.
Submittals will be returned indicating "A", "B" or "C" action.
"A" action
•Examined no comments
•Examined for construction purposes
"B" action

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•Examined subject to minor amendments
•Examined subject to incorporation of comments indicated
•For construction provided that work is in compliance with comments made
"C" action
•Examined subject to major amendments
•Rejected with or without comments
In this case the drawings shall be re-submitted after correction or with further information added.
Drawings and submittals with "B" or "C" action, shall be adjusted/revised for comments immediately and re-submitted to the CA within days or earlier if site progress dictates.
Where drawings are revised and updated during the construction stage these shall be issued to the CA for examination of the revision only, the revision being clearly marked.
•Builder's work information and installation drawings shall not be examined in detail but shall be examined by the CA for general suitability.
•Record drawings are to be prepared as the contract works progress and shall be examined in the same manner as for other submittals.
•The timescale for review or comment or otherwise of record drawings shall be

510.070 MISTAKES IN SUBMITTALS:

Examination and/or issue on a CA instruction of submittals shall not be deemed to remove any duties, obligations and responsibilities under the contract.
Be responsible for any error, discrepancy or omission in any submittal, presentation or drawing prepared or where others have prepared these for submittal.
The said indemnity shall be subject to the proviso that such error, discrepancy or omission is not due to any inaccurate data, drawing or information provided by the employer or by the CA on his behalf.

510.080 SAMPLES:

Provide free of charge samples of material and workmanship proposed to be used in the Works.
Samples shall include all alternative finishes available if required.
In the case of articles of special construction:
•drawings may be temporarily substituted for the samples
•drawings when approved will be retained until the articles concerned are supplied, as a sample
The samples submitted and approved, shall remain the property of the Employer until the completion of the contract.
Approval of the CA shall be obtained before equipment is placed on order
•The CA will undertake to approve samples within 2 weeks from receipt.
Samples to be submitted:
Include all alternative finishes available for the following samples:

510.081 FORM AND NUMBER OF SUBMITTALS TO BE PROVIDED:

All submittals shall be issued to the
•CA

Provide drawn information in the following forms:
- Refer to Main Contract preliminaries.

510.090 REVISIONS TO DRAWINGS:

Where revisions take place either under the authority of a CA instruction, or by written agreement with the CA or when revised architectural, structural or services information is issued, all drawings shall be modified accordingly and shall be re-issued for construction purposes subject to examination by the CA.
The issue of revised drawings shall be in accordance with and with regard to the agreed programme for construction and where time is available re-issues shall be grouped together, as agreed with the CA.

520.000 OBLIGATIONS AND RESPONSIBILITIES

520.010 GENERAL:

•Complete the design development.
•Undertake the responsibility for resolving final spatial co-ordination.
•Undertake specific detailed design tasks as indicated elsewhere in the specification.
•Prepare construction programmes for the Works as stated elsewhere and for design activities.
•Co-ordination of the engineering services, with each other and with the building structure and fabric.
•Undertake all on-site co-ordination with all other trades, disciplines, manufacturers and suppliers.
•Undertake the role of lead co-ordinator and agree principles of co-ordination with all parties concerned.
•Incorporate details provided by others into the
•Design development.
•Installation information.
•Provide the following drawings as defined elsewhere
•Co-ordinated working
•Installation
•Manufacturer's
•Record
•Carry out final detailed location and dimensioning of second fix equipment based on architectural information
•Luminaires
•Control devices
•Electrical switches, outlets etc
•Grilles
•Prepare such reports, calculations and details as required for submission to any appropriate authority including the co-ordination of such information by suppliers, specialists, etc needed to be included in any submission.
•Notify the necessary statutory Authorities (Building Control, Fire Officer, Environmental Health etc) in respect of all tests and demonstrations required
•Building Control
•Fire Officer
•Environmental Health
Arrange all necessary attendance, documentation to ensure full approval.
•Seek full statutory approval of the Works and arrange all necessary attendance, documentation to ensure full approval.
•Demonstrate that all plant and equipment incorporated into the works can be safely and easily maintained in compliance with current legislation.
•Provide compliance statements for all selected plant and equipment demonstrating full compliance with the specification prior to order and commencement of the Works. Highlight for review all non-compliances.
•Fully re-evaluate and take full responsibility for all parts of the design and building elements that may be affected by acceptance of alternative plant selections
•Modify the final detailed spatial co-ordination for approved alternative equipment or materials.
•Supply, deliver to site, unload, store, protect and co-ordinate movement of all plant, equipment and materials required for the Works including lifting and hoisting.
•Fix and install correctly all plant, equipment and materials and ensuring that all associated works are correctly executed.
•Inspect all plant, equipment and materials as delivered or where specified at the manufacturer's works. Inspection and/or tests to be carried out at the manufacturers' works jointly with the CA for equipment as stated elsewhere. Include for the travel and other expenses of the CA for the inspection and/or tests to be carried out at the works.
•Prepare detailed electrical wiring diagrams of all equipment supplied showing all interconnections between equipment to enable all necessary wiring to be undertaken
•Check software engineering and programming is completed so that systems function in the

prescribed manner.
•Provide:
•Suitable accommodation.
•Workshops.
•Stores.
•Removal of rubbish and redundant materials.
•Clearance on completion.
•Obtain final quotations for incoming services based on final agreed building loads.
•Seek utility company comments on the spatial requirements and builder's work associated with the provision of incoming services.
•Advise on the impact of any changes during the course of the Works that may result in the final CO_2 Buildings Emissions Rate not achieving compliance.
•Assist and collaborate with others in liaison with Statutory Authorities with respect to Building Regulations approvals and compliance. Prepare supporting documentation.
•Evaluate and assess the impact of all proposed alternative equipment or materials on the final 'as constructed' CO_2 Buildings Emissions Rate not achieving compliance. Submit a report to the CA.
•Calculation of the final 'as constructed' CO_2 Buildings Emissions Rate for Part L.
Collaborate and provide all necessary information for the accredited final 'as constructed' calculation of the CO_2 Buildings Emissions Rate for Part L undertaken by others.
Undertake the 'as constructed' calculation of the CO_2 Buildings Emissions Rate for Part L compliance. Collaborate and receive from others all necessary information required to undertake the calculation which shall be undertaken by a qualified person and using accredited software.
•As instructed by the CA prepare a report in consideration of any additional works associated with the Works that may be a consequence of the 'as constructed' CO2 Building Emissions Rate for Part L not achieving compliance. Identify costs, programme and method statement for executing the additional works.

520.015 BUILDER'S WORK OBLIGATIONS AND RESPONSIBILITIES:

•Check the spatial requirements and adequacy of builders work information issued by others for utilities works.
•Provide final builders work details based on the installation and manufacturer's drawings to facilitate the installation of the works. Provide fully dimensioned drawings showing both size and position of builder's work making due reference to the structural engineering and architectural final dimensioned detailed drawings.
•Detail all access requirements including access to false ceilings and ducts for maintenance.
Provide fully dimensioned and annotated drawings.
•Undertake the redesign of the associated builder's work for approved alternative equipment or materials which subsequently varies the works in any way whatsoever.
•Detailed design and locations of brackets and supports.
•Submit details of all types of brackets and supports including fixing details.
•Submit load and thrust calculations.
•Design, supply and installation of support for plant and services.
•Steelwork.
•Brackets.
•Hangers and clips etc.
•Plinths.
•Inertia bases.
•Detail and supply sleeves, inserts, frames, fixing anchors etc., and any other items required to be cast or built into the structures by others, including coordination of positions to such extent and accuracy to allow structural construction to proceed.
•Detail design, supply, installation and co-ordination of all access platforms, access covers, gratings, ladders, stairs, rails and protecting elements required for future maintenance and operation of plant/equipment.
•Provide fully dimensioned and annotated drawings.
•Undertake and detail all fire stopping and sleeving systems for the Works where they pass through fire compartments.
•Detail and install fire barriers where a fire rated partition is penetrated.

Deleted: Stage E Issue

•Undertake and detail the weatherproofing of all services passing through external elements of the building.
•Undertake and detail all acoustic stopping associated with the Works. **Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates. Refer to SBA details for standard acoustic penetration details.**
•Detail the final requirements for access to ceiling voids and builder's work ducts for maintenance and operation.

520.025 ELECTRICAL SERVICES:

•Selection of fuse sizes installed in plug tops appropriate for the rating of the connected equipment.
•Design of cable or cable containment terminations on to electrical equipment.
•Dimensioning and final installation details of electrical switchgear including.
•Provision of safe operating and maintenance clearances.
•Acceptable cable entries for the final location.
•Detailed design of earthing and bonding requirements for:
•Electrical engineering services.
•Mechanical engineering services.
•Architectural elements.
•Structural elements.
•Design of fixing, connections and bonding details as required for final installation of lightning protection systems.
•Check that cable size selections as specified are not invalidated by the selection of alternative routes during installation or selection of alternative manufacturers.
•Detailed sizing, location, routes and design of electrical containment systems
•Trunking.
•Tray.
•Supporting structures, brackets, fixings etc.
•Design of electrical conduit systems including capacity, location, routes and fixing.
•Verify cable sizes, voltage drops, discrimination and fault handling of cables based on the installation drawings, selected equipment and actual installed cable lengths for:
•CCTV.
•Access control.
•Final detailed design of the fire alarm system including component and cabling requirements to meet with particular manufacturer's recommendations, the engineering specification and requirements of statutory bodies, standards and codes.
•Detailed design of the lightning protection system in accordance with the engineering specification requirements and current code of practice and standards.
•Undertake a study to determine compliance with G5/4 and BS EN 61000-2-4 (electromagnetic compatibility)
•Assimilate all relevant technical data including the final selected equipment from all parties prior to the study being undertaken.
•Issue a report on the study findings in due time to suit the requirements of the programme for the Works.
•Verify spatial requirements, routes and anchor points for cable pulling.
•Provide a report confirming the final metering strategy as installed.

520.045 COMMISSIONING:

•Undertake the testing, commissioning, regulation and setting to work of the Works.
•Design all necessary facilities required for setting to work commissioning and testing of the completed installations.
•Appoint an independent specialist responsible for the testing and commissioning.
•Ensure that the commissioning requirements are compatible with any project restraints concerning sectional handover/ phasing.
•Review all designs to ensure that systems are commissionable and highlight for review by the CA any considerations in respect of commissioning.

Deleted: Stage E Issue

•Provide a statement
•Prior to commencement of the Works.
•Provide a report signed, by a competent person confirming, prior to installation that all system designs can be commissioned.
•Incorporate into the systems design the essential components and features necessary to enable the proper preparation and commissioning of the building services.
•Prepare comprehensive commissioning method statements including procedures, logic diagrams and risk assessments for:
•Pre-commissioning checks.
•Setting to work.
•Commissioning and testing.
•System proving.
•Environmental testing of the Works.
•Prepare flushing, chemical cleaning and water treatment method statements, logic diagrams and programme
•Prior to commencement of Works.
•Produce a detailed commissioning programme
•Prior to commencement of Works.
•Establish procedures with all parties to allow the demonstration of normal, emergency, shutdown and standby mode operation of plant and systems.
•Prepare method statement
•Provision of all necessary facilities to enable tests to be witnessed and inspections carried out including all necessary instruments and recorders to monitor systems during the commissioning and environmental proving period.
•Produce record pro-forma documentation for review by the CA relating to the commissioning and testing of plant and systems
•Prior to commencement of the Works.
•Co-ordinate the activities of:
•Specialists.
•Manufacturers.
•Provide all necessary attendance.
•Measure and reconcile noise levels to verify compliance with the design criteria:
•external noise levels.
•internal noise levels.
•Ensure all certification is attained and witnessed as necessary for inclusion in the record documentation.
•Maintain a log of all significant activities during the testing, commissioning and system proving process.
•Record all plant and system settings.
•Provide and submit a report for every test, demonstration, balance or commissioning activity witnessed, together with an engineering appraisal on the performance, either on or off-site.
•Provide a final commissioning report, signed by a competent person, detailing the results of the commissioning and commenting on the performance of systems. The report to confirm that each installation is correctly tested and commissioned, achieves the specified performance and in accordance with CIBSE Code M.
•Demonstrate that equipment is capable of the performance and method of operation specified.
•Demonstrate that the overall and complete systems perform correctly in the required manner and as intended by the specification.

520.050 HANDOVER:

•Appoint an independent specialist author for the production of operating and maintenance manuals. Identify four specialists as part of the tender return.
•Prepare operation and maintenance manuals in accordance with the specified requirements.
Ensure that information needed for inclusion in the operating and maintenance manuals is obtained as the works progress. Identify individual sources of information.
•Produce record drawings.

Deleted: Stage E Issue

•Modify the record drawings as the works progress so that all alterations from the installation drawings are recorded as the work proceeds
•Modify and update operating details to reflect commissioning results.
•Record all water, gas and electricity meters on completion of the works.
•Prepare planned preventative maintenance schedules for
•12 months from practical completion.
•Prior to commencement of works.
•Instruct the Employer's staff in the use, operation and maintenance of the installations.
•Fully operate and maintain the installations in accordance with the Employer's normal occupational requirements prior to practical completion.
•Prepare a schedule of all spare parts require for the works including recommendations of any others not stated in the specification.
•Prepare a schedule of all tools require for the works including recommendations of any others not stated in the specification.
•Supply and handover over:
•All tools.
•Spares
•Keys

520.055 DURING THE 12 MONTHS AFTER PRACTICAL COMPLETION:

•Record all plant and system settings following any fine tuning activities.
•Fine tuning activities
•Assess the need for fine tuning of the Works and prepare statement.
•Prepare programme in advance and agree with CA.
•Arrange for the relevant parties to be retained and appointed to provide input to fine tuning activities.
•Planned with regard to the health and safety of occupants and such that any disturbance to them is minimised.
•Attended meetings to deal with issues arising from fine-tuning of the Works.
•Carry out visits to undertake fine tuning of the Works
•As stated elsewhere.
•Provide a mechanism by which the Employer can provide feedback on the performance of the building both before and after fine tuning.
•Ensure that BMS trend logs are maintained
•For the whole of the 12 month period.
•Can be readily accessed by the CA.

Deleted: Stage E Issue

530.000 LOCAL AUTHORITY REQUIREMENTS

530.010 GENERAL:

This section details the requirements for compliance with Local Authority By-laws.

530.020 STATUTORY AUTHORITY APPROVALS:

•Make full and formal submissions to Building Control/District Surveyor at the earliest opportunity to ensure the approval of the Statutory Authorities for the proposed installation works.
•Notify the District Surveyor, Building Control Officer and Fire Officer directly in respect of all tests and demonstrations relevant to life safety installations, and include for all necessary attendance, documentation, etc., to ensure full Statutory Authority approval of the installation.
•Include for all fees and charges legally required under such Act of Parliament, Regulations or By-Laws in respect of the Works.

530.030 AUTHORITY NOTICES:

•Documents requiring the Employer's signature shall be forwarded to the CA in time to meet the contract works programme in order for the necessary test and supply arrangements to be made.
•No additional costs or extension to programme shall be allowed due to reconnections, revisits etc by supply authorities or failure to programme the works.

530.040 BYE-LAWS, NOTICES, ETC:

Observe and comply with the requirements of all Statutes and Bye-Laws.
Serve notices on the Authorities having control of the road surfaces before the same are broken up and likewise serve notices on the owners of sewers, drains, water, gas or other mains, electric cables, tramways and other services which may in any way be affected by the execution of the Works.
Inform all necessary parties when work necessitates such notices to be given.

Deleted: Stage E Issue

540.000 HEALTH AND SAFETY

540.010 GENERAL:

•Refer to the Main Contract Preliminaries for the requirements of safety, health and welfare.

540.020 CDM REGULATIONS:

•The management of health and safety is to be undertaken in conformity with the requirements of The Construction (Design and Management) Regulations 2007, and the corresponding Approved Code of Practice.
•Comply with the requirements of the CDM Regulations by
•Compiling risk assessments
•Preparing method statements
•Providing information on the contract works that might affect the health and safety of any person
•Providing all necessary input to the Pre-Construction Information and Construction Phase Plan
•Providing all necessary input to the health and safety file
•Supply any method statements and comply with all CDM procedures required by the CDM co-ordinator and the Principal Contractor.

540.030 PRE-CONSTRUCTION INFORMATION AND CONSTRUCTION PHASE PLAN:

•Pre-Construction Information is included as part of the tender documents.
•The Pre-Construction Information provides information required by the CDM Regulations and highlights significant risks to health and safety identified during the design stage.
•Produce the Construction Phase Plan in accordance with the requirements of the CDM Regulations prior to the commencement of works on site
•The Construction Phase Plan shall not be limited to those particular risks identified in the Pre-Construction Information but shall include consideration of all reasonably foreseeable risks
•The Construction Phase Plan must be adequately developed, as far as is reasonably practicable allowing for any phasing of works, etc., in sufficient time to allow it to be submitted for approval prior to the commencement of any works on site.
•In the case of phased works the health and safety plan relating to the work content of any phase must be adequately developed and submitted for approval prior to the commencement of any work within that phase of the project.
•Where design activities are undertaken or there is involvement in the design of any elements of the contract works co-operate with and provide information to the CDM co-ordinator in accordance with the designer's duties under the CDM regulations.
•Ensure that all sub-contractors are issued with copies of the Construction Phase Plan prior to the submission of their tenders and that they price for compliance.
•Ensure that all sub-contractors complete appropriate assessments of the risks to health and safety in respect of their works as required under applicable statutory legislation, including The Management of Health and Safety at Work Regulations, The Control of Substances Hazardous to Health Regulations and The Control of Substances Hazardous to Health (Amendment) Regulations 2003.
•The Construction Phase Plan shall be reviewed and revised as necessary in line with any information received or any changes in the requirements of the contract works. Any changes shall be promptly advised to all relevant parties.
•Ensure, so far as is reasonably practicable, that all sub-contractors, employees and self employed persons who are at work on the construction of the project conform with the requirements of the Construction Phase Plan.

540.040 COSHH REGULATIONS:

•Comply with The Control of Substances Hazardous to Health Regulations and The Control of Substances Hazardous to Health (Amendment) Regulations 2003.
•Provide with the tender an assessment of the risks in undertaking the contract works

C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE
A64
GENERAL CONDITIONS

Deleted: Stage E Issue

•Provide with the tender a method statement on the steps proposed to meet the requirements of the Regulations
•Undertake COSHH assessments for all activities and substances provided or used on site to assess their potential health hazards.
•Copies of all relevant COSHH assessments must be issued to the operatives concerned and strictly monitored. Particular attention must be given to the use of glues and sealant.
•Where the use of substances falling within the scope of the Regulations forms part of the contract works notify the CA in writing, together with the additional costs, if any, of use of non-hazardous alternative.
•Ensure during the course of the contract works, and under all circumstances, that all substances falling within the scope of the Regulations are positively so identified at all times and that they are transported, handled, stored, used and disposed of in strict accordance with their manufacturer's/supplier's recommendations.
•Where use of substances falling within the scope of the Regulations are required for the operation and maintenance of the completed contract works, ensure that
•Suitable facilities are available for the on site storage of such substances and that all necessary warning/instruction notices are provided at the point of their storage and use
•Provision of any special protective clothing, eye protection and similar safety equipment for the operation and maintenance of the Works and in sufficient quantity for
•1 year operation
•Employer's staff have been fully trained in the use, handling, storage, transport and disposal of the substances concerned prior to handover.
•The type, use and control of the substances have been fully and correctly identified in the operating and maintenance manuals/health and safety file.

540.050 ASBESTOS:

•No material or goods containing asbestos shall be incorporated in the contract works.
•Be responsible for certifying at practical completion of any section of the contract works that no asbestos or asbestos related materials have been incorporated or by any sub-contractor employed.

540.060 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 contract works and the measures proposed to safeguard the health and safety of operatives and of any person who may be affected by the contract works.

550.000 BUILDING REGULATIONS REQUIREMENTS

550.010 GENERAL:

This section details the requirements for compliance with the Building Regulations.

550.020 BUILDING REGULATIONS APPROVALS:

•Make full and formal submissions to Building Control/District Surveyor/Approved Inspector at the earliest opportunity to ensure the approval of the relevant Authorities for the proposed installation works.
•Notify the District Surveyor, Building Control Officer and Fire Officer directly in respect of all tests and demonstrations relevant to life safety installations, and include for all necessary attendance, documentation, etc., to ensure full relevant Authority approval of the installation.
•Include for all fees and charges legally required under the Building Regulations in respect of the Works.

600.000 THE SITE

600.010 GENERAL:

This section outlines information on the site.

600.020 SITE LOCATION:

The site is located at
Refer to the Main Contract preliminaries.

600.030 DESCRIPTION OF THE SITE:

Refer to the Main Contract preliminaries.

600.040 THE BUILDING:

The building fabric is
•Refer to architectural and structural engineering drawings for full details.

600.050 RISKS TO HEALTH AND SAFETY:

Undertake responsibility to obtain any information required to ensure the safety of all persons and the Works.
Comply with the requirements of the CDM Regulations by
•compiling risk assessments for the contract works.
•providing information on the contract works which might affect the health or safety of any person.
•providing appropriate input to the Construction Phase Plan and health and safety file for the works.

600.060 ADDITIONAL DETAILS:

Refer to the Main Contract preliminaries.

700.000 DESCRIPTION OF THE WORKS

700.010 GENERAL:

This section outlines the extent of the works and provides a description in a brief manner of the scope of each of the building services installations.

700.020 SCOPE OF WORKS:

The engineering services included in the Works and covered by this contract comprise:
•Electrical services.

700.030 EXTENT OF THE WORKS:

The extent of the Works is as follows:
Electrical services
•Incoming electrical supplies.
•Transformers.
•High voltage distribution and switch-gear.
•Low voltage distribution and switch-gear.
•Sub-mains distribution.
•Power installation.
•Lighting installation.
•Emergency lighting.
•Security systems.
•Intercom systems.
•Data systems.
•Fire alarm systems.
•Lightning protection.
•Earthing and bonding.
•Spares and tools.
•Testing and commissioning.
•Record documentation.

700.040 DESCRIPTION OF THE WORKS:

The following clauses describe in a brief manner the extent of the engineering services.
Refer to the Main Contract preliminaries.

700.060 PRODUCTS BY/ON BEHALF OF THE EMPLOYER:

Products provided by or on behalf of the Employer.
•Details of such products are given in the relevant sections of this specification, for fixing by the Subcontractor.
•Take delivery, check condition, mark receipts and take into appropriate storage. Advise the CA of details and number of items.
•Use for no other purpose than the Subcontract Works.
•Keep safe any surplus to requirements and obtain instructions in relation thereto.
•Once products provided by or on behalf of the Employer are in the possession of the Subcontractor all conditions of the contract and technical specifications are applicable to such items, including all requirements for protection, storage, distribution, fixing, insurances, replacement if damaged/stolen/lost etc., painting, identification, setting to work and commissioning.

700.070 WORKS BY/ON BEHALF OF THE EMPLOYER:

Works provided by or on behalf of the Employer.
•Details of such works are given in the relevant sections.

710.000 GENERAL DESIGN CRITERIA AND STANDARDS

710.010 GENERAL:

This section outlines the general design criteria and definitions applicable to the engineering services forming the contract Works.

710.020 GENERAL DESIGN CRITERIA:

•The criteria listed in the following clauses apply to all work sections included in the contract unless specified otherwise.
•The design of the engineering services is based on the criteria and design data stated in the following clauses
•Changes or amendments shall be by prior written notice from the CA.

710.070 PLANT OPERATING CONDITIONS:

•Ensure all plant items are suitable for operation in the environment in which they are to be located.

710.090 ELECTRICAL WIRING:

Where systems are specified as being maintained under fire conditions ensure wiring selected is suitable for the temperatures to be encountered.

710.100 ELECTRICAL SUPPLY CHARACTERISTICS:

The characteristics of the electrical supply or supplies:
•Nominal voltage(s) 400V/230V
•Nature of the current and frequency a.c., 50Hz
•Prospective short-circuit current at the origin of the installation T.B.C.
•Earth fault loop impedance (Z_e) of that part of the system external to the installation T.B.C.
•The suitability for the requirements of the installation, including the maximum demand T.B.C.
•Type and rating of the over-current protective device acting at the origin of the installation T.B.C
•Confirm with the Supply Authority before ordering any equipment dependent upon voltage or frequency.
•Ensure all electrical equipment supplied and installed is suitable for the power supply indicated.

710.110 STANDARDS AND REGULATIONS:

•Unless stated otherwise the Works shall comply with the appropriate British Standard (BS) or Code of Practice (CP) and where no BS or CP is applicable comply with
•the Agreement Certificate for the particular item.
•CIBSE recommendations and guides to current practice.
•BS 7671 Requirements for Electrical Installations
•Guidance published by IEE and IET.
•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 in the same location.
•All product and materials shall have product conformity certification (e.g. BSI Kitemark, BSI Safety Mark or CARES scheme) or product approval (e.g. British Board or Agreement Certificate)
•All products must have the recognised 'CE' mark attached.
•Provide certificates of compliance with British Standards, BSI Certification Schemes, and/or other Quality Assurance Schemes
•when requested by the CA.

Deleted: Stage E Issue

•In the absence of specific design, performance or installation standards being stated seek the instructions of the CA prior to commencement of the Works and with adequate time so as not to cause delay.
•When new editions, versions and amendments are published during the construction, seek the instructions of the CA with respect to any modifications or changes necessary.
•References to BSI documents shall be to the versions and amendments listed in the British Standards Catalogue and in subsequent issues of BSI Update Standards up to
•one month prior to the tender issue date.
•The tender shall be based on the standards and regulations current
•one month prior to the issue date of the tender.
•As requested by the CA keep copies on site, readily accessible for reference by all supervisory personnel
•relevant BS Codes of Practice

710.120 METRIC AND IMPERIAL CONVERSIONS:

•Some dimensions and units in metric have been converted from imperial units and approximated to the nearest practical dimension, i.e. 12" has been converted to 300 mm.
•Metric sizes have been used for both metric and imperial components.
•Where only imperial components are available the imperial size has been converted to the metric equivalent size.
•Due allowance shall be made for metric and imperial conversions.

710.130 ELECTROMAGNETIC COMPATIBILITY:

•Ensure all equipment and systems are installed to provide electromagnetic compatibility within the system and with any other systems installed in the same area.
•Ensure all systems and buildings are assessed for protection to, and that such protection meets the requirements of BS EN 62305.
•Ensure all equipment meets the requirements of the appropriate electromagnetic compatibility standard.
•Ensure all apparatus covered by the Wireless Telegraphy Act meets regulations issued by Ofcom.
•Ensure all equipment and systems meet the requirements of BS 6701 and BS EN 41003.
•Ensure that all cable installations meet the minimum separation in BS 7671 and BS EN 50174.

710.150 ATEX DIRECTIVE:

All equipment and protective systems used in potentially explosive atmospheres shall comply with the ATEX Directive 94/9/EC of the European Parliament and the Council.
Equipment meeting the requirements of the Directive shall have the CE symbol clearly affixed to indicate compliance
All equipment, protective systems and components must bear the specific marking of explosion protection as required by the ATEX Directive 94/9/EC in addition to the CE marking.

710.160 FACILITIES FOR REMOVAL OF EQUIPMENT:

•De-coupling facilities shall be provided for all services connections to equipment and plant and be located adjacent to the equipment such that any removable section, cover or the complete unit can be readily removed or withdrawn without the removal or disturbance to large sections of adjacent services.
•Ensure isolation and drain down of any item of equipment without isolating large sections of the remaining system.

710.170 SOFTWARE:

Obtain on behalf of the end user all appropriate licences, permissions, copyright waivers, rights of use and the like from the owners of the software rights. Ensure that the end user is properly registered with

C0605 The New LMB Building Project A64
Electrical Specification GENERAL CONDITIONS
Revised Stage E Scheme Including Agreed VE

Deleted: Stage E Issue

the software supplier for support and appropriate updating. Ensure that application software is written in compliance with BS 7649.

710.180 EU DECLARATION OF CONFORMITY:

Provide an EU Declaration of Conformity prior to delivery to site.
•As requested by the CA
•For all equipment.
•For the following equipment:
The declaration shall state the following as a minimum:
•The manufacturer or his authorised representative.
•Description of equipment.
•The harmonised standard(s) that have been applied.
•The signatory who has been empowered to enter into commitments on behalf of the manufacturer.
•The last two digits of the year in which the CE marking was affixed.
•Where only a Declaration of Incorporation for component parts of the assembly can be provided advise all aspects to be considered to enable others to provide a Declaration of Conformity.

720.000 BUILDERS WORK

720.010 BUILDERS WORK PROVIDED:

•Where structural and/or architectural facilities or provisions, for engineering services are already indicated check that these are correct, satisfactory and adequate for the purpose and confirm same in writing to the CA.
Timescale:
•Within weeks of the award of contract (no) Refer to the Main Contract preliminaries.
•Where the preliminary builder's work facilities issued prior to the award of contract are not correct or insufficient advise the CA immediately and obtain further instructions.
•Where alternative equipment or materials has been offered that the CA has accepted and which subsequently varies the works in any way whatsoever, then undertake the redesign of the associated builder's work.

720.020 BUILDER'S WORK RESPONSIBILITIES:

•The requirements for and responsibilities with regard to builder's work items are in addition to that normally provided as is normal custom and practice in the building industry.
•Confirm and amplify any information provided by the CA.
•Provide builder's work information, appropriate to the stage of design development. Revise, supplement and/or issue final information, drawings/details for the actual requirements of the contract works.
•Provide fully dimensioned drawings showing both size and position of builder's work making due reference to the structural engineering and architectural final dimensioned detailed drawings.
•As approved by the CA Mark out on site, all cut holes and chases required, any pockets cast in concrete, any inserts, any built in sleeves or similar items.
•All builders work information shall be provided to comply with the programme and include sufficient time for the necessary approvals.
•All materials provided for fixing by others are to be included in the contract works cost and supplied in accordance with the programme.

720.030 SCOPE OF BUILDER'S WORK:

•Builder's work is
•included in the contract works.
•All builder's work to be carried out by the Main Contractor.
•Builder's work excludes drilling and/or plugging walls, floors, ceilings etc., for fixings for services and such work is included in the contract works.
•Provide the following as necessary for the complete installation
•all supporting steelwork
•brackets, clamps and fixings
•Pipe, duct and cable sleeves through walls, floors, slabs etc.
•Supply all sleeves and hand-over to others for fixing
•Making good around sleeves to provide correct fire barrier shall be by
•Puddle flanges
•Supply all puddle flanges and hand-over to others for fixing
•Pipe and duct penetrations through the building envelope
•Carry out final weatherproof flashing over pipe or duct angle flange
•On ducts through roofs the provision and fixing of timber or metal up-stands will be by others
•Concrete bases and plinths
•Provide all necessary dimensions and details for work by others.
•Preparation of bases to required tolerances for equipment with pockets for holding down
•Supply and install holding down bolts
•Where equipment fixings are drilled into bases, undertake drilling and "making good" after installation.

•Making good around holding down bolts after installation
•By others.
•Included in the contract works
•Inertia pads and inertia block bases
•Provide all necessary dimensions and details for work by others.
•Where neoprene inertia materials are to be provided in concrete bases supply and hand over materials to others for correct fixing and final construction of base.
•Hand over framework for inertia block bases (including holding down bolts and AV mounts) for others to fix and fill the inertia block with concrete and make good.
•Include filling the inertia block with concrete and making good.
•Steelwork bases
•Provide all necessary dimensions and details for work by others.
•Supply and hand over steelwork bases, plinths, channel support steels for fixing and weatherproofing by others.
•Supply and install steelwork bases, plinths, channel support steels for fixing and weatherproofing by others.
•Secondary steelwork for support
•Provide all necessary dimensions and details for work by others.
•Provide suitable secondary steelwork for permanent fixing by others onto the main building steelwork frame or concrete frame required for the support of engineering services
•Provide suitable secondary steelwork and undertake permanent fixing for the support of engineering services
•Preparation of holes and making good around fixing shall be by others for cast in fixings.
•Anchor points and guides
•Provide all necessary dimensions and details for work by others.
•Supply and hand over to others for fixing permanently to the building structure
•Anti-vibration mountings
•Install Anti-vibration mountings
•Undertake direct drilling fixings if applicable.

720.040 MARKING OUT OF BUILDER'S WORK HOLES ON SITE:

•If approved by the CA, mark on site actual locations of minor non-structural holes through walls, partitions, floors etc and also chases in non fair-faced walls, etc for conduits, pipes and the like in preference to providing drawings of such builder's work requirements. The CA is to be given the opportunity to inspect prior to work being carried out.
•The CA shall inspect all marking out on site prior to work commencing.
•Establish a method of working with the CA to ensure the works may proceed without hindrance.
•The maximum size for a non-structural hole for marking on site shall be

720.050 BUILDER'S WORK INFORMATION TO BE PROVIDED:

•All builder's work drawings shall be fully dimensioned.
•Builder's work drawings to be provided shall be as follows:
•Details of all bases for plant formed in concrete, brickwork or blockwork

•Details of all attendant builders work, holes, chases, etc for conduits, cables and trunking etc and any item where access for a function of the installation is required
•Details of all types of purpose made brackets for supporting service or plant/equipment
•Details of all accesses into ceilings, ducts, etc
•Details of all special fixings, inserts, brackets, anchors, suspensions, supports etc
•Details of all sleeves, puddle flanges, access chambers
•Submit all necessary load and thrust calculations with drawings/details.

720.060 STRUCTURAL STEELWORK:

•No steelwork shall be cut, drilled or welded without written approval from the CA.

•The cutting and drilling of structural steelwork shall be agreed with the CA prior to the commencement of the work and shall require application in writing with all necessary drawings/details.
•Fixings to steelwork shall be
•the approved clamp type
•All fixings shall be of the correct size and type for the fixing load applied and the type shall be approved prior to commencement of the works.

720.070 PRE-CAST CONCRETE:

•Holes may not be cut in precast concrete without written approval from the CA.
•Under no circumstances will holes be cut in pre-stressed concrete.

740.000 COMMISSIONING AND TESTING

740.010 DEFINITIONS:

Where used in the documentation the following definitions shall apply and shall be interpreted as such:
•Commissioning: The advancement of an installation from the stage of static completion to working order to the specified requirements
•Testing: The measurement and recording of specified quantifiable characteristics of an installation or parts thereof and includes off site testing.
•Setting to work: The process of setting a static system in motion
•Regulation: The process of adjusting the rates of fluid flow in a distribution system to achieve specified values
•Environmental testing: The measurement and recording of internal environmental conditions
•System proving: the measuring, recording, evaluating and reporting on the seasonal performance of the systems against their design values
•System demonstration: Demonstrating the capability of the installation to achieve and maintain the specified performance criteria
•Fine-tuning: The adjustment of the system where usage and system proving has shown such a need and includes the re-assessment of design values and control set points to achieve the required system performance.

740.020 PROGRAMME:

Prepare comprehensive programmes for the pre-commissioning checks, setting to work, testing, commissioning, system proving and environmental testing of the contract works.
Timescale:
•Within weeks of contract appointment (no) 4
Review and update the commissioning programme at agreed intervals and if necessary revise and amend the programme to suit the progress of the contract works.
•Due account shall be taken of any phasing requirements.

740.030 COMMISSIONING SPECIALIST:

•Employ an independent company who specialises in testing and commissioning of building services to undertake the following:
•All commissioning and testing activities associated with the contract works
•Supervision of works testing
•Submit with the tender details of the independent company to be employed.
•The commissioning specialist shall be a member of The Commissioning Specialists Association (CSA).

740.040 COMMISSIONING AND TESTING:

When the contract works or parts thereof are ready for testing and commissioning notify the CA in writing.
All necessary facilities shall be provided to enable tests to be witnessed and inspections carried out including all necessary instruments and recorders to monitor systems during commissioning system proving and environmental testing.
Provide information where access is required into ceiling voids, service risers etc and ensure these points are not closed up until the commissioning and testing is complete.
Where commissioning, testing, balancing, adjustment, is undertaken in an area of the building taken over and occupied by the Employer, then take all necessary precautions against and be responsible for any damage caused whilst working in such areas for that purpose.
Prior to witnessing and inspection by the CA the contract works shall be fully tested, commissioned and be fully operational

Where portions of the work are required to be commissioned and tested separately, then upon final completion, demonstrate to the CA that all the several portions are capable of proper simultaneous operation in accordance with the requirements of the specification.
If testing demonstrates that the plant and equipment is not properly installed and/or not functioning correctly carry out such remedial measures and adjustments as may be necessary and repeat the commissioning and testing procedure to the satisfaction of the CA.
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 are provided prior to commencement of commissioning
Undertake to:
•Commission, test, regulate and set to work the installations that form the contract works.
•Prepare comprehensive programmes, commissioning plans, schedules and method statements and procedures supported by risk assessments for the pre-commissioning checks, setting to work, commissioning, system proving and environmental testing of the contract works.
•Comply with the requirements of the Building Regulations (Approved Document Part L2) for the inspection and commissioning of the building services systems. Prepare all necessary submittals including commissioning plans and reports. Obtain all compliance approvals from the building control bodies.
•Provide all specialist personnel including manufacturer's representatives and coordinate their activities, together with providing any attendance required.
•Prior to commencement of the works submit to the CA for approval sample pro-forma for the various commissioning record and certification documentation.
•Provide reports detailing progress of testing and commissioning activities at intervals agreed with CA.
•Maintain a diary/log of significant commissioning and testing activities.
•Measure and reconcile noise levels at agreed locations to verify compliance with design criteria.
•Submit to the CA all certification documents prior to any system being offered for final acceptance
•Confirm in writing to the CA that each installation has been correctly tested and commissioned and that the performance requirements can be achieved.
•Ensure all certification is attained and witnessed as necessary for inclusion in the record documentation.
•Submit a report for every test, demonstration, balance or commissioning activity witnessed, together with an engineering appraisal on the performance, either on or off-site.
•Co-ordinate and liaise with the Employer's representative.
Maintain on site full records of all testing, commissioning and performance testing.
The extent and proportion of results to be witnessed by the CA will be at the discretion of the CA.
•The CA will
•examine subsequent to setting to work and regulation of the contract works the results of the commissioning and the documentary records thereof.
•only witness test proceedings to establish a level of confidence in the commissioning results being presented.
•confirm recorded results
•determine if the specified requirements have been satisfied.

740.050 STATIC TESTING:

Progressive static testing shall include the following tests, but other tests may be required and witnessed:
•Insulation resistance
•Earth fault loop impedance
•Earth continuity
The CA shall be given the opportunity to witness all static tests.
Advance notice of the tests shall be given to the CA.
Timescale:
•days prior to test (no) 5

740.060 PRE-COMMISSIONING CHECKS:

Ensure all pre-commissioning examinations and tests have been undertaken and that each system, including components, or item of equipment is complete and in a safe condition prior to start-up.
All necessary notices shall be displayed.

740.070 FUEL FOR TESTING:

Fuel for testing and operating the contract works shall be
•included within the contract price and due allowance made within the tender

740.080 SYSTEM DEMONSTRATION:

•Subsequent to the completion of all testing and commissioning to the satisfaction of the CA and when directed operate the plant and demonstrate that the overall systems function correctly in accordance with the requirements of the specification.
•During this period be responsible for the recording of results and the operation and maintenance of the plant.
•Provide the following:
•An operational report of the demonstration
•Schedule of the conditions maintained within the space for a period of
•Hours

740.090 PLANT AND EQUIPMENT PERFORMANCE TESTING:

Where stated elsewhere plant and equipment shall be tested at the works of the manufacturer or in a recognised and approved testing facility to demonstrate the performance complies with the stated and specified duties.
These tests shall be in addition to works tests as stated elsewhere.
Performance testing shall demonstrate but not limited to the following:
•Full, partial and minimum load
•Response to load change
•Efficiency
•Noise levels
The tests shall be conducted to simulate design conditions and all ancillary plant and equipment needed to support the tests together with all instrumentation shall be provided and included in the contract cost.
Upon successful completion of the performance tests the plant and equipment shall be thoroughly cleaned and returned to its new condition and correctly packaged for delivery to site.
Test certificate records of the tests shall be issued to the CA as stated elsewhere.

740.100 INSPECTIONS AND TESTS:

Submit schedules indicating those parts of the contract works for which inspections and tests are required to substantiate conformity with the specification.
Should any alternative item be proposed that does not carry appropriate certification, ensure independent testing is carried out at no expense to the contract works to confirm compliance.
Provide 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 details for corrective action.
Maintain records of all specified inspections and tests performed including third party and works testing.
Maintain all records on site for inspection.

740.110 TEST CERTIFICATES AND RECORDS:

Ensure that test certificates include:
•project title

Deleted: Stage E Issue

•details and date of test
•instruments used, serial numbers, calibration dates
•signature of those witnessing test
•installers name
•specific location of the item in the contract works
The number of copies of each test certificate to be issued to the CA
•(no) Refer to the Main Contract preliminaries.
•Time scale Refer to the Main Contract preliminaries.
•within working days of the test (no) Refer to the Main Contract preliminaries.

740.120 WORKS TESTING:

•All costs of such tests
•All expenses of the CA to attend inspections and witness tests at the works of the manufacturer or other location away from the site.
•Number of persons to be included shall be (no) Refer to the Main Contract preliminaries.
Where required provide method statements supported by risk assessments detailing the procedures for carrying out the tests.
Notify the CA and all other parties in advance of such tests and provide for approval a programme for the visit, procedures for inspections and testing to be undertaken.
Timescale:
•weeks in advance of works tests (no) Refer to the Main Contract preliminaries.
All ancillary plant and equipment needed to support the tests together with all instrumentation shall be provided and included in the contract price.
Should the tests indicate non-compliance with the specification submit immediately details of the non-compliance and proposals for corrective action. No additional costs or extension to the programme will be allowed for re-testing or other non-compliance corrective action.
Signed certificates of tests carried out at the manufacturer's works for any items of plant shall be forwarded to the CA prior to delivery of equipment to site.
Timescale:
•within working days of the tests (no) Refer to the Main Contract preliminaries.
Attendance by the CA or otherwise during specified inspections or tests will not reduce the obligations or responsibilities under the contract.
Carry out all tests required by legislation.
Upon successful completion of the testing the plant and equipment shall be thoroughly cleaned and returned to new condition and correctly packaged for delivery to site.

740.160 ROTATING EQUIPMENT:

Immediately prior to practical completion adjust, ease and lubricate moving parts as necessary to ensure easy and efficient operation.
Ensure that temporary electrical supplies are provided to enable rotating plant items delivered and/or installed to be run at regular intervals to avoid damage or deterioration.
If temporary electrical supplies are not available ensure that rotating plant is hand-turned.

Deleted: Stage E Issue

800.000 DRAWING DEFINITIONS

800.010 GENERAL:

This section defines each of the main drawing types and outlines the extent and content of drawn information.

800.020 THE TENDER DRAWINGS:

Drawings produced to enable those tendering to interpret the design and to submit a tender for executing all or any part of the Works as defined elsewhere.
The tender drawings are

800.030 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 and with respect to any zoning.

800.035 SKETCH SCHEMATICS:

Line diagrams indicating main items of plant and their interrelationship in such detail as to illustrate the incorporation of the engineering services within the project as a whole.

800.040 DETAILED SCHEMATICS:

Line diagrams describing the interconnection of components in a system and showing the engineering principles. The main features of a schematic drawing are as follows
•The drawings include all the functional components that make the system work, such as ducts, pipes, cables, busbars, plant items, pumps, fans, valves, dampers, control devices, strainers, terminals, electrical switchgear and components, security and fire sensors and control equipment.
•Symbols and line conventions in accordance either with a recognised standard, such as ISO or BS, or a supplied legend.
•Drawings labelled with appropriate pipe, duct, busbar and cable sizes, pressures and flow rates.
•The drawings indicate components which have a sensing, control or measurement function.
•Identify major components on the schematic drawing for cross-referencing purposes.
•All data essential to testing and commissioning including:
•electrical fault levels.
•current ratings.
•short circuit capacities and tripping times.

800.050 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 nevertheless be feasible to install the services within the general routes indicated. It should be possible to produce co-ordinated working drawings or installation drawings without major re-routing of the services.
•Pipework and cable containment represented by single line layouts.
•Ductwork represented by either double line or single line layouts as required to demonstrate that the routes are feasible.
•Symbols and line conventions in accordance with either a recognised standard, such as ISO or BS, or supplied legend.
•The drawing should indicate the space available for major routing in both horizontal and vertical

planes.

800.060 CO-ORDINATED WORKING DRAWINGS:

Drawings showing the inter-relationship of two or more engineering services and their relation to the structure and building fabric. The main features of co-ordinated working drawings are:
•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.
•The drawings should make allowance for installation working space and space to facilitate commissioning and maintenance.
•The drawings should be spatially co-ordinated and there should be no physical clashes between components when installed. Critical dimensions, datum levels and invert levels should be provided.
•The spaces between pipe and duct runs down on the drawing should make allowance for the service at the widest point. Insulation, standard fittings dimensions and joint widths should therefore have been allowed for on the drawing.
•The drawing should indicate positions of main fixing points and supports where they have significance to the structural design of spatial constraints.

800.070 INSTALLATION DRAWING:

A drawing based on the detailed drawing or co-ordination drawing with the primary purpose of defining that information needed by the tradesman on site to install the works. The main features of installation drawings should be as per co-ordinated working drawings plus:
•Allowances should be made for inclusion of all supports and fixings necessary to install the works.
•The drawing should make allowances for installation details provided from manufacturer's drawings.
•Allowances should be made for plant and equipment. This includes any alternatives to the designer's original specified option that have been chosen.

800.100 MANUFACTURER'S DRAWING:

Drawing prepared by a manufacturer, fabricator or supplier for a particular project, and which is unique to that project. Examples include drawings for ductwork, pre-fabricated pipework, sprinkler systems, control and switchgear panels and associated internal wiring, pre-fabricated plant, customised plant and equipment.

800.120 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.
- The drawings should be to a scale not less than that of the installation drawings

•Locations of all mechanical, electrical and public health systems and components installed including ducts, pipes, cables, busbars, plant items, pumps, fans, valves, dampers, control devices, strainers, terminals, electrical switchgear and components, security and fire sensors and control equipment.
•The drawing should be labelled with appropriate pipe, duct and cable sizes, pressures and flow rates.
•The drawings should have marked on them 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.

800.130 BUILDER'S WORK DETAILS:

Drawing to show requirements for building works necessary to facilitate the installation of the engineering services.
Unless stated or agreed with the CA the following builder's work details can be marked out on site:
•Holes less than the threshold dimension stated elsewhere.
•Electrical socket and switch boxes.
•Openings that are best cut into blockwork and partitions.
Builder's work drawn information to be provided shall include:

Deleted: Stage E Issue

C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE
A64
GENERAL CONDITIONS

Deleted: Stage E Issue

•Details of all bases for plant formed in concrete, brickwork or blockwork to a scale of not less than 1:20
•Details of all attendant builders work, holes, chases, etc for conduits, cables and trunking etc and any item where access for a function of the installation is required to a scale of not less than 1:100
•Details of all purpose made brackets for supporting service or plant/equipment to a scale of not less than 1:50
•Details of all accesses into ceilings, ducts, etc at a scale of not less than 1:50
•Details of all special fixings, inserts, brackets, anchors, suspensions, supports etc at a scale of not less than 1:20

800.170 PLANTROOM SCHEDULES AND SCHEMATICS:

Provide good quality plant and switch room drawings, schedules, schematics and instructions and hang in the respective plant room or any other appropriate location or where directed by the CA. Protect surfaces of such information by
•Framing under glass or other rigid, transparent, cleanable and protective surface.
Hang using suitable fixings and provide backboards if necessary
A sample shall be submitted for approval to the CA prior to commencing production.
•Schematic drawings of circuit layouts showing:
•Location, identification and duties of equipment.
•Location of controls devices.
•Circuit layout.
•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.
•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.

810.000 RECORD DOCUMENTATION

810.010 STANDARDS:

Provide operating and maintenance manuals, system records and full documentation in accordance with the following standards
•BS 4737 and BS EN 50131-1 - Intruder alarm systems.
•BS 5839 - Fire detection and alarms in buildings.
•BS 6701 - Telecommunications equipment and telecommunications cabling.
•BS 7671 - Requirements for electrical installations.(IEE Wiring regulations)
•BS EN 62305 - Protection against lightning.
•Building Regulations (Approved Document Part L2)
•Comply with the requirements of the CDM Regulations in providing the appropriate input to the Construction Phase Plan and health and safety file for the contract works.

810.020 RECORD DOCUMENTS:

Provide:
•Record drawings and schedules.
•Plant room and switch room drawings, schedules and schematics.
•Operating and maintenance manuals.
•Blank maintenance logs.
•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 contract 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 that building log books contain all the information necessary to comply with the Building Regulations Approved Document Part L2.

810.030 RECORD DRAWINGS AND SCHEDULES:

•Prepare record drawings and schedules based on the As Installed Drawings maintained on site during the progress of the contract works.
•The scale of the drawings shall be not less than.
•Each record drawing shall show the following information:
•The name of the contract and, where appropriate, the zone or floor designation.
•Description of drawing, drawing reference and scale.
•Name and address of the installer and the consultant.
•Endorse all such documents
•'Record drawings'
•Where agreed with the CA certain detailed information may be provided in schedule form.
•Where portions of the work are to be concealed, draft copies of record drawings shall be supplied to the CA before the work is concealed in order to facilitate checking and examination.
•Prepare electrical drawings in accordance with BS EN 61082-1.
•Issue at practical completion the complete approved package of record drawings in the following numbers and format:
•CAD format on CD disk. Each CD shall be labelled and the CD jewel cases shall be labelled

identifying project title, issue date and index of contents.
•Number of sets of complete record drawings (no)
•'White' prints.
•Number of sets of complete record drawings (no)
•Provide reduced scale copies for inclusion in the operating and maintenance manuals as stated elsewhere.
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, emergency shut-off isolation locations, 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.
•Diagrammatic dimensioned plans and sections of each system or service showing sizes and locations of all ancillaries, plant, equipment controls, test points, and means of isolation etc. including any items forming an integral part of the engineering systems provided by others (such as plenum ceilings, builders' work shafts, chimneys etc.).
•Identification of all terminals/cables etc. by size/type and duty/rating as recorded from the approved commissioning results.
•Detailed wiring drawings/diagrams/schedules for all systems, including controls, showing origin, route, cable/conduit size, type, number of conductors, length, termination size and identification, and measured conductor and earth continuity resistance of each circuit. 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.
•Location and identity of each room or space housing plant, machinery or apparatus.
•Dimensioned plans and sections of plantrooms, service subways, trenches, ducts and other congested areas where in the opinion of the CA smaller scale drawings cannot provide an adequate record. Indicate the location, identity, size and details of each piece of apparatus.
•The scale of drawings to be
•Manufacturer's 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 etc
•alarm priority
•control specification reference
•any other such applicable parameters
•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.

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810.040 PLANT ROOM AND SWITCH ROOM DRAWINGS, SCHEDULES AND SCHEMATICS:

Provide good quality plant and switch room drawings, schedules, schematics and instructions and hang in the respective plant room or any other appropriate location or where directed by the CA.
•Protect surfaces of such information by
•Framing under glass or other rigid, transparent, cleanable and protective surface
•Hang using suitable fixings and provide backboards if necessary
•A sample shall be submitted for approval to the CA prior to commencing production.
•Schematic drawings of circuit layouts showing:
•Location, identification and duties of equipment
•Location of controls devices
•Circuit layout
•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.
•Emergency operating procedures and telephone numbers for emergency call out service applicable to any system or item of plant and equipment.
•Location of metering facilities.
•All other items required under Statutory or other regulations.
•Prepare electrical drawings in accordance with BS EN 61082-1.

810.050 OPERATING AND MAINTENANCE MANUAL SPECIALIST:

•Employ a specialist to prepare the operating and maintenance manuals.
•Submit details of the proposed specialist to the CA for approval
•Provide details of the proposed specialist as part of the tender submission
•Employ one of the following specialists to prepare manuals

810.060 PRESENTATION OF THE OPERATING AND MAINTENANCE MANUALS:

•Agree format and contents with the CA.
•Provide the operating and maintenance manuals in the following form:
•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.
•Electronic format stored on CD
•Provide copies of the operating and maintenance manual as follows:
•Draft copies for comment (no) Refer to the Main Contract preliminaries.
•Final copies for Client use (no) Refer to the Main Contract preliminaries.
•Provide a draft copy of the operating and maintenance manual to the CA for comment
Timescale:
•Weeks before the contract completion date (no) Refer to the Main Contract preliminaries.
•The draft copy of the manual shall conform to the final format required by the specification to enable all relevant comments to be made by the CA.

810.070 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.
•A photo-reduction of all record drawings together with an index. Reduced size of drawings to be
•Legend of all colour-coded services.
•Schedules (system by system) of plant, equipment, valves, etc., stating their locations, duties and

Deleted: Stage E Issue

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 manufacturer's guarantees or warranties, together with maintenance agreements offered by subcontractors and manufacturers.
•Copies of insurance and 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 lubrication for lubricated items including schedules of lubricant type, frequency, etc.
•Details of regular tests to be carried out (e.g. water analysis for pseudonomas.)
•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.
•Hospital Operational Policy.
•Back-up copies of any system software.
•Documentation of the procedures for updating and/or modifying software operating systems and control programmes.
•Instructions for the creation of control procedure routines and graphic diagrams.
•Details of the software revision for all programs 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.
•A provision for update and modification.

810.080 PROVISION OF INFORMATION:

•Co-operate with the specialist firm in the compilation of the manuals and provide them with copies of the following:
•Diagrammatic drawings of each system indicating principal items of plant, equipment, valves etc.
•Record drawings, together with an index.
•Plant room and switch room drawings, schedules and schematics, together with an index.
•Legend for all colour-coded services.
•Schedules (system by system) of plant, equipment, valves etc, stating their locations within the building, duties and performance figures.

•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.
•All manufacturer's guarantees or warranties.
•Copies of insurance and inspecting Authority certificates and reports.
•Schedules of all fixed and variable equipment settings established during commissioning.
•Back-up copies of any system software.
•Two back-up copies of all software items, as commissioned.

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900.000 COMPLETION AND HANDOVER

900.010 GENERAL:

This section details the requirements and procedures for completion and handover.

900.020 HANDOVER REQUIREMENTS:

As a pre-requisite to Practical Completion in respect of the contract works or part thereof, demonstrate to the satisfaction of the CA that:
•All the contract works are complete.
•With the exception of minor snags or limited defects as agreed with the CA that could be reasonably completed within an agreed programme without causing disruption to the Employer's use of the building or part thereof.
•All spares, keys, tools and other consumables as stated elsewhere have been supplied and handed over to the Employer.
•The instruction of the Employer's staff in the use and correct operation of the installation has been completed satisfactorily. In particular, safety devices and controls demonstration.
•All commissioning and testing completed
•including the issue of a final commissioning report signed by an approved competent person
•A complete demonstration of the contract works with fully functional operational controls tested has been undertaken in the presence and to the satisfaction of the CA.
•All necessary certification by the Employer's insurers has been completed.
•All approved record documentation including record drawings, operation and maintenance manuals, etc is issued
•All information required for the health and safety file is issued to the satisfaction of the Planning Supervisor.
The information shall include:
•A written description of plant operation.
•Control strategy/logic diagrams recording the final version of configuration software installed at handover.
•Details of system application software configuration.
•A points list including hard and soft-points (all points should have a unique mnemonic).
•A description of user adjustable points.
•Commissioning record details.
•Detailed data sheets for all control components and equipment.
•Wiring circuit details including origin, route and destination of each cable.
•Basic security access to the system.
•Comprehensive instructions for switching on, operation, switching off, isolation, fault finding and procedures for dealing with emergency conditions.
•Instructions for any precautionary measures necessary.
•Instructions for the routine operation of the control system including simple day-to-day guidance for those with limited technical skill.
•Instructions for servicing and system upkeep.
•A provision for update and modification.
•All necessary Statutory Authority approvals have been undertaken and written confirmation established
•Completion and issue of log books in accordance with Building Regulations.
•Air permeability test certificate in accordance with Building Regulations.
•Should adequate record documentation not be available Practical Completion will not be granted.

900.030 READING OF METERS:

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

900.040 RECOMMENDED SPARE PARTS:

Before Practical Completion submit to the CA a schedule of spare parts as stated elsewhere and recommend any that should be obtained and kept in stock by the Employer for maintenance of the installations included in the Works.
Time scale
•Weeks before (no) Refer to the Main Contract preliminaries.
State against each item the manufacturer's current price, including packaging and delivery to site.
Identify those items that are additional to those specified for inclusion as stated elsewhere.

900.050 INITIAL SUPPLY OF ADDITIONAL SPARE PARTS:

Submit to the CA a quotation, priced in detail, for the initial supply to the Employer of the additional spare parts identified elsewhere and including for:
•Checking that each spare part is suitable for the replacement of the corresponding part supplied with the item of plant or equipment.
•Checking receipt, marking and numbering in accordance with the schedule of spare parts.
•Referencing to the plant and equipment list in the operation and maintenance manual.
•Painting, greasing, etc. and packing to prevent deterioration during storage.
•Time scale
•Within weeks of request (no) Refer to the Main Contract preliminaries.

900.060 RECOMMENDED TOOLS:

Prior to Practical Completion submit to the CA a schedule of tools and portable instruments as stated elsewhere and recommend any that should be obtained and kept in stock by the Employer for maintenance of the installations included in the Works.
Time scale
•weeks before Practical Completion (no)
•State against each item the manufacturer's current price, including packaging and delivery to site.
Identify those items that are additional to those specified for inclusion as stated elsewhere.
•Submit to the CA a quotation, priced in detail, for the initial supply to the Employer of the additional tools identified under the clause headed 'recommended tools'.
•Include for the following.
•Checking that each item is suitable for the intended application.
•Checking receipt, marking and identifying.
•Referencing, where appropriate, to the plant and equipment list in the Operation and Maintenance Manual.
•Protecting, greasing, etc. and packing to prevent deterioration.
•Providing a suitable means of storing and securing same.
•Time scale
•Within number of weeks of request Refer to the Main Contract preliminaries.

900.070 SUPPLY OF TOOLS:

Provide all tools, keys and portable instruments as detailed elsewhere prior to practical completion and additional items if so instructed by the CA.
Time scale
•Weeks before Practical Completion (no) Refer to the Main Contract preliminaries.

900.080 INSPECTION BY EMPLOYER'S INSURERS:

Where indicated elsewhere installations, equipment, plant or materials are to be inspected by a representative acting for the Employer's insurers.
The installations, equipment, plant or materials shall satisfy the insurance company's requirements in all respects.
•Inform the CA when the installation or equipment is ready for examination
•Provide a programme for the inspection and certification by the Employer's insurers.

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C0605 The New LMB Building Project A64
Electrical Specification GENERAL CONDITIONS
Revised Stage E Scheme Including Agreed VE

Deleted: Stage E Issue

•All necessary information shall be provided to enable the insurers to approve the design before manufacture.
•Arrange for the attendance of the insurance company's representative at agreed stages of manufacturer and installation.
•All necessary attendance, access and facilities for inspecting and testing as is required shall be provided.
•Certification shall have been received from the insurers before equipment or installations subject to inspection and certification will be accepted on behalf of the Employer.
•The order with the insurance company
•will be placed by the Employer
•All insurance company charges will be
•paid for by the employer
•included in the contract price
•all other costs associated with such inspections shall be included in the contract price.

900.090 TRAINING OF EMPLOYER'S STAFF:

Prior to 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.
•to the operational staff.
Submit to the CA for approval a detailed programme for the training of the Employer's staff.
Time scale
•Weeks before commencement of training (no)
•Employ the services of relevant specialists and suppliers for the purpose of training and instruction.
•Provide each person with a comprehensive set of teaching notes and diagrams.
•Be responsible for the correct operation and maintenance of the installation during such periods of instruction.
•All costs associated with the instruction of the Employer's personnel and required attendance following practical completion shall be included in the contract price.
•Following practical completion and occupation be available for a period as agreed with the CA to assist the Employer's personnel in the operation of the various systems together with the
•controls specialist
•commissioning specialist
Training
•Number of persons to be included for training is
•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.
•Provide training for the operation of the controls, monitoring or BMS installations as follows.
•Carry out initial training at the works of the controls supplier.
•Include hands on experience of equipment and software similar to the installation.
•Include instruction on the procedures for testing and routine inspection of sensors and actuators to enable the operator to assess the nature of faults and extent of remedial action required.
•Provide all appropriate reference and training manuals.
•Complete initial instruction prior to commissioning of the installed system.
•Provide site instruction on the installed system.
•Include for training operating staff (no)
•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.

900.100 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

910.000 MAINTENANCE

910.020 PROPOSALS FOR ANNUAL MAINTENANCE CONTRACT:

•Submit with the tender a supplementary proposal for an annual maintenance contract for the following:
Refer to the Main Contract preliminaries.

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P30 TRENCHES/PIPEWAYS/PITS FOR BURIED ENGINEERING SERVICES:

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide trenching and ducting for underground services

100.030 SYSTEM DESCRIPTION
Carry out the installation of underground services and building entry service points as detailed on the drawings. Install all trenching as detailed in the drawings and in accordance with manufacturer's instructions and industry practice.

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Install all road crossings using solid ducts buried in the ground and ensure that the duct extends at least 600mm beyond the pavement edge.

Install draw-ropes in all vacant ducts and leave coiled in the access chamber. Tie an oversized timber section (bigger than the duct aperture) to the rope to prevent the rope from being accidentally withdrawn.

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Install all ducts, duct access chambers, draw ropes, etc. associated with public utility telecoms services in strict compliance with this specification and the requirements of the Telco.

Install all duct access chambers with lids parallel or perpendicular to building lines and entirely within one surface type. Refer to Landscape Architect's details.

Install all duct access chamber lids in carriageway as heavy duty non-rocking type. Install all duct access chamber lids elsewhere as recessed non-rocking type capable of accepting specified landscape finish. Refer to Landscape Architects details.

100.060 SYSTEM DRAWINGS
2053-Z-(6-) series and 2053-Z-(5-) series

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¶
Install all duct access chamber lids in carriageway as heavy duty non-rocking type. Install all duct access chamber lids elsewhere as recessed non-rocking type capable of accepting specified landscape finish. Refer to Landscape Architects details.¶

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PART 3 SPECIFICATION CLAUSES SPECIFIC TO P30

300.000 GENERAL

300.010 UNDERGROUND PIPE DUCTS FOR SERVICE SUPPLY CABLES AND PIPES:
•Type Incoming HV supply cables
Requirements Bury cables direct, except at road crossings and building service entry points. Bed cables in sand bed, bury to adequate depths, lay cable with adequate radius bends and to suit all relevant Regulations, Statutory Requirements and NJUG requirements.

300.011 UNDERGROUND PIPE DUCTS FOR SERVICE SUPPLY CABLES AND PIPES:
•Type Incoming telecoms services
Requirements Install telecom ducts as detailed in the drawings and as required for each service. Bed ducts in sand bed, bury to adequate depths, provide draw ropes in all ducts, provide duct access chambers at all changes in direction, all bends to be slow radius. Install all services to suit all relevant Regulations, Statutory Requirements and NJUG requirements.

300.012 UNDERGROUND PIPE DUCTS FOR SERVICE SUPPLY CABLES AND PIPES:
•Type External lighting cables
Requirements Install all cables in ducts throughout their entire length. Install ducts as detailed in the drawings and as required for each service. Bed ducts in sand bed, bury to adequate depths, provide draw ropes in all ducts, provide duct access chambers at all changes in direction, all bends to be slow radius. Install all services to suit all relevant Regulations, Statutory Requirements and NJUG requirements.

300.013 UNDERGROUND PIPE DUCTS FOR SERVICE SUPPLY CABLES AND PIPES:
•Type External CCTV cables
Requirements Install all cables in ducts throughout their entire length. Install power and data services in separate ducts. Install ducts as detailed in the drawings and as required for each service. Bed ducts in sand bed, bury to adequate depths, provide draw ropes in all ducts, provide duct access chambers at all changes in direction, all bends to be slow radius. Install all services to suit all relevant Regulations, Statutory Requirements and NJUG requirements.

300.020 SPECIAL PROTECTION FOR SERVICES:
Install identification tapes directly above all services identifying service installed below. Install tape 150mm below finished ground level. Specification of tape as required by NJUG and relevant Regulations of Utilities Services.

V10 ELECTRICITY GENERATION PLANT

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide standby electricity generation plant and associated automatic control systems and fuel storage and distribution systems to provide standby power to selected building systems in the event of mains power failure.

100.020 DESIGN PARAMETERS
BS 7671: 2001 - Requirements for Electrical Installations.
Engineering Recommendation G.59/1 - Recommendation for the Connection of Embedded Generating Plant to the Regional Electricity Companies' Distribution Systems.
The Electricity Supply Regulations.

100.030 SYSTEM DESCRIPTION
Design, supply, install, commission and set to work 2No. 2250kVA, 400V, 50Hz standby diesel generators c/w sound attenuation, combustion air ventilation system, exhaust system, control system suite, bulk and day fuel storage tanks and fuel transfer system, and all necessary interconnecting cabling, pipework, etc.

The generators and all associated equipment will be located in purpose built rooms within the Energy Centre

The system shall comprise:
- 2No. 2250kVA, 400V, 50Hz standby diesel generating sets located in sound attenuated room in Energy Centre operating in N + 1 configuration;
- Bulk fuel storage tanks located at Ground floor in Energy Centre providing 24 hours continuous operation of both sets at 100% load;
- Day fuel tanks within the generator room;
- Duty and standby fuel transfer system;
- Acoustic attenuation system;
- Combustion air ventilation system;
- Exhaust system;
- Control system suite;

Generating Sets

- water cooled, turbo-charged, 16 cylinder, diesel engines coupled to brushless alternators, prime rated to 2250kVA/1800kW, 3-phase, 400V/230V, 50Hz, 1500rpm, 0.8p.f.;
- 10% overload available 1 hour every 12 hour period;
- minimum 60% single load step pick-up;
- engine water jacket heater;
- factory tested.

Generator Room

- purpose built room located in Energy Centre;
- generator room floor level approx. 3.5m below grade, plant access via knock-out panels in Energy Centre wall or via air intake/discharge wells at roof level;
- sound attenuation system to meet Planning Condition and as set out in Sandy Brown Associates "Standby generator installation Acoustic criteria specification" included in Appendix 4 of this specification;
- intake and discharge air via wells to roof level at front and rear of generator room;
- sound attenuators located in wells and at roof level of Energy Centre. Refer to Mechanical drawing numbers 2053-Z-(59)-707 and 2053-Z-(59)-707a for attenuator schedules;

- ventilation fans within generator room to provide adequate combustion air;
- demountable panels to front of room for generating set removal;
- all builders work shall be undertaken by the Main Contractor. The Generator Specialist Sub-Contractor shall fit out the generator rooms with all necessary sound attenuation, cabling, pipework, etc.

Fuel Storage and Transfer System
- suitably sized double-skinned vertical bulk diesel storage tank(s) to provide fuel for a minimum of 24 hours operation of both generating sets at 100% load, located in open-air compound at ground floor level of Energy Centre;
- 8 hour (or 800 litre, whichever is greater) day tanks within generator room;
- duty and standby transfer pumps and pipework between bulk storage tank(s) to day tanks and to 1No. LTHW boiler plant, located in boiler room area of Energy Centre;
- double skinned bulk tanks and interconnecting pipework throughout;
- remote fuel fill points for bulk tanks;
- allow for first fill of bulk fuel tank(s).

Exhaust System
- reactive/absorptive primary and secondary exhaust silencers within plant room manufactured in mild steel with heat resistant paint, to each generator;
- double skinned, fully welded exhaust pipes manufactured in schedule 40 black steel with heat resistant paint from generator room to adjacent Plant Tower via high level gantry and rising to exhaust stack at roof level in Plant Tower.
- Sound attenuation will be required to meet Planning Condition and as set out in Sandy Brown Associates "Standby generator installation Acoustic criteria specification" included in Appendix 4 of this specification.

Control System Suite
- factory built cubicle type control and synchronising panel to Form 4 Type 6 segregation as defined by BS EN 60439-1, control and switching equipment in separate sections;
- control and synchronising panel c/w motorised ACB changeover to allow both sets to operate in parallel and to select output, i.e. building or load bank;
- mains fail sensing circuit inputs from main switchboards;
- microprocessor based control and diagnostic system;
- control and indication facilities;
- integral meters and measuring devices;
- ventilation fan controls;
- system to be compatible with and linked to building BMS system via RS485 connection.

Additional Items
- system design including acoustic performance;
- project management throughout from design to completion;
- factory witness test for CA or representative;
- site commissioning test;
- on site training for Client's maintenance staff;
- 1st year service.

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Deleted: auto-transfer switches (ATS)
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Deleted: - G59 protection to allow synchronising with mains on restoration of mains power;
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Deleted: - 2000kW, 400V, 50Hz resistance load bank, located at roof level of Energy Centre;
- Sound attenuation will be required to meet Planning Condition and as set out in Sandy Brown Associates "Standby generator installation Acoustic criteria specification".

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

210.000 PIPELINES

210.010 GENERAL:
Comply with work section general clauses reference Y10.1000 and those detailed below.

210.020 STEEL PIPES AND FITTINGS:
- Type Double-skinned.
- Application Fuel transfer system.
- Fluid conveyed fuel oil.
  - Working pressure to suit manufacturer's recommendations.
  - Working temperature to suit manufacturer's recommendations.
- Carbon steel pipes to BS 1387
  - Heavy, black - reference Y10.2010A
- Carbon steel fittings to BS 1387
  - Reference Y10.2020A
- Carbon steel fittings to BS 1965-1
  - Heavy weight - reference Y10.2060A
- Fittings, grooved for mechanical joints
  - Black steel - reference Y10.2080B
- Compression couplings to BS EN ISO 8434
  - Steel - reference Y10.2215A
- Jointing materials
  - Circular flanges
    - Welding flanges - reference Y10.3010A
    - Screwed flanges - reference Y10.3010B
  - Jointing rings for circular flanges
    - Non-metallic flat for flanges to BS EN 1092-1 - reference Y10.3020A
    - Metallic for flanges to BS EN 1092-1 - reference Y10.3020B
  - Screwed joints to BS 21
    - Paste and hemp and PTFE tape - reference Y10.3030A
    - PTFE tape - reference Y10.3030B
    - Where chemical cleaning is required - reference Y10.3030C
  - Union connections
    - Railroad pattern - reference Y10.3040A
    - Navy pattern - reference Y10.3040B
  - Welding rods
    - Reference Y10.3050A
  - Use press fitting jointing system for thin walled carbon steel pipe.
    - Jointing equipment for press fitting jointing system - reference Y10.3125
  - Mechanical joints, grooved steel pipes
    - Reference Y10.3140A
  - Mechanical joints, plain end steel pipes
    - Reference Y10.3150A
  - Flexible couplings, sleeve type
    - Reference Y10.3170A
  - Flexible flange adapters, sleeve type
    - Reference Y10.3180A

210.050 PLASTICS PIPES AND FITTINGS:
- Type Double skinned.
- Application Fuel oil transfer system.
- Manufacturer Durapipe Fuel System Type PLX

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  - Or approved equivalent
- Fluid conveyed Fuel oil.
  - Working pressure To suit system requirements.
  - Working temperature To suit system requirements.

210.070 PIPEWORK ACCESSORIES:
- Pipe rings and clips
  - Steel pipework - reference Y10.3200A

210.080 GENERAL WORKMANSHIP
- Appearance - reference Y10.4010
- Spacing - reference Y10.4020
- Gradients - reference Y10.4030
- Air venting requirements
  - Automatic air vents - reference Y10.4040B
- Drain requirements - reference Y10.4050
- Expansion and contraction - reference Y10.4060
- Pipe fittings
  - Bends/swept tees - reference Y10.4070A
  - Elbows/square tees - reference Y10.4070B
- Fabricated junctions - reference Y10.4080
- Fabricated fittings
  - Ferrous - reference Y10.4090
  - Non-ferrous - reference Y10.4100
- Pipes through walls and floors - reference Y10.4110
- Pipe sleeves
  - Reference Y10.4120A
  - Insulation carried through - reference Y10.4120B
- Pipe sleeves through fire barriers - reference Y10.4125
- Connections to equipment - reference Y10.4130
- Distribution headers - reference Y10.4140
- Temporary plugs, caps and flanges
  - Reference Y10.4150A.
- Flanged joints general - reference Y10.4160
- Dissimilar metals - reference Y10.4170
- Pipe rings and clips - reference Y10.4180
- Anchors - reference Y10.4190
  Location
- Slide guides - reference Y10.4200
  Location
- Pipe supports - reference Y10.4210
- Support spacing - reference Y10.4220
- Isolation and regulation
  - Reference Y10.4230A
- Maintenance and renewal - reference Y10.4240
- Cleaning - reference Y10.4250
- Non-ferrous components - reference Y10.4260

210.090 WORKMANSHIP, STEEL PIPEWORK:
- Welding, general
  - Class 1 - reference Y10.5010A
- Welded joints - reference Y10.5020
- Painting welded joints - reference Y10.5030
- Flanged joints - reference Y10.5040
- Screwed joints - reference Y10.5050
- Mechanical joints - reference Y10.5060
- Anchors

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- U-bolts - reference Y10.5070A
- Flanges - reference Y10.5070B

- Press fitting joints - reference Y10.5080
- Pipework painting - reference Y10.5090

210.120 WORKMANSHIP, PLASTICS PIPES:
- Solvent welded joints, PVC - reference Y10.8010
- Fusion joints, PE - reference Y10.8020
- Mechanical fittings, PE - reference Y10.8030
- Anchors, PVC - reference Y10.8040
- Jointing polybutylene pipes and fittings - reference Y10.8050
- Compression fittings on multi-layer pipes - reference Y10.8060

220.000 PUMPS

220.010 GENERAL:
Comply with work section general clauses reference Y20.1000 and those detailed below.
- Provide suitable duty and standby pumps to pump fuel from bulk fuel storage tank to day tank within generator container. All pumps to comply with relevant clauses of Mechanical Services Specification.

230.000 AIR DUCTLINES AND ANCILLARIES

230.010 GENERAL:
Comply with Work Section general clauses reference Y30.1000 and those detailed below.
- Supply and install ductwork as section U10 of Mechanical Services Specification.

241.000 FANS

241.010 GENERAL:
Comply with work section general clauses reference Y41.1000 and those detailed below.
- Supply fans as schedule reference 2053-Z-(59)-705

245.000 SILENCERS/ACOUSTIC TREATMENT

245.010 GENERAL:
Comply with work section general clauses reference Y45.1000 and those detailed below.
- Supply sound insulation equipment
  - as set out in Sandy Brown Associates "Standby generator installation Acoustic criteria specification", enclosed in Appendix 4 of this specification

245.020 SOUND POWER LEVELS:
- Provide equipment to achieve sound power levels as set out in Sandy Brown Associates "Standby generator installation Acoustic criteria specification", enclosed in Appendix 4 of this specification.

245.090 WORKMANSHIP
- General - reference Y45.3010
- Acoustic enclosures - reference Y45.3020
- Access to acoustic enclosures - reference Y45.3030
- Supports - reference Y45.3040
- Acoustic linings - reference Y45.3050
- Sound power level readings - reference Y45.3060
- Measure sound insulation of building elements - reference Y45.3070

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251.000 TESTING AND COMMISSIONING OF MECHANICAL SERVICES

251.010 GENERAL:
Comply with work section general clauses reference Y51.1000 and those detailed below.
- Carry out testing and commissioning as specified in section S41 and U10 of Mechanical Services specification.

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
- Supply conduit and cable trunking as specified in section V20.

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
- Supply HV/LV cables and wiring as work section V20.

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
- Supply support components as specified in section V20.

271.000 LV SWITCHGEAR AND DISTRIBUTION BOARDS

271.010 GENERAL:
Comply with work section general clauses reference Y71.1000 and those detailed below.
- Supply switchboards and distribution boards as work section V20.

272.000 CONTACTORS AND STARTERS

272.010 GENERAL:
- Supply contactors and starters as specified in work section V20.

274.000 ACCESSORIES FOR ELECTRICAL SERVICES

274.010 GENERAL:
Comply with work section general clauses reference Y74.1000 and those detailed below.
- Supply accessories for electrical services as section V20, V21 and V22.

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
- Supply earthing and bonding components as specified in section V20 and W51.

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20.

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20.

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
•Carry-out off-site painting and anti-corrosion treatment as work section V20.

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PART 3 SPECIFICATION CLAUSES SPECIFIC TO V10.

300.000 GENERAL

300.010 GENERATING SET APPLICATION RATING AND PERFORMANCE:
Provide alternating current generating set driven by a reciprocating internal combustion engine in accordance with BS 7698, with characteristics:
•Generated electricity supply.
  •3-phase, 4-wire, 415 Vac, 50 Hz.
•System earthing
  •TN.
•Generator.
  •Standard - BS EN 60034-22.
  •Synchronous.
•Mode of operation.
  •Limited-time.
    •Standby operation.
•Site criteria.
  •Land use.
•Operation.
  •Parallel operation by generating sets.
•Modes of start-up and control.
  •Automatic.
•Start-up time.
  •Short break set.
    •Power available in time (seconds) 15
•Installation features.
  •Fixed.
  •Self contained package.
•Additional installation features.
  •Inside.
  •Common bed plate with antivibration mountings.
•Site conditions.
  •Location Cambridge, UK.
•Power rating (kW) 1800
  •Rated frequency (Hz) 50
  •Power factor
    •0.8 lagging
•Kinds of power output
  •Limited-time running power.

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300.020 GUARDS:
Guard all exposed hot or moving parts in accordance with BS EN 292 and Health and Safety at Work Act, 1974.

310.000 PRODUCTS/MATERIALS

310.010 GENERATOR SET:
•Type Standby diesel
•Application Provision of standby power.
•Manufacturer and reference Cummins, Perkins, Caterpillar, FG Wilson, MTU.
  •Or approved equivalent
Provide generating set to BS 7698.

310.060 FUEL SYSTEM:
•Type Bulk Storage Tank

Install rectangular, internally stiffened c/w 110% capacity double-skinned tank with integral bund within open-air compound at ground floor level of Energy Centre.

- Install duty and standby pumps from bulk tank to day tank within enclosure.
- Install all necessary pipework, valves and fittings linking bulk tank and day tank system. All pipework to be provided with trace heating.

Tank capacity

- Fuel for running both sets at full load for 24 hours.

- Tank fittings
  - Outlet/jettison connection.
  - Weight operated 3-way fire valve to close fuel outlet to engine and open jettison outlet in event of fire.
  - Dial type contents gauge.
  - Overflow connection.
  - Injector spill and excess fuel return connection.
  - Filling connection.
  - Bolted access cover.
  - Drain plug.
  - Vent with gauze flametrap.
  - Provision for fitting float controlled fuel oil transfer pump switch and float-controlled high level alarm switch. Fit holes with gasket and bolted covers.
  - Fitted with hand-operated fuel transfer pump and flexible suction hose.
- Fuel filter

  Provide fuel filter, to BS 4552, with disposable filter elements, fitted in fuel inlet pipe.
  Ensure engine fuel system is isolated and cannot contaminate engine lubricating oil.

310.060A FUEL SYSTEM:

- Type Day Tank
- Tank capacity
  - Fuel for running both sets on full load for 8 hours.
- Tank fittings
  - Outlet/jettison connection.
  - Weight operated 3-way fire valve to close fuel outlet to engine and open jettison outlet in event of fire.
  - Dial type contents gauge.
  - Overflow connection.
  - Injector spill and excess fuel return connection.
  - Filling connection.
  - Bolted access cover.
  - Drain plug.
  - Vent with gauze flametrap.
  - Provision for fitting float controlled fuel oil transfer pump switch and float-controlled high level alarm switch. Fit holes with gasket and bolted covers.
  - Fitted with hand-operated fuel transfer pump and flexible suction hose.
- Fuel filter

  Provide fuel filter, to BS 4552, with disposable filter elements, fitted in fuel inlet pipe.
  Ensure engine fuel system is isolated and cannot contaminate engine lubricating oil.

310.070 ENGINE LUBRICATION:
Provide automatic engine lubrication using an integral gear driven pump. Provide coarse strainer on suction side and full flow filter on delivery side.
Ensure engine lubricating oil dipstick is accessible and marked to indicate maximum and minimum levels.
Provide engine sump with accessible drain point or drain pipe, fitted with plug.
Provide electric motor driven lubricating priming pump with automatic intermittent time control to keep engine bearings lubricated.
Ensure lubricating oil system enables the engine to run continuously for period indicated at any load

without replenishment. Ensure system can be replenished while engine is running.

310.080 ENGINE STARTING SYSTEM:
Provide 24 volt dc supply to start engine from any crankshaft position, by axial type starter motor engaging with flywheel. Ensure starter motor disengages automatically when engine starts or when de-energised.
Ensure starter motor is accessible and fit non-conducting protective shrouds to terminals.
Ensure system has sufficient capacity to initiate three starting cycles.

310.100 EXHAUST SYSTEM:
Provide exhaust system in accordance with manufacturer's recommendations and to meet characteristic requirements. Include all fittings, gaskets, joints and fixings.

- Material
  - Black mild steel.
- Exhaust system characteristics.
  - Noise limitations as specified by Sandy Brown Associates (refer to Appendix 4 of this specification).
  - Structure-borne sound and vibration insulation to be provided where appropriate.
  - Heat insulation and cladding.
    - Radiation protection shall be provided.
    - Penetration through walls shall be insulated and weatherproof.
    - Protection against contact shall be provided.
  - Expansion compensation.
    - Expansion bellows to be provided where necessary.
  - Prevention of water ingress to be provided to the pipe externally and to penetrations through walls.
  - Exhaust outlet configuration.
    - Protection against birds to be provided.
  - Gaseous emissions in accordance with local regulations

310.130 CONTROLGEAR AND SWITCHGEAR:
Type

- 1. ACBs mounted within cubicle in generator container;
- 2. Set mounted synchronising control panel.
-

- Application

- 1. Switching generator output between LV network feeders and loadbank;
- 2. Controlling generator operation.
-

Provide controlgear and switchgear for reciprocating internal combustion engine driven alternating current generating sets in accordance with BS 7698.

- Install Form 4, Type 6 cubicle switch panel within generator room comprising incoming ACB from generator output feeding paralleling switchboard.
- Mounting.

Synchronising panel - set mounted.

- Switchgear panel - cubicle type, floor standing.
- Enclosure.
  - BS EN 60439.
  - Anti-condensation heater.
- Starter battery system.
  - Battery capacity to suit generator requirements.
  - Battery type.
    - BS EN 50342.
    - BS EN 60095-2.
  - Battery housing and ancillaries.
    - Shielded connections.

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- Intercell.
- Acid resistant stand.
- Ventilated cubicle.
- Charger monitoring and control.
- On/Off switch.
- Indicator lights.
- Supply available.
- Charge fail.
- Monitoring.
- Battery voltage
- Charger failure
- Load switching device ACB
- Current rating (A) 4000

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- Utilisation category.

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- AC-1.
- Number of poles.
- 4.
- Fault current rating (kA) 50kA for 1 second

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- Short-circuit protection.
- Current limiting circuit breaker.
- Modes of control.
- Hand start/hand stop.
- Local electric start/electric stop.
- Remote start/electric stop.
- Automatic start/automatic stop.
- Key operated duty selector switch.
- 4 position.
- Standby-to-mains control.
- Additional facilities for standby control.
- Start delay.
- Engine start repeater.
- Engine warm up timer.
- Switch closure delay timer.
- Engine stop delay at no-load speed.
- Battery charger failure detection.
- Starter pinion repeater.
- Pre-heating system.
- Hours run counter.
- Automatic operation.
- Including recommended controls and instrumentation.
- Monitoring.
- Electrical instrumentation.
- Voltmeter to be provided in synchronising panel.
- Generator to be provided.
- Ammeter to be provided in synchronising panel.
- Frequency meter to be provided in synchronising panel.
- Generator.
- Mains.
- Hour run counter.
- Phase selection switch.
- Power factor indication to be provided.
- Load (kW) indication to be provided.
- Demand (kVA) indication to be provided.
- Reactive power (kVAR) indication to be provided.
- Battery.
- Voltage.
- Current.

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- Charging.
- Indicator lights.
- Mains normal.
- Mains supply contractor closed.
- Alternator supply contractor closed.
- Alternator protection tripped.
- Earth fault tripped.
- Engine protection.
- Low lubricating oil pressure.
- Alarm and load disconnection.
- Overspeed.
- Alarm and load disconnection.
- Coolant temperature.
- Alarm and load disconnection.
- Belt failure.
- Alarm and load disconnection.
- Coolant level.
- Alarm and load disconnection.
- Exhaust gas temperature.
- Alarm and load disconnection.
- Lubricating oil temperature.
- Alarm and load disconnection.
- Fire protection.
- Alarm and immediate shutdown.
- Cooling fan failure.
- Alarm and load disconnection.
- Cooling system failure.
- Alarm and load disconnection.
- Start failure.
- Alarm and load disconnection.

320.000 WORKMANSHIP

320.010 GENERATOR SET:
Install generator set in accordance with manufacturer's recommendations.
Ensure set is positioned to allow on-site maintenance and repairs, including barring facility where indicated. Provide access for removal of pistons and connecting rods.

320.020 FUNCTIONAL TEST REPORT:
Provide completely documented ISO standard functional test report in accordance with BS 7698-6.

320.030 ACCEPTANCE TEST-GENERATOR SET:
Carry out acceptance tests and provide Acceptance Test Report in accordance with BS 7698-6 and the specified requirements.

- Acceptance test.
- Manufacturer works.
- Using sets own switchgear.
- With resistive loadbank.
- At site of installation.

BS APPENDIX

BS 1387:1985
Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or screwing to BS 21 pipe threads

BS 1965-1:1963
Specification for butt-welding pipe fittings for pressure purposes. Part 1 Carbon steel.
Replaced by BS EN 10253-1:1999 but remains current

BS 21:1985
Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)

BS 4552-1:1979
Fuel filters, strainers and sedimentors for compression-ignition engines. Part 1 Methods of test

BS 7698-1:1993
Reciprocating internal combustion engine driven alternating current generating sets. Part 1 Specification for application, ratings and performance

BS 7698-12:1998
Reciprocating internal combustion engine driven alternating current generating sets. Part 12 Emergency power supply to safety devices

BS 7698-2:1993
Reciprocating internal combustion engine driven alternating current generating sets. Part 2 Specification for engines

BS 7698-3:1993
Reciprocating internal combustion engine driven alternating current generating sets. Part 3 Specification for alternating current generators for generating sets

BS 7698-4:1993
Reciprocating internal combustion engine driven alternating current generating sets. Part 4 Specification for controlgear and switchgear

BS 7698-5:1993
Reciprocating internal combustion engine driven alternating current generating sets. Part 5 Specification for generating sets

BS 7698-6:1993
Reciprocating internal combustion engine driven alternating current generating sets. Part 6 Test methods

BS 7698-8:1996
Reciprocating internal combustion engine driven alternating current generating sets. Part 8 Requirements and tests for low-power generating sets

BS EN 1092-1:2002
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 1 Steel flanges

BS EN 292-1:1991
Safety of machinery. Basic concepts, general principles for design. Part 1 Basic terminology, methodology

BS EN 292-2:1991

Safety of machinery. Basic concepts, general principles for design. Part 2 Technical principles and specifications

BS EN 60034-22:1998
Rotating electrical machines. Part 22 A.C. generators for reciprocating internal combustion (RIC) engine driven generating sets

BS EN 60439-1:1999
Specification for low-voltage switchgear and controlgear assemblies. Part 1 Type-tested and partially type-tested assemblies

V11 HV SUPPLY/DISTRIBUTION/PUBLIC UTILITY

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide a private 11kV distribution system to the site derived from the incoming supplies provided by the). Cambridge University Hospitals NHS Foundation Trust from their private network.

100.020 DESIGN PARAMETERS
The Electricity Supply Regulations.
BS 7671: 2001 - Requirements for Electrical Installations, including all amendments.

100.030 SYSTEM DESCRIPTION
Supply, install, test, commission and set to work the HV distribution system including incoming supplies, HV switchgear and metering, private HV ring circuit including ring main units (RMUs), transformers, interconnecting cabling and protection.

Incoming Supplies, HV Switchgear & Metering

- 2No. incoming 11kV ring feeders to the site, installed in a diverse route to the North and South of the site;
- 11kV feeds provided and installed and terminated to HV switchgear by others. Co-ordinate with supplier to arrange installation of feeders;
- incoming feeds terminate within a 5-section HV switchboard comprising:
- fixed pattern metal clad vacuum switchgear and protection;
- cast resin insulated busbar system;
- insulation voltage 28kV AC, 75kV BIL;
- fault rating 25kA for 3s;
- demountable vacuum circuit breakers;
- internal arc protection;
- current transformers (CT) and voltage transformers (VT) provided in separate chambers;
- multi function protection and control units;
- auto-changeover bus switch c/w PLC control;
- active operating mimic display;
- front access cable and vacuum test facility;
- integral HV metering facilities
- incoming 11kV feeds, 5 section switchboard and HV metering shall be supplied, installed, tested and commissioned as part of the contract works, and handed over for adoption by Cambridge University Hospitals NHS Foundation Trust. The switchgear shall be tested in accordance with Trust requirements and shall be demonstrated to their nominated engineer. Once adopted, the HV switchgear and switchroom will be under the control of the Trust.

HV Ring Circuits

- 1 No. private 11kV ring main circuit shall emanate from the HV switchboard via normally closed motorised vacuum circuit breakers,
- ring circuit shall operate as an open ring;
- each transformer shall be connected to the ring circuit via a ring main unit.

Ring Main Units

- non-extensible;
- IP54 outdoor environment;
- free standing
- 630A busbars;

- normal current rating 630A/200A;
- normal rated voltage 12/13.8kV;
- short time withstand current 16/21kA for 3s;
- ring cable earth switch, 16/21kA 3s;
- transformer earth switch, 16/21kA 3s;
- self-powered IDMT relay providing 3-phase overcurrent and earth fault protection, VIP300;
- ring switches and circuit breaker;
- integral ring switch cable test facility.

Transformers

- 4No. mineral oil-filled (ONAN) 2500kVA 11kV/433V (no load), 50Hz externally rated transformers;
- 3-phase (double wound);
- insulation level 12kV;
- power frequency 28kV;
- basic impulse voltage 75kV
- HV tappings ± 2.5% and ± 5.0%;
- 6% impedance;
- free-standing RMU (refer above);
- direct connection between RMU and transformer via oil insulated trunking. Coordinate requirements with vendor.
- ACB c/w earth fault protection outgoing feeder;
- outgoing feeder suitable for busbar trunking connection;
- allowance to be made within contract for factory witness test of transformers

Earthing

The service equipment earth buses shall be bonded to earth through a series of bare copper conductors installed minimum 600 mm below grade surrounding the transformers and the HV switchgear. This earth loop shall be continuous with the use of exothermic welds

The quantity of earth rods shall be dependant on soil resistivity and shall be determined during installation.

An earth loop shall surround the Energy Centre and lab building and be bonded to the transformer loop. Earth rods shall be 3m long and located between 7 and 20 metres apart.

The loop shall be bonded to the transformers and service entrance switchgear ground buses. The switchgear neutral bus shall be bonded once to the earth bus within the switchgear by the manufacturer.

One supplemental earthing bus shall be provided in each main electrical room for convenience. It shall be bonded to the loop surrounding the building and to a steel column.

The generators and paralleling switchgear shall be bonded to the earth loop surrounding the Energy Centre similar to the service switchgear. The paralleling switchgear neutral bus shall be bonded to the earth bus once, similar to the service switchgear.

The Energy Centre loop shall also be bonded to the Lab Building underground loop.

100.050 SYSTEM SCHEMATICS
2053-Z-(61)-001.

100.060 SYSTEM DRAWINGS
2053-Z-(61) series.

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20

262.000 BUSBAR TRUNKING

262.010 GENERAL:
Comply with Work Section general and Common clauses reference Y62.1000 and those detailed below.
•Supply busbar trunking as specified in section V20

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20

271.000 LV SWITCHGEAR AND DISTRIBUTION BOARDS

271.010 GENERAL:
Comply with work section general clauses reference Y71.1000 and those detailed below.
•Supply switchboards and distribution boards as schedule reference V20

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51.

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20

C0605 The New LMB Building Project V11
Electrical Specification HV SUPPLY/DISTRIBUTION/PUBLIC UTILITY
Revised Stage E Scheme Including Agreed VE

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282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
•Carry-out off-site painting and anti-corrosion treatment as work section V20

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PART 3 SPECIFICATION CLAUSES SPECIFIC TO V11.

300.000 GENERAL

300.010 HV SWITCHGEAR STANDARDS:
Comply with BS 159, BS EN 62271 and BS EN 60265, BS EN 60694 and BS EN 60298 and EATS 41-36 where applicable.

300.020 TRANSFORMER STANDARDS:
Supply transformers with a no load voltage ratio of 11000/433 volts, 3 phase to BS EN 60076 or BS 6436 as applicable.

300.030 TYPE TEST:
Provide certificates of verification of type test for short-circuit strength of components of each assembly. Ensure that drawings and other documents forming part of certificate are available prior to order being placed.
Certificates issued by The Association of Short-Circuit Testing Authorities (Inc) - ASTA - are preferred.

Deleted: 300.025 SF6 EQUIPMENT:¶
Ensure all new SF6 equipment allows for recycling of SF6 during maintenance or decommissioning.¶

300.040 SITE BUILT ASSEMBLIES:
Ensure that components of site assemblies are part of a proprietary system and type tested as appropriate. Install assemblies in accordance with manufacturer's drawings and instructions.

300.050 SITE MODIFICATION:
Do not make site alterations unless authorised. Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with type test certificate obtained for arrangement of components.

300.060 ELECTRICAL CHARACTERISTICS:
Ensure that electrical characteristics of component parts of assemblies are as indicated and apply when components are mounted in enclosures. Allow appropriate de-rating factors for effect of enclosures, other components and inter-connections.

300.070 SERVICE CONDITIONS:
- Maximum daily temperature - 40°C
- Average daily temperature - 30°C
- Average yearly temperature - 20°C
- Minimum temperature - -25°C
- Altitude not exceeding 1000 m above sea level.
- Supply voltage approximately sinusoidal.

300.080 CO-ORDINATION STUDY
Carry out a complete protection grading and setting calculation of the complete electrical distribution system, including all connected equipment.
Provide fault (short circuit) calculations for the distribution system as indicated on the drawings and a protective device co-ordination study to ensure that all protective devices are co-ordinated. Base the study on the actual devices and cable lengths installed.
Prepare the fault calculations and protective device study with a network analyser, digital computer or by written calculations, include complete fault calculations for each proposed source and combinations thereof including motor and generator contributions.
Present the fault calculations including the following:
- General description of calculations methods, assumptions and base per unit quantities selected.
- One line diagrams, source impedance data including X/Ratio and source system characteristics.
- Impedance diagrams, typical calculations, tabulations of calculation quantities and results, conclusions and recommendations.
- Calculation of three phase symmetrical fault currents at each switchboard, motor control centre and distribution board.
- Calculation of earth fault currents including the associated zero sequence impedance diagram.

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- Tabulations which include fault impedance, X/R ratios, asymmetry factors, motor contributions, short circuit MVA and symmetrical and asymmetrical fault currents.

Carry out the protective device co-ordination study including the following:
- Time-current co-ordination curves graphically indicating the proposed co-ordination for the system on log-log graph transparencies. Include on each sheet, a complete title and one line diagram identifying the specific portion of the system covered.
- A detailed description of each protective device identifying its type, function, manufacturer and time current characteristics and tabulation of recommended settings.
- Include on the curve sheets, system HV equipment relay characteristics, pertinent transformer, motor and generator characteristics including up to the largest outgoing LV circuit breaker/fuse for each distribution board. Indicate manufacturing tolerances clearly showing the final grading margin.

Submit the calculation
- As a bound report for approval by the CA, as indicated.

Upon approval by the CA, submit copies of the approved report.
Carry out adjustments of the protection settings to conform with the requirements of the report.
Ensure that discrimination is achieved throughout the network and select protective devices and settings accordingly.

310.000 PRODUCTS/MATERIALS

310.020 ENCLOSURES:
Supply an enclosure that provides protection in accordance with BS EN 60529 category IP4x

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- Secure all removable panels with
  - set studs and captive nuts.
- Marking
  Screw labels to outside of switchboards. Ensure that fixed panel or cubicle of withdrawable type units are fitted with label to identify circuit with wording identical to that on circuit breaker.

310.030 ENCLOSURES FINISH:
Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.
Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.
- Finish
  - Stove enamel finish.
- Colour
  - Manufacturer's standard colour.

310.040 SWITCHGEAR:
- Type – Ring main unit
- Application – Transformer protection
- Manufacturer and reference Merlin Gerin Ringmaster RN2c-T2
  - Or approved equivalent
- Standard - BS EN 60298.
- Electrical supply
  Nominal voltage (kV) 11
  Highest voltage (kV) 12
  Frequency (Hz) 50

Supply floor standing, metal clad, separately compartmented structure comprising switchgear, controlgear and components as follows.
- Type
  - Ring main unit
  - Non-extensible.
- Configuration
  - See drawing number 2053-Z-(61)-001

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- Electrical characteristics
  - Uninterrupted normal current rating 630A/200A
  - Short-time withstand current rating 16/21kA for 3s.

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•Rated insulation level 75/95kV
•Position
•Outdoor.
•Access - Rear.
•Cable entry
•Bottom.
•Outgoing cable
•Angled.
•Cable boxes
•Provide incoming cable boxes.
•Provide outgoing cable boxes.

Ensure all switches and circuit breakers are operated by independent mechanisms and have a facility for manual operation.

•Enclosure

Provide an enclosure to house voltage transformers and associated protection fuses and current transformers where indicated.
Secure access to enclosure by a padlock. Provide engraved danger notices detailing the switching procedure for safe isolation and earthing of the equipment before gaining access to the enclosure.

•Earthing bar

Securely fix an earthing bar made of copper to BS EN 13601 through full length of switchgear. Connect each end of bar to an earthing terminal. Bond all metalwork other than current carrying parts to earthing bar. Make provision for armouring and metal sheath of all incoming and outgoing cables to be bonded to the earthing bar.
Size earthing bar
•As manufacturer's standard.

Ensure continuity of protective circuits at all times.
Ensure all equipment is fully interlocked for safe operation. Fit warning notices to all devices that can be damaged or cause harm to personnel or equipment if operated incorrectly.

310.041 SWITCHGEAR:
•Type – HV switchgear
•Application – HV distribution and protection
•Manufacturer and reference - FKI Switchgear Eclipse

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•Or approved equivalent

1.1 Regulations, Specifications etc., to be Observed

The complete HV switchgear shall be in accordance with the particular requirements of this specification and in accordance with the latest edition and current amendments of the following British/European Standards:

BS	IEC	DESCRIPTION
	60044-1	Current transformers
	60044-2	Voltage transformers
	60056	Medium Voltage alternating current circuit breakers.
	60129	Specification for alternating current disconnectors and earthing switches.
	62271-100 62271-200	Specification for A.C. metal enclosed switchgear and control gear.
	60529	Specification for degrees of protection provided by enclosures (IP code).

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6231	Specification for PVC insulated cable for switchgear and control gear wiring.

Also equipment to comply with the requirements of ESI 41-36 Distribution switchgear for services up to 36kV (cable connected).

1.2 Type of Switchgear

Unless specified otherwise the circuit breakers shall be of the air insulated, metal clad, fixed pattern type arranged in single tiers to form complete switchboards and suitable for installation in a permanent indoor substation building. Earthing facilities for both circuit and busbars shall be available using separate integral fault rated earthing switches, with no separate earthing attachments. The type of equipment shall have been in similar proven service for a minimum of five years. It shall be constructed to provide a degree of protection no less than IP4x, as defined in IEC60529, integral segregation between compartments shall be to IP4x, but restricted to 2.0mm

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The design of the switchgear offered should have been fully tested in accordance with IEC62271-200 (was IEC298 Appendix AA), to show full compliance with all six categories listed. The fault current associated with these tests shall be 20kA for 1s.

1.3 Busbar and Busbar connections

The switchgear shall be equipped with a set of 3 phase flat copper busbars contained in a separate vermin proof compartment within the switchgear. Busbar and busbar connections of high conductivity copper shall have bolted joints and be fully insulated in an approved manner. Connections shall be arranged to avoid current flow along any threaded section. Joints shall be encapsulated once the equipment is installed on site. The busbars shall be suitable for extension with holes pre-drilled at both ends of the switchgear. The jointing faces of each busbar shall be tinned using an approved good quality tinning process. Every busbar joint shall be checked for resistance after erection to the satisfaction of the site representative.

1.4 Circuit breaker equipment

The circuit breaker units shall be of the vacuum type as specified in the particular requirements and shall be of robust construction designed to ensure the safety of all personnel. Circuit breakers not requiring handling equipment are preferred.

Vacuum interrupters shall be from the same manufacturer as the switchgear panels.

1.5 Ratings

Complete circuit breaker equipments shall be provided with short circuit and voltage ratings, which have been verified by an approved testing authority.
To allow for possible future requirements, the manufacturer should be able to offer equipment, which covers the following continuous, and short time ratings;

630A, 1250A, 2000A, 3150A with 16kA, 20kA and 25kA for 3s
1250A, 2000A, 3150A with 31.5kA and 40kA for 3s
3150A with 50kA for 1s

1.6 Operating Mechanisms

Circuit breakers shall be of the trip free type fitted with either manual or motor wound spring closing mechanisms as appropriate. Where specified spring charging motors shall be operated from 110V d.c.

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Spring operated closing mechanisms shall be provided with means for charging the spring by hand.

Each operating mechanism shall be provided with a shunt trip device and means of local manual tripping by a lockable push-button.

Checking vacuum breaker wear shall be an integral part of the interrupter and not by loose wear gauges.

Closing and tripping coils shall be operated from 110V d.c.

Double pole fusing shall be used throughout.

1.7 Operations counter

Operations counters shall be fitted to all circuit breakers to check the number of operations.

1.8 Position indication

Visible mechanical indication shall be provided to show whether the circuit breaker is OPEN or CLOSED.

Spring closing mechanisms shall have a visual mechanical indicating device to indicate that the spring is charged or free.

Indication shall be visible from the unit.

1.9 Auxiliary Switches

With each circuit breaker, there shall be supplied a minimum of 8 N/C and 8 N/O circuit breaker auxiliary switches, for indication, protection, metering, control, interlocking, supervisory etc.
For circuit breaker units, auxiliary switches shall be provided to interrupt the supply to the closing mechanism after the circuit breaker has closed and to complete the trip circuit when the unit is in the closed position.

All auxiliary switches shall be designed to make, break and carry the current of their associated circuit. The contacts used for all auxiliary wiring and control shall be strong and shall have a positive wiping action when closing.

All auxiliary switches and auxiliary wiring contacts shall be mounted in accessible positions clear of the operating mechanism and shall be adequately shrouded.

1.10 Interlocks

Shall be provided to prevent the following:

a) A closed circuit breaker being withdrawn from or inserted into the primary isolating contacts.
b) The closing of the circuit breaker unless correctly located in the ‘service’ or ‘isolated/test’ positions.
c) Circuit breakers from being placed in fixed housings of higher ratings. The interlock shall prevent damage to isolating contacts, bushings and shutters.

1.11 Earth bar and connections

In addition to the requirements of ESI Standard 41-36, an earth bar of no less than 50mm x 5mm hard drawn conductivity copper strip or equivalent shall be provided.

1.12 Testing facilities

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To enable functional tests to be carried out, provision shall be made for temporarily completing the secondary circuits when the circuit breaker is in the isolated/test position. Facilities shall be provided to enable primary and secondary injection tests to be performed. This shall utilise a flexible control ‘jumper’.

1.13 Safety shutters

Safety shutters of metal, effectively earthed, shall be provided to completely shroud the fixed isolating contacts for the circuit breaker busbar and feeder circuits when the circuit breaker is withdrawn. Particular attention should be paid to sealing of the shutter apertures.

Shutters shall operate automatically by the movement of the circuit breaker and shall be individually lockable in the closed position.

When breaker is withdrawn means shall be provided to manually open the shutters and hold open, during phasing out / testing. This feature shall not require the operator to lean into the equipment and shall be automatically overridden on re insertion of breaker.

1.14 Power cables, Cable boxes and Glands

The number and size of incoming and outgoing cables shall be as detailed in the individual data sheets.
All cable boxes required for receipt of HV power and multicore cables shall be supplied and fitted.
Cable boxes shall be suitable for receiving cables terminated with Raychem or equivalent dry type terminations.

Dedicated cable boxes are preferred for housing cables only. The cables can either enter the switchboard from above or below and to the rear of the board. Top entry control cables shall enter directly into the front relay compartment or alternatively into rear mounted LV compartments.

1.15 Heaters

When necessary anti-condensation heaters shall be fitted in all breaker cubicles. The heater supply shall be 230V a.c. and fed from an external 230V supply.

A double pole ON/OFF switch shall be provided for each busbar section.

1.16 Current transformers

Current transformers shall be provided as required for protection, metering, instrumentation or other purposes. They shall be in accordance with ESI Standard 41-36 and IEC60044 – Current Transformers.

The correct ratio, ratings and accuracy class shall be calculated for the required protection Current transformer primaries shall be of the ring type and have a short time rating equivalent to that of the associated switchgear.

1.17 Location & Mounting of CTs

Current transformers shall be air insulated and shall be installed on the side of the circuit breaker remote from the busbars. Current transformers shall be in the fixed portion of the switchgear.

The method of securing current transformers in position shall be such that undue mechanical pressure cannot be exerted on the transformer windings.

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Each current transformer shall bear a label giving the appropriate details and serial number. In addition, labels bearing this information shall be fitted on the outside of the equipment.

1.18 Connections

All connections from the secondary windings shall be brought out and wired to terminal blocks in the fixed portion of the switchgear.

The secondary winding of each single-phase current transformer and the star point of the secondary windings of each 3-phase group shall be connected to earth, at one point only through a separately mounted bolted link. The links shall be placed in an accessible position in the switchgear. The link shall be of the captive type.

1.19 Voltage Transformers

Voltage transformers, for protection, synchronising and metering purposes shall comply with the requirements specified in IEC60044 –2 Voltage Transformers.

The yellow phase of the secondary shall be earthed through a bolted link.

The voltage transformers shall be of the draw out type and fitted with close coupled primary fuses.

The voltage transformers shall have an earthed metal screen between primary and secondary windings.

1.20 Secondary Wiring

The switchgear controls shall be wired in 600/1000v grade PVC insulated multi-stranded copper wire complying with BS6231. The minimum size permitted shall be 2.5mm^2.

All wiring shall be identified Black on White insulated and numbered ferrules as shown on the manufacturers wiring diagrams.

All wiring shall be neatly run and either securely fixed in cleats, run in wiring troughs, bunched in neat forms, or run in non-corroding tubes.

The number of wires in any one bunch shall not exceed 20, where possible.

All wiring accessories of plastic material such as cleats, troughs, strapping, etc., shall be non corroding and resistant to flame propagation.

Bus wiring shall be run at the front of the cubicles and connections shall be so arranged that they are not disturbed when the tee-off connections are removed.

When provision is made for future equipment, wiring shall be permanently fixed and all ends of wire shall be secured and insulated.

Wiring to hinged panels/doors shall be run for a distance along the length of the hinge to allow the wires to be twisted rather than bent when the panel/door is swung.

If coloured cable is used each group of circuits shall be wired in the same distinctive colour.

1.21 Secondary Wiring Termination's

All wiring, including flexible conductors, shall be terminated with approved tinned crimped terminations. The size of termination shall be suited to the size of conductor.

Insulating sleeves shall be used on all crimp terminations to ensure adequate insulation between adjacent terminals.

C0605 The New LMB Building Project V11
Electrical Specification HV SUPPLY/DISTRIBUTION/PUBLIC UTILITY
Revised Stage E Scheme Including Agreed VE

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1.22 Fuses & Links

All fuses shall be of the high breaking capacity cartridge type, in accordance with BS88: Part 1 and 2 (fusing factor – Class 0.1).

Removable neutral links shall be in WHITE holders. All fuses shall be in BLACK holders.

Fuses and links shall be logically and consistently grouped, to assist isolation and identification and shall be clearly labelled to show function, voltage and current ratings.

1.23 Auxiliary Supplies

DC supplies for control and indication shall be provided for connection at one end of the switchgear.

All DC equipment shall operate satisfactorily within the voltage limits over the complete range of operating temperatures.

1.24 Multicore & Light Current Control Cables & Glands

Removable gland plates shall be provided for multicore and light current control cables.

The type of control cable with 2.5mm^2 stranded copper conductors shall be PVC insulated wire armoured and PVC served to ESI 09-6.

1.25 Terminal Rails

Terminals shall be of the spring-loaded insertion type with a hooked crimp blade fitted to each conductor.

Where a maximum continuous rating exceeding 30A is required stud type terminals should be provided. Covers of non-flammable transparent insulating material shall be provided for all stud terminal boards.

Links shall be provided to facilitate isolation of supplies to each cubicle.

All terminals shall be grouped according to their function and labels fitted showing the function and voltage of the group.

Terminal rails for control cables and secondary wiring shall be completely segregated from the main circuit.

Spare terminals shall be provided equal to approximately 20% of the terminals to which connections are made. Additionally, sufficient terminals shall be allowed at the top of the terminal rails to cater for all spare cores in control cables.

The space between adjacent rows of terminal rails shall be sufficient to allow for proper accommodation and making-off of wiring, i.e. a clear space of not less than 100mm between rows of terminal rails. They shall be mounted horizontally and where necessary, set obliquely to give access to terminations and to enable ferrule numbers to be read without difficulty.

1.26 Indicating Instruments & Metering

All indicating instruments shall be in accordance with IEC60051. The accuracy class of instruments shall be a class index 1.5 and the total scale length shall have a minimum value of 85mm.

Instrument scales shall be marked as recommended in IEC60051 and arranged so that the normal working indication is between 50% and 75% of full scale deflection.

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Ammeters shall be connected to all three phases via a selector switch. Voltmeters shall be connected across all phases via a selector switch. Labels stating the instrument function shall be fitted.

Voltmeter connections shall be protected by fuse links.

Covers shall be made of glass designed to reduce reflections and give a clear view of the scale and pointer. Instruments shall be flush mounted and the case finish shall be semi-gloss Black.
Metal cases shall be connected to the switchboard earth bar by green and yellow PVC insulated connections of 2.5mm^2 cross-sectional area.

1.27 Indications & Alarms

A fault trip lamp shall be provided for each circuit on which a control switch is fitted to indicate when a circuit breaker has tripped automatically. The indication shall continue until cancelled by the resetting of the trip relay.

Where remote indication of automatic tripping is required an initiating contact for this indication shall be provided.

A trip circuit healthy lamp push button shall be provided for each circuit breaker. The trip healthy circuit shall be designed so that it will not trip the circuit breaker under any conditions.

1.28 Tools

A set of special tools necessary for the overhauling maintenance and adjustments of the equipment supplied shall be provided for the switchgear.

Each set of tools shall be in the new and unused condition and shall be contained in suitably fitted steel boxes arranged for padlocking and supplied with padlock and key.

1.29 Works Tests

The following tests shall be performed at the manufacturer's works, to determine whether the materials and apparatus comply with the specification.

All instruments shall be calibrated at the expense of the Manufacturer by such body as may be approved.

Tests shall be arranged to represent the working conditions as closely as possible.

Electrical tests shall be carried out at a frequency of 50Hz unless otherwise approved and the r.m.s. voltage shall be measured or calculated in an approved manner.

Unless otherwise specified all tests shall be carried out in the manner prescribed in the relevant IEC or where no IEC applies, in a manner approved by the engineer.

i) Routine Tests
a) Power frequency tests in accordance with IEC.
b) Function tests on mechanically operated systems, such as interlocks, earthing devices and door operation.

ii) Circuit breakers
Tests in accordance with IEC60056

iii) Current transformers
Tests in accordance with IEC60044

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iv) Voltage transformers
Tests in accordance with IEC60186

v) Relays
Tests in accordance with IEC60255

vi) Type tests
Tests in accordance with the appropriate IEC/ESI Standards.

1.30 Off Loading and Erection

The Vendor shall include an optional price for the off-loading, positioning and erection of the switchboard at site

310.090 METERING UNIT:
Provide a dry type metering unit comprising an enclosure housing two wound primary current transformers and two single phase voltage transformers encapsulated in a moulding and totally enclosed in a weatherproof ventilated steel chamber.
Bolt and connect the metering unit to the outgoing circuit (Tee-Off) circuit breaker.
Provide a separate enclosure to house the current transformer secondary winding blocks, the voltage transformer output fuse cartridges, fuse bases and fuse carriers and instruments and meters

310.100 INSTRUMENT PANEL:
Provide a panel to mount the instruments and meters with degree of protection and finish to match the ring main unit.

310.110 PROTECTION DEVICES INTERPOSING RELAYS AND INTER-TRIPPING RELAYS:
- Type – Protection relay
- Application – Overcurrent and earth fault protection device
- Manufacturer and reference – Merlin Gerin VIP 300
  Standard
  - BS EN 61810.
- Housing
  Flush panel mounting type. House all protection relays, excluding motor protection relays, in draw out cases.
- Reset type
  - Automatic reset type.
- Contacts
  - One normally open and one normally closed contact.
- Protection relays features
  - IDMT 3 pole overcurrent with instantaneous high set elements - solid state type.
  - Restricted Earth Fault.
  - Undervoltage Sensing (Triple Pole Measuring Fixed Time Type).
  - Self-powered.
  - Micro-processor based.

310.120 CURRENT TRANSFORMERS:
- Standard
  - BS EN 60044-1, current transformers.
  - BS EN 60044-3, combined transformers.

Provide separate current transformers for each protection device and instrumentation. Ensure current transformers provide appropriate accuracy and are compatible with over current factors, characteristics, performance and VA rating required for satisfactory operation of protection devices, instruments and meters indicated. Ensure that current transformers are capable of withstanding maximum short-time withstand current of value and duration indicated for the switchgear. Provide test links in secondary connections of all current transformers to facilitate testing of instruments, meters and protection devices.

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310.130 VOLTAGE TRANSFORMERS:
•Application
Standard
•BS EN 60044-2, voltage transformers.
•BS EN 60044-3, combined transformers.
•BS 7729.
•Voltage transformer type
•Supply fully encapsulated and impregnated dry epoxy resin type.
Connect the secondary windings to outgoing terminals. Protect the secondary windings with cartridge fuses located outside the transformer enclosure, in an accessible position. Where more than one circuit is connected to the secondary winding, fuse each circuit separately. Connect the star point of the 3 phase and one side of the single phase secondary windings of the transformer to the switchgear earth bar through removable bolted links.

310.140 VOLTAGE TRANSFORMERS ENCLOSURE:
House voltage transformers and associated protection fuses in an enclosure provided with mechanical interlocks to prevent access at all times that the transformer is in service.
Provide engraved danger notices detailing the switching procedure to be adopted for safe isolation and earthing of the equipment before gaining access to the fuse/transformer compartment.

310.150 INSTRUMENTS AND METERS:
Standards
Comply with BS EN 60051-1 for voltmeters, ammeters, watt meters, frequency indicators and power factor indicators.
Comply with BS EN 62053-11 or BS 7856 for kWh meters, BS 5685 for kVA and kW maximum demand meters and polyphase reactive kVA meters and BS EN 62053-23 for VAR meters.
Protect wiring to voltmeters by separate fuses. Protect potential coils of watt meters, frequency indicators, power factor indicators and kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters by separate fuses.
Supply instruments and meters suitable for flush mounting and type, size and accuracy +/- 10%
Ensure that indicating scales for all other instruments comply with BS 3693. Supply so that normal indication is 50% to 75% of full scale deflection.
Completely segregate all instruments and meters in instrument compartments.
•Provide test link for energy meter testing within instrument compartment.

310.160 INDICATOR LIGHTS:
Supply lamps of same type throughout. Provide indicator lamps with lamp test facility.
•Supply interchangeable indicators for respective units.
•Include an integral double wound transformer for each lamp unit on ac indicator circuits.
•Include an integral ballast resistor for each lamp unit on dc indicator circuits.
•Provide neon indicators.
•Provide 24V indicator circuits for 30V lamps.
•Provide 230V indicator circuits and lamps.
•Protect wiring to indicator lamp units by separate cartridge fuses.
•Lens colour in accordance with BS EN 60073.

310.170 CONTROL SELECTOR SWITCHES:
Supply heavy duty, panel mounting, independent manual operation rotary type control selector switches in accordance with BS EN 60947-5-1.
•Operation - Fit key operated mechanical interlocks, key notation tbc
•Contacts
•Minimum continuous thermal rating of 10A and a make and break duty rating of 30A at 30V to 250V ac and dc.

310.180 TRIP/CLOSE SWITCHES AND SELECTOR SWITCHES:
Provide a panel mounted heavy duty, spring return trip/close switch on each circuit breaker fitted with solenoid or motorised spring closing mechanisms.
Ensure contacts have a continuous rating of 10A minimum at between 30V to 250V ac and dc, and make and break duty rating of 30A at 250V ac or dc for a minimum period of 3 sec.

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Remote trip/close control
•Supply a panel mounted selector switch to select circuit breaker for local or remote closing. Ensure that selection of remote or local closing does not prevent circuit breaker tripping under operation of local or remote trip switch.

310.190 EMERGENCY TRIP, TEST AND AUDIBLE ALARM SILENCING PUSH BUTTONS:
Supply mushroom actuator latch type emergency trip push buttons to BS EN 60947-5-1, coloured red, released by
•means of a key.
Supply flush button type test push buttons and audible alarm silencing push buttons.

310.200 HV CABLE BOXES AND CABLE TERMINATION:
Standard - The Electricity Association Specification ESI Standard 12-11.
Provide terminals and rigidly fix generally in accordance with BS 5372, ensure adequate access to the means of tightening the termination.

310.210 CONTROL, INSTRUMENTATION AND INDICATION CABLE TERMINATION BOXES:
Provide separate cable termination boxes or a segregated cable termination box for the termination and connection of remote control, instrumentation, intertripping, alarm and indication cabling associated with each circuit breaker. Where a segregated cable termination box is provided ensure the terminals within the box for each system are segregated. Ensure the terminals in each box are voltage segregated.
Locate the boxes at the back of the assemblies, ensure the boxes are clearly identified.
Group all remote control and indication wiring within the assemblies and connect to terminal blocks in the respective box.
Supply rail mounted type terminals blocks.
Provide the boxes with undrilled removable glanding plates.

310.220 COILS - VARIOUS APPLICATIONS:
Ensure coils for switching relays, contactors and other applications are capable of operating with a 20% drop in voltage without the armature or switching apparatus dropping out of position.

310.230 BATTERY CHARGER AND BATTERY UNIT:
•Supply a unit for
•Closing.
•Tripping.
•Input Supply
•230 V single phase 50 Hz.
•Operating temperature range
•-10°C - 55°C.
•Charger type
•Thyristor.
•Battery type
•Lead acid (sealed).
•Cubicle (sheet steel)
•Floor standing.
•Cable entry
•Top.
•Finish
•Acid and Alkaline resistant acrylic gloss paint.
•Colour
•Manufacturer's standard.
•Ventilation
•Natural.
•Facilities - MCB input protection; float charge.
•Battery over-discharge protection
•Fuses for battery protection.
•Automatic selection of boost charge.

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•Meters
Battery voltage.
Charging current (dual scale for float and boost).
•Output current
•Input voltage to the rectifier circuit.
•Lamp indications
Supply on.
Supply fail (monitor input terminals).
Float charge.
Boost charge.
No charge (when supply is on).
Battery voltage low.
Battery voltage high.
•Earth fault on output.
•Low electrolyte level.
•Alarms (connected to operate a relay with shrouded 230V 3A a.c. or 0.5A d.c. N/C volt free contacts, closed on any alarm, for remote indication circuit)
Supply failed.
No charge (when supply is on).
Battery voltage low.
Battery voltage high.
•Earth fault on output.
•Low electrolyte level.

310.240 LV FUSES:
Supply cartridge fuse links including fuse carrier, bases and associated components that comply with
•BS 88/BS EN 60269.
•BS 2692.

310.250 PADLOCKS:
Provide each switchboard with sets of padlocks.
•Allow for each switching unit to be locked in the off, earthed and/or isolated position.
•Manufacturer's standard.
•Provide manufacturer's standard padlocks.
Provide each padlock with two keys complete with disc and ring. Engrave disc and padlock with suitable legend.

310.260 TOOLS:
Supply a complete set of tools, including a torque spanner, necessary for maintaining all the equipment, in a lockable hardwood case.

310.270 TRANSFORMER:
•Type – Oil cooled, naturally ventilated
•Application – 11kV/400V
•Manufacturer and reference – Merlin Gerin Fast Trans
•Or approved equivalent
•Duty
•Electrical supply
HV (V) 11
LV (V) 415
Phases 3
Frequency (Hz) 50
•Rating
•Continuous rating (kVA) 2500

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•Transformer losses
Scheduled by manufacturer.
•Transformer impedance - scheduled by manufacturer.
•6%

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•Particulars of system
Supply transformers for systems with a highest voltage of 12kV, 3 phase, 50 Hertz, with neutral earthed:-
•solidly.
•Standard
•BS 6436.
•BS EN 60076.
•Transformer type
•Oil immersed.
•Position
•Supply transformers for ground mounting in
•outdoor location.
•Core
•Construct the core from double insulated high quality, cold rolled, grain oriented, stress relieved silicon iron alloy/steel laminations.
•Windings
•Provide three phase, double wound windings, connected and marked to vector group reference Dyn 11 of BS EN 60076.
•Manufacture windings from:-
•aluminium or copper foil with high quality cellulose insulation for oil or synthetic liquid immersed transformers.
•Tappings
•Provide off-load tappings on higher voltage winding for a variation of +/-2.5% and +/- 5% of the primary voltage.
•Oil-immersed transformers
Control tapping switch by an externally operated hand wheel which can be locked in any of the positions and fitted with a tap position indicator.
•Terminals for external conductors
•Neutral conductor size
•Make terminals for neutral conductors on three-phase and neutral circuits same size as phase terminals.
•Cooling
•Winding
•Medium
•Oil.
•Method
•Natural.
•External
•Medium
•Air.
•Method
•Natural.
•Cable boxes and terminal chambers
•Provide connection of ring main unit via an oil insulated trunking.
•HV cable box
•BS 7821
•Air cable box - below
•Drilled gland plate for bottom entry
•LV cable box
•Provide a disconnect chamber on welded sealed transformers, to facilitate cable testing.
•LV terminations
•Provide a four pole air circuit breaker c/w terminations for accepting 4000A cast resin busbar system.
•Dimensions as BS 7821
•Accessories
•Rating plate.
•2 No. earthing terminals.

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- Lifting lugs.
- Oil level indicator.
- Oil temperature indicator.
- Dehydrating breather.
- Marshalling box.
- Padlock kit.
- Foundation fixings kit.
- Filling hole.
- Drain and sampling plug or valve.

- Fire behaviour class to BS 7844
  - F1.

320.000 WORKMANSHIP

320.010 FIXING:
Fix all equipment independently of wiring system. Use cadmium or zinc electroplated bolts, nuts, washers and screws.

320.020 ACCESS:
Ensure that clearance in front of switchgear, withdrawn circuit breaker or controlgear is
- not less than 1m.

320.030 MARKING:
Number terminals, cables and component parts to correspond with manufacturer's certified drawings.

320.040 INSTALLATION OF BUSBARS:
Tighten busbar joints and connections with a torque spanner in accordance with manufacturers' recommendations. Allow for expansion due to operating temperature conditions and load.

320.050 INSTALLATION OF TRANSFORMERS:
Install transformers in accordance with manufacturer's recommendations.

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BS APPENDIX

BS 159:1992
Specification for high-voltage busbars and busbar connections

BS 2692-2:1956
Fuses for voltages exceeding 1000 V a.c. Part 2 Expulsion fuses

BS 2692-3:1990
Fuses for voltages exceeding 1000 V a.c. Part 3 Guide to the determination of short circuit power factor

BS 3693:1992
Recommendations for design of scales and indexes on analogue indicating instruments

BS 5372:1997
Specification for dimensions of cable terminations for multi-core extruded solid dielectric insulated distribution cables of rated voltages 600/1000 V and 1900/3300 V having copper or aluminium conductors

BS 5685-1:1979
Electricity meters. Part 1 Specification for Class 0.5, 1 and 2 single-phase and polyphase, single rate and multi-rate watt-hour meters.
Current but obsolescent

BS 5685-2:1986
Electricity meters. Part 2 Specification for single-phase coin operated prepayment flat rate and two-part tariff watt-hour meters of Class 2 and fixed charge collectors of Class 2

BS 5685-3:1986
Electricity meters. Part 3 Specification for meters having Class 1 electro-mechanical maximum demand indicators
Current but obsolescent

BS 5685-4:1986
Electricity meters. Part 4 Specification for Class 3 var-hour meters.
Current but obsolescent

BS 5685-5:1987
Electricity meters. Part 5 Specification for input and output switching or logic arrangements for multi-rate registers for electricity meters

BS 5685-8:1991
Electricity meters. Part 8 Specification for impulse operated multiple registers for use with induction electricity meters

BS 6436:1984
Specification for ground mounted distribution transformers for cable box or unit substation connection

BS 7821-1:1995
Three phase oil-immersed distribution transformers, 50 Hz, from 50 to 2500 kVA with highest voltage for equipment not exceeding 36 kV. Part 1 General requirements and requirements for transformers with highest voltage for equipment not exceeding 24 kV

BS 7821-2.1:1995
Three phase oil-immersed distribution transformers, 50 Hz, from 50 to 2500 kVA with highest voltage for equipment not exceeding 36 kV. Part 2.1 Distribution transformers with cable boxes on the high voltage and/or low voltage side. General requirements

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BS 7821-2.2:1998
Three phase oil-immersed distribution transformers, 50 Hz, from 50 to 2500 kVA with highest voltage for equipment not exceeding 36 kV. Part 2.2 Distribution transformers with cable boxes on the high voltage and/or low voltage side. Cable boxes of type 1 for use on distribution transformers meeting the requirements of BS 7821-2.1

BS 7821-2.3:1998
Three phase oil-immersed distribution transformers, 50 Hz, from 50 to 2500 kVA with highest voltage for equipment not exceeding 36 kV. Part 2.3 Distribution transformers with cable boxes on the high voltage and/or low voltage side. Cable boxes type 2 for use on distribution transformers meeting the requirements of BS 7821-2.1

BS 7821-3:1995
Three phase oil-immersed distribution transformers, 50 Hz, from 50 to 2500 kVA with highest voltage for equipment not exceeding 36 kV. Part 3 Supplementary requirements for transformers with highest voltage for equipment equal to 36 kV

BS 7821-4:1995
Three phase oil-immersed distribution transformers, 50 Hz, from 50 to 2500 kVA with highest voltage for equipment not exceeding 36 kV. Part 4 Determination of the power rating of a transformer loaded with non-sinusoidal currents

BS 7821-6:2002
Three phase oil-immersed distribution transformers, 50 Hz, from 50 to 2500 kVA with highest voltage for equipment not exceeding 36 kV. Part 6 Requirements and tests concerning pressurized corrugated tanks

BS 7844-1:1996
Three-phase dry-type distribution transformers 50 Hz, from 100 to 2500 kVA with highest voltage for equipment not exceeding 36 kV. Part 1 General requirements and requirements for transformers with highest voltage for equipment not exceeding 24 kV

BS 7844-2:1996
Three-phase dry-type distribution transformers 50 Hz, from 100 to 2500 kVA with highest voltage for equipment not exceeding 36 kV. Part 2 Supplementary requirements for transformers with highest voltage for equipment equal to 36 kV

BS 7844-3:1998
Three-phase dry-type distribution transformers 50 Hz, from 100 to 2500 kVA with highest voltage for equipment not exceeding 36 kV. Part 3 Determination of the power rating of a transformer loaded with non-sinusoidal current

BS 7856:1996
Code of practice for design of alternating current, watt-hour meters for active energy (classes 1 and 2)

BS EN 13601:2002
Copper and copper alloys. Copper rod, bar and wire for general electrical purposes

BS EN 60051-1:1999
Direct acting indicating analogue electrical measuring instruments and their accessories. Part 1 Definitions and general requirements common to all parts

BS EN 60073:2002
Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuators

BS EN 60076-1:1997
Power transformers. Part 1 General

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BS EN 60076-10:2001
Power transformers. Part 10 Determination of sound levels

BS EN 60076-2:1997
Power transformers. Part 2 Temperature rise

BS EN 60076-3:2001
Power transformers. Part 3 Insulation levels, dielectric tests and external clearances in air

BS EN 60076-4:2002
Power transformers. Part 4 Guide to the lightning impulse and switching impulse testing. Power transformers and reactors

BS EN 60076-5:2001
Power transformers. Part 5 Ability to withstand short circuit

BS EN 60265-1:1998
Specification for high-voltage switches. Part 1 Switches for rated voltages above 1 kV and less than 52 kV

BS EN 60265-2:1994
Specification for high-voltage switches. Part 2 Specification for high-voltage switches. High-voltage switches for rated voltages of 52 kV and above

BS EN 60298:1996
A.C. metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

BS EN 60529:1992
Specification for degrees of protection provided by enclosures (IP code)

BS EN 60694:1997
Common specifications for high-voltage switchgear and controlgear standards

BS EN 62053-11:2003
Electricity metering equipment (a.c.). Part 11 Particular requirements. Electromechanical meters for active energy (classes 0,5, 1 and 2)

BS EN 62053-23:2003
Electricity metering equipment (a.c.). Particular requirements. Part 23 Static meters for reactive energy (classes 2 and 3)

BS EN 62271-100:2001
High-voltage switchgear and controlgear. Part 100 High-voltage alternating-current circuit-breakers

BS EN 62271-102:2002
High-voltage switchgear and controlgear. Part 102 High-voltage alternating current disconnectors and earthing switches

V20 LV DISTRIBUTION

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide distribution of electricity throughout the site from the 11kV/400V transformers via switchboards, sub-circuit distribution boards and interconnecting cabling/busbars.

100.020 DESIGN PARAMETERS
BS 7671: 2001 - Requirements for Electrical Installations, including all amendments; The Electricity Supply Regulations.

100.030 SYSTEM DESCRIPTION
Supply, install, test, commission and set to work the LV distribution system comprising switchboards, panel boards, switchgear, metering and interconnecting cable and busbar.

Switchboards, Switchgear & Metering

Provide suitably sized floor mounted factory built cubicle type switchboards in internal switchrooms suitable for accepting the main incoming supply cables/busbar and providing electrical protection to each of the load centres in the building, complete with the following and as detailed in clause 271.030:

- Incoming Protection = ACB/MCCB, draw out pattern;
- Outgoing Protection = MCCB, draw out pattern at 250A and above;
- integral Surge Protection Equipment;
- minimum 25% spare capacity;
- integral digital multi-function metering to all incoming and outgoing ways with RS 485 connection to BMS;
- automatic changeover bus switch c/w PLC control to main switchgear;

Solid state digital metering shall be provided to ensure at least 90% of the estimated annual energy consumption can be assigned to each end-use category, e.g. lighting, power, etc., in compliance with Part L2 of The Building Regulations. Meters shall be provided to all feeders and to all outgoing ways serving load centres. Metering shall allow automatic reading and data collection via RS485 connections to the BMS (final connection to BMS by BMS sub-contractor).

Automatic Changeover

Provide automatic changeover switches to essential power switch-boards comprising mechanically and electrically interlocked motorised circuit breakers with local PLC control. Interlink all site PLCs and generator control system.

Busbar Trunking

- 4 conductor + reinforced protective conductor (PER) prefabricated distribution busbar trunking system from transformer secondary breakers to switchgear, from switchgear to switchboards and from panel boards to final distribution boards;
- cast resin, low impedance, high withstand current capacity, IP54 within transformer enclosures;
- low impedance, high withstand current capacity, IP31 within Energy Centre, tunnels and building;
- 4m and made to measure lengths;
- Halogen-free 130°C class B polyester conductor insulation;
- Rated voltage 1000V;
- short-circuit current 86kA rms;
- 2 hour fire resistance rating.

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Provide automatic closed transition transfer switches with bypass facility for automatic transfer between primary and secondary supplies as indicated in the drawings and as detailed in clause 271.060.¶

- rated to suit incoming device, 400V, 50Hz, 3-phase 4 pole;
- ingress protection - IP2X;

C0605 The New LMB Building Project V20
Electrical Specification LV DISTRIBUTION
Revised Stage E Scheme Including Agreed VE

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Deleted: Provide automatic changeover switches to essential power switch-boards comprising ¶ Mechanically and electrically interlocked motorised circuit breakers with local PLC control.¶ Interlink all site PLCs and generator control system.

Cabling

- Low Smoke, Zero Halogen multi-core steel wire armour cables (XLPE/LSF/SWA);
- fixed to galvanised steel medium duty cable basket or on cable ladder, as detailed in the drawings;
- Basket or ladder fixed to building fabric using Unistrut type channels and screwed rod as appropriate;
- All penetrations through fire walls to be sleeved using a 100mm diameter steel sleeve for each cable and fire sealed.

Panel Boards

Provide suitably sized modular switchboard in internal switchrooms, interstitial areas, plant rooms and electrical cupboards for accepting the sub-distribution supply cables/busbar and providing electrical protection to load centres in the building, complete with the following and as detailed in clause 271.031;

- Protection type: Incomer = MCCB, Outgoing = MCCB;
- Integral Surge Protection equipment;
- minimum 25% spare capacity;
- integral digital multi-function metering to all incoming and outgoing ways with RS 485 connection to BMS.

Sub-Circuit Distribution Boards

- miniature circuit breaker (MCB) distribution boards located in interstitial areas, electrical cupboards and plant areas to serve general lighting and power;
- minimum 25% spare capacity to each distribution board;
- integral TPN isolating switch to each distribution board;
- 200A rated busbars;
- boards to comply with BS EN 60439-3;
- ingress protection to IP4X standard;
- integral Surge Protection Equipment;
- earth bar c/w an earth and neutral connection for each outgoing way;
- Type B, C or D MCBs, to BS EN 60898. Breaking capacity = 16kA;
- terminal plugs fitted to all outgoing ways;
- integral digital multi-function metering to all incoming and outgoing ways with RS 485 connection to BMS.

Auto-Changeover Controls Logic Sequence

All auto-changeover systems shall be controlled via programmable logic control devices. The controls logic sequence shall be developed and agreed prior to implementation.

Future UPS Switchgear Provision

Provide means of connecting future UPS system to dedicated distribution boards, as indicated on the drawings. Provide proprietary UPS input/output/bypass panel for each D.B. to allow easy connection of UPS. Future UPS provided by Client post-completion.

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Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that

flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

100.050 SYSTEM SCHEMATICS
2053-Z-(61) series.

100.060 SYSTEM DRAWINGS
2053-Z-(61) series.

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.

260.020 CONDUIT SYSTEMS:
•Application Mechanical protection to all cabling
•Manufacturer and reference
- Wiremould or Mitsushitsu
- Adaptaflex insulated for connection to all motors etc

Or approved equivalent
•Metal
  •Rigid
    •Class 4 - reference Y60.2010B
      •Fittings
        •Reference Y60.2020A
    •Stainless steel - reference Y60.2010C
      •Fittings - reference Y60.2020C
  •Flexible, LSF sheathed - reference Y60.2010D
    •Fittings - reference Y60.2040A
•Support and fixing - reference Y60.2170

260.030 STEEL TRUNKING:
•Type – General lighting and power distribution trunking
•Application Distribution of cable systems
•Manufacturer and reference

•Mita
•Armorduct
•Arena-Walsall

or approved equivalent.

- Sizes as noted on drawings, all lids to be turnbuckle not screw fixed

•Drawing reference (61) series.
•Cable trunking and fittings
  •To BS 4678 - reference Y60.2080A
•Trunking Type
  •Standard cable trunking.
•Installation
  •Surface.
•Trunking
  •Class 2 - reference Y60.2090A
  •Class 1/3 - reference Y60.2090B
•Support and fixing - reference Y60.2170

260.031 ALUMINIUM TRUNKING:
•Type – Laboratory dado trunking
•Application Distribution of cable systems within Chemistry laboratories
•Manufacturer and reference

MK Electric Prestige Plus Aluminium Profile M, white powder coated

or approved equivalent.

•Drawing reference (61) series.
•Cable trunking and fittings
  •To BS 4678 - reference Y60.2080A
•Trunking Type
  •Wall/dado trunking.
  •With Compartments.
•Installation
  •Surface.
•Trunking
  •Class 2 - reference Y60.2090A
  •Class 1/3 - reference Y60.2090B
  •Aluminium Dado trunking - reference Y60.2090F
•Service outlet boxes
  •Reference Y60.2110A
•Service poles, finish to match lab dado trunking
  •Reference Y60.2120A
•Separate or multi-compartment trunking
  •Reference Y60.2150A
Support and fixing - reference Y60.2170

260.033 STEEL TRUNKING:
•Type - Slab recessed trunking
•Application Distribution of cable systems via floor slab
•Manufacturer and reference
Thorsman Under Screed Trunking

or approved equivalent.

• Sizes as noted on drawings
•Drawing reference (61) series.
•Cable trunking and fittings
  •To BS 4678 - reference Y60.2080A
•Trunking Type
  •Floor trunking
  •With Compartments.
•Installation
  •Flush.
•Trunking
  •Flush floor trunking - reference Y60.2090D
•Underfloor trunking
  •Reference Y60.2100A
•Service outlet boxes
  •Reference Y60.2110A
Support and fixing - reference Y60.2170

260.040 TRUNKING OF INSULATING MATERIAL
•Type uPVC white trunking c/w integral copper screen
•Application within laboratory rooms and other areas as illustrated
•Manufacturer and reference
•MK Electric Prestige Plus Profile M c/w integral copper screen
•Or approved equivalent
•Drawing reference (61) & (62) series.

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Deleted: 260.032 ALUMINIUM TRUNKING:¶
<#>Type – Office/Write Up floor trunking¶
<#>Application Distribution of cable systems to perimeter of Office/Write Up areas¶
<#>Manufacturer and reference ¶
<#>Mita TKA¶
¶
or approved equivalent. ..
..
• Sizes as noted on drawings¶
<#>Drawing reference (61) series.¶
<#>Cable trunking and fittings¶
<#>To BS 4678 - reference Y60.2080A¶
<#>Trunking Type¶
<#>Floor trunking¶
<#>With Compartments.¶
<#>Installation¶
<#>Recessed in open floor channel¶
<#>Trunking¶
<#>Class 2 - reference Y60.2090A¶
<#>Class 1/3 - reference Y60.2090B¶
<#>Flush floor trunking - reference Y60.2090D¶
<#>Service outlet boxes¶
<#>Reference Y60.2110A¶
<#>Separate or multi-compartment trunking¶
<#>Reference Y60.2150A¶
<#>Support and fixing - reference Y60.2170¶

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•Cable trunking and fittings
  • To BS 4678 – reference Y60.2080A
•Surface trunking
  • PVC general purpose – reference Y60.2130A
•Service outlet boxes
  • Reference Y60.2110A
•Separate or multi-compartment trunking
  • Reference Y60.2150A
•Wall/Dado Trunking
  • PVC
•Support and fixing – reference Y60.2170

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260.050 GENERAL WORKMANSHIP:
•General
  •Reference Y60.3010A
•Layout - reference Y60.3020
•Spacing - reference Y60.3030
•Condensation prevention - reference Y60.3040
•Protection and repair of steel components
  •Reference Y60.3050A
•Equipment connections - reference Y60.3060
•Cleaning before wiring - reference Y60.3070
•Wiring
  •Reference Y60.3080A
•Builderswork - reference Y60.3090

260.070 WORKMANSHIP FOR CONDUIT:
•Draw-in boxes - reference Y60.4010
•Installation of cast in or buried conduit - reference Y60.4020
•Conduit boxes - reference Y60.4030
•Fixing conduit - reference Y60.4040
•Flexible and pliable conduit - reference Y60.4050
•Screwed steel conduit - reference Y60.4060
•Non-metallic conduit
  •Reference Y60.4070A
•Underground installation - reference Y60.4080

260.080 WORKMANSHIP FOR TRUNKING:
•Manufacture of trunking - reference Y60.5010
•Access - reference Y60.5020
•Fixing trunking
  •Reference Y60.5030A
•Steel trunking
  •Reference Y60.5040A
•Underfloor and flush floor trunking installation
  Reference Y60.5050
•Trunking of insulating material - reference Y60.5060

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as schedule reference Appendix 3 - Cable Schedules (to be completed in Stage F).

Wiring for each service or system shall be c/w a unique sheath colour for ease of identification,

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e.g. red for fire, etc. The colour of each system's cabling shall be agreed with the CA prior to implementation. The Electrical Contractor shall ensure that all sub-contractors recognise and implement the agreed colour coding system.

261.020 STANDARD FLEXIBLE CORDS AND INDUSTRIAL CABLES:
•Application Connection to electrical equipment
•Manufacturer and reference BASEC approved.
•LSOH sheathing - reference Y61.2005
•Standard LSF flexible wires - single copper core - reference Y61.2010B
•Standard heat resisting (95°C or more) flexible wires - single copper core - reference Y61.2010C
•Standard HOFR flexible cords - multi copper cores - reference Y61.2010E

261.030 STANDARD MEDIUM VOLTAGE POWER CABLES:
•Manufacturer and reference BASEC approved.
•LSOH sheathing - reference Y61.2005
•Standard 11kV armoured and sheathed cables, with copper conductors - reference Y61.2030C

261.040 MINERAL INSULATED WIRING AND POWER CABLES:
•Type Heavy Duty
•Manufacture and reference AEI Moisture Resistant
•LSOH sheathing - reference Y61.2005
•Heavy duty mineral insulated cables
  •LSF outer covering, standard fire performance - reference Y61.2040D
  •LSF outer covering, enhanced fire performance - reference Y61.2040E
•Sheath colour Orange

261.050 STANDARD WIRING AND POWER CABLES:
•LSOH sheathing - reference Y61.2005
•Standard power supply cables
  •Thermosetting insulation and copper conductors
    •Sheathed - reference Y61.2020A
    •Sheathed and armoured - reference Y61.2020B
  •LSF sheathed and armoured - reference Y61.2020E
•Standard wires for conduit and trunking
  •LSF insulated, with copper conductors - reference Y61.2020G
•Standard flat cables 2-core or 3-core, with copper conductors; with or without CPC
  •LSF insulated, sheathed - reference Y61.2020J
  •Standard power supply cables, LSF insulation, sheathed - reference Y61.2020K
  •Standard cables with definite fire performance - reference Y61.2020M

261.060 CONTROL AND AUXILIARY CABLES:
•Manufacturer and reference BASEC approved.
•LSOH sheathing - reference Y61.2005
•Paired UTP unarmoured control cables - reference Y61.2050A
•Paired UTP armoured control cables - reference Y61.2050B
•Paired STP unarmoured control cables - reference Y61.2050C
•Paired STP armoured control cables - reference Y61.2050D
•Multi-core unarmoured auxiliary cables - reference Y61.2050E
•Multi-core armoured auxiliary cables - reference Y61.2050F
•Multi-core unarmoured LSF sheathed auxiliary cables - reference Y61.2050G
•Multi-core armoured LSF sheathed auxiliary cables - reference Y61.2050H
•Control and auxiliary cables with definite fire performance - reference Y61.2050I
•Fire Alarm cables - reference Y61.2050K

261.080 STANDARD COMMUNICATIONS CABLES:
•LSOH sheathing - reference Y61.2005
•Standard filled communications cables, for outdoor and underground - reference Y61.2070A

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•Standard communications cables, for indoor use - reference Y61.2070B

261.090 STANDARD COAXIAL CABLES:
•For broadcast receiving - reference Y61.2080A

261.100 OPTICAL FIBRE CABLES:
•Type 50/125um OM3 multi-mode
•Application Comms backbone.
•Reference Y61.2090A

261.110 INFORMATION TECHNOLOGY CABLES:
•Structured wiring - reference Y61.2100A

261.120 NON-STANDARD CABLES:
•LSOH sheathing - reference Y61.2005

261.130 CABLE GLANDS:
•Unarmoured cables, indoors - reference Y61.3010A
•Unarmoured cables, outdoors - reference Y61.3010B
•Armoured cables, dry indoors - reference Y61.3010C
•Armoured cables, indoors - reference Y61.3010D
•Armoured cables, outdoors - reference Y61.3010E

261.140 CABLE SEALS AND GLANDS - MINERAL INSULATED CABLES:
•Heavy duty mineral insulated cables - protected 'd', 'i', or 'n' for hazardous areas - reference Y61.3020A
•Heavy and light duty mineral insulated cables - protected 'e' for hazardous areas - reference Y61.3020B
•Heavy or light duty mineral insulated cables - temperatures up to 105°C - reference Y61.3020C
•Light duty mineral insulated cables - temperatures up to 105°C - reference Y61.3020D

261.150 VOLTAGE SURGE SUPPRESSORS FOR CABLES:
•Reference Y61.3030A

261.160 CABLE TERMINATING AND JOINTING SOCKETS:
•Reference Y61.3040A
  •Connection type

261.170 INSULATING TAPE:
•LSF insulating tape - reference Y61.3050A

261.180 CABLE JOINTS AND TERMINATIONS:
•Reference Y61.3060A

261.200 CONNECTORS FOR COAXIAL CABLES:
•Reference Y61.3080A

261.230 CABLE DUCTS:
•Type Solid drawn UPVC
•Reference Y61.3110A

261.240 CABLE SLEEVES:
•Reference Y61.3120A

261.250 CABLE COVERS AND MARKERS:
•Reference Y61.3130A

261.260 WORKMANSHIP

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•Cable installation - general - reference Y61.4010
•Cable installation in low temperatures - reference Y61.4020
•Installation of LSF cable - reference Y61.4030
•Installation of unarmoured cables - reference Y61.4040
•Cable trenches.
  •Reference Y61.4050A
•Cable installation in trenches - reference Y61.4060
•Cable ducts.
  •Reference Y61.4070A
•Cable installation into ducts - reference Y61.4080
•Cable installation in conduit and trunking.
  •Reference Y61.4090A
•Cable installation on tray and rack - reference Y61.4100
•Cable surface installation.
  •Reference Y61.4110A
•Cable embedded installation.
  •Reference Y61.4120A
•Cable installation - mineral insulated cables
  •Reference Y61.4130A
•Cable installation - flexible cords - reference Y61.4140
•Cable jointing and terminating generally.
  •Reference Y61.4150A
•Cable jointing and terminating - elastomer and plastic insulated cables - reference Y61.4170
•Terminating - mineral insulated cables.
  •Reference Y61.4180A
•Cable joints - mineral insulated cables.
  •Reference Y61.4190A
•Communications coaxial, optical fibre and IT cable installation, jointing and terminating.
  •Reference Y61.4200A
•Cable sleeves - reference Y61.4210

262.000 BUSBAR TRUNKING

262.010 GENERAL:
Comply with Work Section general and Common clauses reference Y62.1000 and those detailed below.

262.020 BUSBAR SYSTEM:
•Type copper or aluminium 4-pole copper + reinforced protective conductor, cast resin, low impedance, high current withstand.
•Application
Power distribution between transformers, switchgear and load centres throughout the building.

•Manufacturer and reference
Schneider Electric Canalis
Eaton MEM XP
Eta Com
Siemens LXA

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  •Or approved equivalent
•General purpose busbar except wall/dado
  Reference Y62.2010A
•Current rating as indicated on drawings and schedules.

262.021 BUSBAR SYSTEM:
•Type copper or aluminium 4-pole copper + reinforced protective conductor

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•Application
Power distribution from sub-distribution panels to Essential and Non-Essential distribution boards in interstitial floors.

•Manufacturer and reference
Schneider Electric Canalis
Eaton MEM XP
Siemens LXA

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  •Or approved equivalent
•General purpose busbar except wall/dado
  Reference Y62.2010A
•Current rating as indicated on drawings and schedules.

262.022 BUSBAR SYSTEM:
•Type 3-pole copper
•Application
Underfloor power distribution.

•Manufacturer and reference
Ackermann
Schneider Electric
Eaton MEM

  •Or approved equivalent
•General purpose busbar except wall/dado
  Reference Y62.2010A
•Current rating as indicated on drawings and schedules.

262.040 WORKMANSHIP:
•General - reference Y62.3010
•Bonding - reference Y62.3020
•Expansion - reference Y62.3030
•Labels - reference Y62.3040
•Fire barriers - reference Y62.3050

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.

263.020 CABLE SUPPORT AND FINISHES:
•Cable supports and finishes
  •Reference Y63.2010A

263.030 CABLE SUPPORT SYSTEM:
•Type Tray, ladder and basket
•Application As shown on drawings
•Manufacturer and reference
Mita, Marshall-Tufflex, Arena-Walsall, Cablofil
Cabofil CF54 for cable basket sizes as per drawing

Or approved equivalent
•Perforated tray - reference Y63.2020A
•Cable rack - reference Y63.2020B
•Cable cleats - reference Y63.2020C
•Proprietary cable ties - reference Y63.2025A

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•Cable clips - reference Y63.2025B
•Two way saddles - reference Y63.2025C
•Cable basket - reference Y63.2025D

263.040 WORKMANSHIP
•Cable tray installation - reference Y63.3010
•Cable cleats, ties, saddles and clips installation
•Reference Y63.3020A

271.000 LV SWITCHGEAR AND DISTRIBUTION BOARDS

271.010 GENERAL:
Comply with work section general clauses reference Y71.1000 and those detailed below.

271.011 FACTORY WITNESS TESTING
Allow for travel to manufacturer's factory to witness the testing of main switchboards for consultant engineer and 1No other personnel.

271.030 SWITCHBOARD:
Type – Main LV switchgear and switchboard
Application – distribution and protection of LV power systems
Manufacturer and reference

Eaton Electrical
Schneider Electric
ABB Switchgear
Terasaki
AF Switchgear
Siemens/ICW Power

Or approved equivalent

Construction In accordance with BSEN60439-1: 1999

Supply: - 400V 3 phase 4 wire 50 Hz

Control Supply: - 110V AC via integral control transformer

Tripping Supply: - Self-powered

Access: - as detailed on drawings/schedules

Ingress Protection: Internal: IP31 to BS EN 60529: 1992

Form of Construction: Form 4 Type 6

Finish: - Textured epoxy powder paint
Colour: Grey RAL 7035

Busbars: - air insulated copper bars, ratings as identified on drawings/schedules.
Fully rated neutral

Cubicles of bolted construction, giving a strong design for mounting of equipment.
The cubicle framework built using 2mm electrogalvanised rolled 'C' profiles, accurately pre-punched at 25mm intervals, with bolted and dowelled corner joints.
Exterior cladding manufactured from 1.5mm sheet steel, including doors and covers.

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Future extension possible in both directions by adding on further cubicle assemblies.
All plastic parts used in the MNS system free of CFCs or halogens, flame-retardant and self-extinguishing.
Terminals of outgoing circuits segregated from each other by means of PVC cable boots
A separate 150mm plinth provided running the length of each cubicle to fully support the cubicles.
Lifting lugs to be provided.

Earth Bar
Running the full length of the switchboard to which all non-conducting metal parts are bonded.

Labels
All components identified by suitably engraved laminated plastic labels secured by plastic rivets.

Moulded Case Circuit Breakers
Moulded case circuit breakers triple pole and bolted neutral, fixed pattern, independent, manually closing, air break type and operated by a door interlocked rotary handle.
MCCBs up to and including 250 Amps fitted with thermal/magnetic trips providing overcurrent and short circuit protection unless specifically noted otherwise. MCCBs above 250 Amps fitted with solid state protection.
All moulded case circuit breakers housed in their own individual sheet steel enclosures and comply with BSEN60947 1996 Part 2.

Air Circuit Breakers
Main incoming breakers to be four pole, motor operated, spring assisted, withdrawable pattern complete with integral overcurrent, restricted earth fault and short circuit protection.
Generator air circuit breakers to be four pole, motor operated, spring assisted, withdrawable pattern complete with integral overcurrent and short circuit protection.
The air circuit breakers comply with BSEN60947 1996 Part 2.

Instruments
The multifunction meters to be digital type complete with data logging capabilities and be capable of measuring the following parameters.
Total Current
Current in Each Phase
Voltage Phase to Phase and Phase to Neutral
Instantaneous KW
KVAr
KVA
Frequency
Power Factor
Maximum Power Demand
Maximum Current Demand
KWH
KVArH
Harmonics Measurement
3 Phase Voltage (%)
3 Phase Current (%)

Meters to provide output to BMS for remote automatic reading and correlation of data.

Relays
To be included for restricted earth fault protection on the main LV feeders by utilising GEC Midos MCAG14 relay, or approved equivalent, complete with stabilising resistor and Class X CTs.
The above relays would also be complete with an MMLG01 test block.

Surge Suppression
To be included for transient surge protection units mounted on the main LV busbars and protected by 63 Amp in line fuses.

Power Factor Correction

Plug-in power factor correction capacitors to comply with IEC 831 Parts 1 and 2 and be dry type, PCB free, three phase units of metalised polypropylene film design.
Each capacitance stage shall have a dielectric strength of 480V and shall be rated at 50KVAr. Each capacitance stage shall be of plug-in design and be supplied complete with one set of three phase control fuses which shall provide individual stage isolation, triple pole contactor and suitably rated capacitor bank.
Power Factor capacitors to be complete with detuning reactors which may be required if harmonic currents are present in the system.

- Electrical supply
  - Three phase - reference Y71.1020A
- LV switchgear and controlgear assembly
  - Cubicle switchboard - reference Y71.2010A
  - Cubicle control panel - reference Y71.2010B
  - Details of equipment
- As shown on drawing/schedules (61) series
- Assembly construction
  - Floor mounted - reference Y71.2020A
  - Access for cabling - Front, top, bottom or rear
    - As shown on drawings/schedules (61) series
- Enclosures finish
  - Reference Y71.2030A
- Type tests
  - Reference Y71.2040A
- Site built assemblies - reference Y71.2060
- Site modification - reference Y71.2070

271.031 SWITCHBOARD:
Type – LV Panelboards
Application – distribution and protection of LV power systems
Manufacturer and reference

Eaton Electrical
Schneider Electric
ABB Switchgear
Terasaki
AF Switchgear
Siemens/ICW Power

Or approved equivalent

Construction In accordance with BSEN60439-1: 1999

Supply: - 400V 3 phase 4 wire 50 Hz

Control Supply: - 110V AC via integral control transformer

Tripping Supply: - Self-powered

Access: - as detailed on drawings/schedules

Ingress Protection: Internal: IP31 to BS EN 60529: 1992

Form of Construction: Form 4 Type 6

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Finish: - Textured epoxy powder paint
Colour: Grey RAL 7035

Busbars: - air insulated copper bars, ratings as identified on drawings/schedules.
Fully rated neutral

Cubicles of bolted construction, giving a strong design for mounting of equipment.
The cubicle framework built using 2mm electrogalvanised rolled 'C' profiles, accurately pre-punched at 25mm intervals, with bolted and dowelled corner joints.
Exterior cladding manufactured from 1.5mm sheet steel, including doors and covers.
Future extension possible in both directions by adding on further cubicle assemblies.
All plastic parts used in the MNS system free of CFCs or halogens, flame-retardant and self-extinguishing.
Terminals of outgoing circuits segregated from each other by means of PVC cable boots
Lifting lugs to be provided.

Earth Bar
Running the full length of the switchboard to which all non-conducting metal parts are bonded.

Labels
All components identified by suitably engraved laminated plastic labels secured by plastic rivets.

Moulded Case Circuit Breakers
Moulded case circuit breakers triple pole and bolted neutral, fixed pattern, independent, manually closing, air break type and operated by a door interlocked rotary handle.
MCCBs up to and including 250 Amps fitted with thermal/magnetic trips providing overcurrent and short circuit protection unless specifically noted otherwise. MCCBs above 250 Amps fitted with solid state protection.
All moulded case circuit breakers housed in their own individual sheet steel enclosures and comply with BSEN60947 1996 Part 2.

Instruments
The multifunction meters to be digital type complete with data logging capabilities and be capable of measuring the following parameters.

Total Current
Current in Each Phase
Voltage Phase to Phase and Phase to Neutral
Instantaneous KW
KVAr
KVA
Frequency
Power Factor
Maximum Power Demand
Maximum Current Demand
KWH
KVArH
Harmonics Measurement
3 Phase Voltage (%)
3 Phase Current (%)

Meters to provide output to BMS for remote automatic reading and correlation of data.

Relays
To be included for restricted earth fault protection on the main LV feeders by utilising GEC Midos MCAG14 relay for approved equivalent, complete with stabilising resistor and Class X CTs.
The above relays would also be complete with an MMLG01 test block.

Surge Suppression

To be included for transient surge protection units mounted on the main LV busbars and protected by 63 Amp in line fuses.

Power Factor Correction

Plug-in power factor correction capacitors to comply with IEC 831 Parts 1 and 2 and be dry type, PCB free, three phase units of metalised polypropylene film design.
Each capacitance stage shall have a dielectric strength of 480V and shall be rated at 50KVAr. Each capacitance stage shall be of plug-in design and be supplied complete with one set of three phase control fuses which shall provide individual stage isolation, triple pole contactor and suitably rated capacitor bank.
Power Factor capacitors to be complete with detuning reactors which may be required if harmonic currents are present in the system.

•

•Electrical supply
  •Three phase - reference Y71.1020A
•LV switchgear and controlgear assembly
  •Cubicle switchboard - reference Y71.2010A
  •Cubicle control panel - reference Y71.2010B
  •Details of equipment
•As shown on drawing/schedules (61) series

•Assembly construction
  •Floor mounted - reference Y71.2020A
  •Wall mounted - reference Y71.2020B
  •Access for cabling - Front, top, bottom or rear
    •As shown on drawings/schedules (61) series
•Enclosures finish
  •Reference Y71.2030A
•Type tests
  •Reference Y71.2040A
•Site built assemblies - reference Y71.2060
•Site modification - reference Y71.2070

271.050 CIRCUIT BREAKERS, TRANSFER SWITCHES AND CONTROL AND PROTECTIVE SWITCHES:
•Type – air circuit breaker c/w automatic changeover
•Application – protection of main LV supplies from transformers to main switchgears and automatic changeover to alternative supply source
•Manufacturer and reference

Merlin Gerin Masterpact NW H2 Micrologic 6.0P (with Earth Fault Protection and power meter)

or approved equivalent

•Air circuit breaker
  •Utilisation A, withdrawable - reference Y71.2090A
•Characteristics of circuit breakers, transfer switches and control and protective switches:
•As shown on drawings/schedules (61) series
  •Number of poles as shown on drawings
  •Rated operational, current (Amps) as shown on drawings
  •Short-circuit characteristics, rated service short-circuit breaking current (Amps) 100kA
  •Control circuits – automatic source changeover system linked by electrical interlocking system with mechanical interlocking back-up. Automatic controller as Merlin Gerin BA controller, self-powered.
  •Auxiliary circuits – external communications gateway for connection to BMS
  •Relays and releases, type and characteristics – Micrologic control unit 6.0P, power meter, selective

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C0605 The New LMB Building Project V20
Electrical Specification LV DISTRIBUTION
Revised Stage E Scheme Including Agreed VE

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  protection + earth fault protection
  •Co-ordination with short-circuit protective devices TBC

271.051 CIRCUIT BREAKERS, TRANSFER SWITCHES AND CONTROL AND PROTECTIVE SWITCHES:
•Type – air circuit breaker
•Application – protection of main LV supplies to main switchboards
•Manufacturer and reference

Merlin Gerin Masterpact NW H2 Micrologic 6.0P (with Earth Fault Protection and power meter)

or approved equivalent

•Air circuit breaker
  •Utilisation A, withdrawable - reference Y71.2090A
•Characteristics of circuit breakers, transfer switches and control and protective switches:
•As shown on drawings/schedules (61) series
  •Number of poles as shown on drawings
  •Rated operational, current (Amps) as shown on drawings
  •Short-circuit characteristics, rated service short-circuit breaking current (Amps) 100kA
  •Control circuits – Micrologic control unit 6.0P, power meter, selective protection + earth fault protection.
•Auxiliary circuits – external communications gateway for connection to BMS
•Relays and releases, type and characteristics – Micrologic control unit 6.0P, power meter, selective protection + earth fault protection
•Co-ordination with short-circuit protective devices TBC

271.052 CIRCUIT BREAKERS, TRANSFER SWITCHES AND CONTROL AND PROTECTIVE SWITCHES:
•Type – moulded case circuit breaker
•Application – protection of LV supplies, greater than 250A rating or where electronic trip specifically noted.
•Manufacturer and reference

Merlin Gerin Compact NSxxxb H Micrologic 6.0P (with Earth Fault Protection and power meter)

Or approved equivalent
•Air circuit breaker
  •Utilisation A, withdrawable - reference Y71.2090A
•Characteristics of circuit breakers, transfer switches and control and protective switches:
•As shown on drawings/schedules (61) series
  •Number of poles as shown on drawings
  •Rated operational, current (Amps) as shown on drawings
  •Short-circuit characteristics, rated service short-circuit breaking current (Amps) 70kA
  •Control circuits – Micrologic control unit 6.0P, power meter, selective protection + earth fault protection.
  •Auxiliary circuits – external communications gateway for connection to BMS
  •Relays and releases, type and characteristics – electronic trip unit
  •Co-ordination with short-circuit protective devices TBC

271.053 CIRCUIT BREAKERS, TRANSFER SWITCHES AND CONTROL AND PROTECTIVE SWITCHES:
•Type – moulded case circuit breaker
•Application – protection of LV supplies, up to 250A rating
•Manufacturer and reference

Merlin Gerin Compact NSxxxb H with TM thermal/magnetic trip unit or STR electronic trip unit as noted on drawings (with Earth Fault Protection and power meter)

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Or approved equivalent
•Air circuit breaker
•Utilisation A, MCCB - reference Y71.2090B
•Characteristics of circuit breakers, transfer switches and control and protective switches:
•As shown on drawings/schedules (61) series
•Number of poles as shown on drawings
•Rated operational, current (Amps) as shown on drawings
•Short-circuit characteristics, rated service short-circuit breaking current (Amps) 70kA
•Control circuits – Micrologic control unit 6.0P, power meter, selective protection + earth fault protection.
•Auxiliary circuits – external communications gateway for connection to BMS
•Relays and releases, type and characteristics – thermal-magnetic trip unit
•Co-ordination with short-circuit protective devices TBC

271.070 PROTECTION DEVICES INTERPOSING RELAYS AND INTER-TRIPPING RELAYS:
•Automatic reset - reference Y71.2110A
•Manual reset - reference Y71.2110B

271.080 VOLTAGE SENSING RELAYS:
•Reference Y71.2120

271.090 TRIP/CLOSE SWITCHES AND CONTROL SELECTOR SWITCHES:
•Reference Y71.2130

271.100 CURRENT TRANSFORMERS:

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Type – automatic transfer switch (ATS)¶
Application – automatic t... [1]
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Deleted: Pickup / Reset
Deleted: Undervoltage
Deleted: N&E, 3ϕ
Deleted: 70 to 98%
Deleted: 85 to 100%
Deleted: Overvoltage
Deleted: N&E, 3ϕ
Deleted: 102 to 115%
Deleted: 2% below trip
Deleted: Underfrequency
Deleted: N&E
Deleted: 85 to 98%
Deleted: 90 to 100%
Deleted: Overfrequency
Deleted: N&E
Deleted: 102 to 110%
Deleted: 2% below trip
Deleted: Voltage unbalance
Deleted: N&E
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•Reference Y71.2140

271.110 INSTRUMENTS AND METERS:
•Reference Y71.2150A

271.120 ELECTRICAL RECORDING INSTRUMENTS:
•Reference Y71.2160A

271.130 INDICATOR LIGHTS:
•Reference Y71.2170A

271.140 LOW VOLTAGE COILS RATING:
•Reference Y71.2180

271.150 FRAMEWORK:
•Reference Y71.2190A

271.160 FUSES:
•Reference Y71.2200A

271.170 DISTRIBUTION BOARDS:
•Manufacturer and reference

Eaton MEM
ABB
Schneider Electric
Siemens

Or approved equivalent

Electrical supply
•Three phase - reference Y71.1020A
•Single phase - reference Y71.1020B
•Reference Y71.2210A
•Provide spare ways
•minimum 25%

271.190 MINIATURE CIRCUIT BREAKERS:
•Manufacturer and reference

Eaton
ABB
Merlin Gerin
Siemens

Or approved equivalent
•Reference Y71.2230A

271.200 RESIDUAL CURRENT DEVICE:
•RCCD's
•Reference Y71.2240A
•Residual current monitors - reference Y71.2242
•RCBO's - reference Y71.2245

271.210 CABLE TERMINATIONS:
•Reference Y71.2250

271.230 AUTOMATICALLY CONTROLLED CAPACITOR BANKS:

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Manufacturer and reference

Eaton MEM
ABB
Schneider Electric
SDC Industries
Siemens

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Or approved equivalent
•Single cubicle within switchboard - reference Y71.2270E
•Capacitor rating - Output (VAR)
  •As shown on drawings/schedules (61) series drawings.

  Relay stages
  •As shown on drawings/schedules (61) series drawings.
•Reference Y71.2270Z

271.240 HARMONIC FILTER BANK:
•Type Space to be left in switchboards for future connection of harmonic filtration equipment.
•Reference Y71.2280A

271.260 SWITCHGEAR AND CONTROLGEAR ACCESSORIES:
•Reference Y71.2300Z

271.270 WORKMANSHIP
•Fixing - reference Y71.3010
•Mounting height - reference Y71.3020
•Access - reference Y71.3030
•Marking and drawing
  •Reference Y71.3040A
•Cable terminations - reference Y71.3050
•Installation and commissioning
  •Reference Y71.3060A

272.000 CONTACTORS AND STARTERS

272.010 GENERAL:
Comply with work section general clauses reference Y72.1000 and those detailed below.

272.030 LV CONTACTORS AND MOTOR STARTERS:
•Electrical supply
  •3 phase - reference Y72.1010A
  •Single phase - reference Y72.1010B
•LV contactors
  •Continuous - reference Y72.2050C

272.040 CONTROL CIRCUIT DEVICES:
•Electrical supply
  •3 phase - reference Y72.1010A
  •Single phase - reference Y72.1010B
•Reference Y72.2060A

272.050 ISOLATING SWITCHES:
•Electrical supply
  •3 phase - reference Y72.1010A
  •Single phase - reference Y72.1010B

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•Reference Y72.2070A

272.060 CONTROL SELECTOR SWITCHES:
•Electrical supply
  •3 phase - reference Y72.1010A
  •Single phase - reference Y72.1010B
•Reference Y72.2080A

272.070 IN-BUILT PUSH BUTTONS:
•Electrical supply
  •3 phase - reference Y72.1010A
  •Single phase - reference Y72.1010B
•Reference Y72.2090A

272.080 INDICATOR LIGHTS:
•Electrical supply
  •3 phase - reference Y72.1010A
  •Single phase - reference Y72.1010B
•Reference Y72.2100A

272.090 CONTACTOR CONTROL RELAYS:
•Electrical supply
  •3 phase - reference Y72.1010A
  •Single phase - reference Y72.1010B
•Reference Y72.2110A

272.100 CONTROL AND INDICATOR LIGHT CIRCUIT FUSES:
•Electrical supply
  •3 phase - reference Y72.1010A
  •Single phase - reference Y72.1010B
•Reference Y72.2120A

272.110 MOTOR STARTERS:
•Electrical supply
  •3 phase - reference Y72.1010A
  •Single phase - reference Y72.1010B
•General
  •Motors below 0.37kW - reference Y72.2130A
  •Motors above 0.37kW - reference Y72.2130B
•Current limiting type - reference Y72.2140
•Direct-on-line type - reference Y72.2150
•Star delta type - reference Y72.2160
•Auto-transformer type
  •Reference Y72.2170A
•Stator rotor type
  •Reference Y72.2180A
•Inverter type
  •Control panel - reference Y72.2190A
  •Motor control centre - reference Y72.2190B

272.120 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY:
•Single power supply - reference Y72.2200
  •Provide system malfunction audible alarm.
•Dual power supply - reference Y72.2210
  •Provide system malfunction audible alarm.

272.130 CONTROL CIRCUIT TRANSFORMERS:

Deleted: Stage E Issue

•Reference Y72.2220

272.140 SWITCHING AND INDICATION:
•Reference Y72.2230A

272.150 AUDIBLE ALARMS:
•Reference Y72.2240

272.160 PROGRAMMABLE LOGIC CONTROLLERS:
•Electrical supply
  •3 phase - reference Y72.1010A
  •Single phase - reference Y72.1010B
•Reference Y72.2250A

272.180 STARTER AND CONTROL PANEL INTERNAL WIRING:
•Reference Y72.2260A

272.190 COMPONENT MOUNTING:
•Reference Y72.2270A

272.200 CONTROL SYSTEM FUNCTION CHARTS:
•Reference Y72.2280A

272.210 WORKMANSHIP:
Reference Y72.3010

274.000 ACCESSORIES FOR ELECTRICAL SERVICES

274.010 GENERAL:
Comply with work section general clauses reference Y74.1000 and those detailed below.

274.020 SAMPLES:
Provide samples of the following items all visible and exposed services prior to ordering.

274.030 ACCESSORIES COMMON REQUIREMENTS:
•Type
Occupied Areas = Moulded plastic
Plant Areas = Metal clad

•Manufacturer and reference

MK Electric
Eaton Electric
Wandsworth

Or approved equivalent

•White plastic plates, flush installation - reference Y74.2010A
•Matt finish metal plates, flush installation - reference Y74.2010B
•White plastic plates, embedded cables, surface installation - reference Y74.2010C
•Metal clad plates, surface steel conduit installation - reference Y74.2010D
•Surface, steel conduit, weatherproof installation - reference Y74.2010E
•Surface, plastic, weatherproof installation - reference Y74.2010F

274.040 INTERIOR LIGHTING SWITCHES:
Manufacturer and reference

Deleted: Stage E Issue

• MK Electric Logic Plus

Or approved equivalent

•General purpose moulded plastic - reference Y74.2020A
•Grid moulded plastic - reference Y74.2020B
•Pull cord - reference Y74.2020C
•General purpose secret key - reference Y74.2020D
•General purpose dimmer - reference Y74.2020E
•Grid secret key - reference Y74.2020F
•Switch details
  •As indicated on drawings/schedules (63) series drawings
  •Gangs as shown on drawings.
  •Pole characteristics Emergency test to be double pole

274.050 EXTERIOR LIGHTING SWITCHES:
•Manufacturer and reference

MK Electric weatherseal

Or approved equivalent

•Sealed rocker bar - reference Y74.2030B
•Switch details
  •As indicated on drawings/schedules (63) series drawings
  •Gangs as shown on drawings.
  •Pole characteristics as shown on drawings.

274.060 TIME SWITCHES:
•24 hour - reference Y74.2040A
•7 day - reference Y74.2040B

274.070 LUMINAIRE CONNECTORS:
Manufacturer and reference

Wieland

Or approved equivalent

•General and emergency lighting - reference Y74.2050A
•General lighting - reference Y74.2050B
•Cord grip general and emergency lighting.
  Reference Y74.2050C

274.090 ISOLATING SWITCHES:
•Manufacturer and reference

MK Electric
Wandsworth
Eaton Electric

Or approved equivalent

•BS EN 60669-1 - reference Y74.2070A
•BS EN 60947-3 - reference Y74.2070B

274.100 FUSE CONNECTION UNITS:
Manufacturer and reference

Deleted: Stage E Issue

- MK Electric
- Wandsworth
- Eaton Electric

Or approved equivalent

•Switched - reference Y74.2080A
•Unswitched - reference Y74.2080B
•Details
  •As indicated on drawings/schedules as shown on drawings.
  •Essential supplies outlets shall have red coloured rocker switch.
  •UPS backed supply outlets shall be coloured red.
  •Clean earth outlets shall be coloured blue.
  •Cleaner's outlets shall be coloured grey.
  •Colours noted above are suggested. Final colour scheme to be agreed with CA prior to ordering.

274.110 SOCKET-OUTLETS:
Manufacturer and reference
- MK Electric
- Wandsworth
- Eaton Electric

Or approved equivalent
•Single, switched - reference Y74.2090A
•Single with integral RCD, switched.
  Reference Y74.2090B
•Double, switched - reference Y74.2090C
•Single, unswitched - reference Y74.2090D
•Single with integral RCD, unswitched.
  Reference Y74.2090E
•Details
  •As indicated on drawings/schedules as shown on drawings
  •Essential supplies outlets shall have red coloured rocker switch.
  •UPS backed supply outlets shall be coloured red.
  •Clean earth outlets shall be coloured blue.
  •Cleaner's outlets shall be coloured grey.
  •Colours noted above are suggested. Final colour scheme to be agreed with CA prior to ordering.

274.130 CORD OUTLETS:
Manufacturer and reference
- MK Electric
- Wandsworth
- Eaton Electric

Or approved equivalent
•Cooker connection unit - reference Y74.2110A

274.140 CABLE AND APPLIANCE COUPLERS:
•Manufacturer and reference • MK Electric
- Wandsworth
- Eaton Electric

  •Or approved equivalent
•16A, 230V single phase, general purpose - reference Y74.2120A
•Details
  •As indicated on drawings/schedules as shown on drawings

274.150 TELEPHONE AND DATA OUTLET SOCKETS:
•Type Category 6 RJ45

Deleted: Stage E Issue

•General purpose - reference Y74.2130A

274.160 TELEPHONE CORD OUTLETS:
•General purpose - reference Y74.2140A

274.170 D TYPE MULTIPIN CONNECTORS:
•General purpose - reference Y74.2150A

274.180 BNC SOCKETS:
•General purpose - reference Y74.2160A

274.190 AERIAL SOCKETS:
•TV and FM aerials - reference Y74.2170A
•Single TV aerials - reference Y74.2170B

274.200 LOW VOLTAGE ISOLATING TRANSFORMER UNITS:
•230/25V units - reference Y74.2180A

274.220 INDICATOR LAMPS:
•General purpose neon - reference Y74.2200A

274.240 WORKMANSHIP:
•Earthing - reference Y74.3010
•Protection - reference Y74.3020
•Fixing - reference Y74.3030
•Measuring mounting heights - reference Y74.3040
•Accessories mounting heights
  •As indicated on the drawings/schedules.
  •Standard - reference Y74.3050
  •For the disabled - reference Y74.3070

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51

280.040 EQUIPOTENTIAL BONDS:
•Main equipotential bonds
  •Reference Y80.2090A
•Supplementary equipotential bonds
  •Reference Y80.2100A

280.050 EARTHING:
•Circuit protective conductors
  •Reference Y80.2110A
•Earthing clamps - reference Y80.2120
•Earth busbars
  •Reference Y80.2130A
•Test links - reference Y80.2140
•Lugs/tags - reference Y80.2150
•Protective cable terminations - reference Y80.2160
•Protective conductor warning notices/labels
  Reference Y80.2170
•Main earth conductor - reference Y80.2180
•Earth bar label - reference Y80.2190

Deleted: Stage E Issue

280.060 WORKMANSHIP:
•Clean earth distribution - reference Y80.3010
•Dissimilar metals - reference Y80.3020
•Tape joints
  •Copper - reference Y80.3030A
•Stranded conductor joints - reference Y80.3040
•Protective cable terminations
  •Reference Y80.3050A

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.

281.020 TESTING AND COMMISSIONING:
•Incorporated equipment characteristics
  •Reference Y81.2010A
•Prospective short circuit current (I_P)
  •Reference Y81.2020A
•Initial verification
  •Reference Y81.2030A
•Test equipment and consumables
  •Reference Y81.2040A
•Testing
  •Reference Y81.2050A
•Continuity of protective conductors
  •ac or dc - reference Y81.2060A
•Earth fault loop impedance (ZS)
  •Reference Y81.2070A
•Settings and adjustments - reference Y81.2080
•Standby generators
  •Reference Y81.2090A
•HV and LV switchgear
  •Reference Y81.2100A
•HV power transformers
  •Reference Y81.2110A
•Specialist installations
  •Fire detection and alarm systems - BS 5839.
    Reference Y81.2120A
  •Lightning protection - BS 6651 - reference Y81.2120B
  •Fire extinguishing installations and equipment on premises - BS 5306 - reference Y81.2120D
  •Emergency lighting installations - BS 5266.
    Reference Y81.2120E
•Calibration - reference Y81.2130
•Certification and reporting
  •Reference Y81.2140A
•Completion certificates
  •Reference Y81.2150A
•Records - reference Y81.2160

281.030 WORKMANSHIP:
•Conductive parts - reference Y81.3010
•Phase sequence - reference Y81.3020
•High voltage tests
  •Reference Y81.3030A
•Cables

Deleted: Stage E Issue

  •LV buried cables - reference Y81.3040A
  •LV and HV buried cables - reference Y81.3040B
•Conduit, trunking and ducting - reference Y81.3050

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.

282.020 LABELS AND NOTICES:
•Reference Y82.2010A

282.030 LABELS AND NOTICES MATERIALS:
•Application All sub main cables at both ends and where pass through walls and floors, all electrical outlets to be labelled with permanent label identifying circuit reference.
•Material
  •Reference Y82.2020A
•Fixing
  •Reference Y82.2030A
•Arrangement
  •Reference Y82.2040A
•Lettering and size of labels and notices
  •Reference Y82.2050A

282.040 CONDUCTOR ARRANGEMENT:
Reference Y82.2060A

282.045 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:
Reference Y82.2085

282.050 EQUIPMENT SIGNS AND LABELS:
•Safety signs
  •Reference Y82.2070A
•Plant and equipment labels
  •Reference Y82.2080A
•Colour corrected light fittings - reference Y82.2100
•Motors and starters labels
  •Reference Y82.2110A
•Engraved accessory plates
  •Reference Y82.2120A
•Switchgear
  •Reference Y82.2130A
•Distribution boards - reference Y82.2140

282.055 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:
Reference Y82.2085

282.060 SCHEMATIC DIAGRAMS:
•Reference Y82.2150A

282.070 SPECIAL PURPOSE EARTHING:
•Reference Y82.2160A

282.080 INDICATOR LAMPS AND PUSH BUTTONS FOR POWER SYSTEMS:
•Reference Y82.2170A

Deleted: Stage E Issue

282.090 CONDUIT AND TRUNKING COLOUR CODING:
•Reference Y82.2180A

282.100 CABLE IDENTIFICATION:
•Cable identification
  •Reference Y82.2190A
•Terminal marking and conductor identification
  •Reference Y82.2200A
•Underground cable identification
  •Reference Y82.2210A
•Cable conductor colour coding
  •Reference Y82.2220A
•Cable jointing and termination - reference Y82.2230
•Cable sheath identification - internal
  •Reference Y82.2240A
•Cable sheath identification - external
  •Reference Y82.2250A

282.110 ADDITIONAL SAFETY SIGNS:
•Application Electric Shock Poster, Emergency resuscitation poster, electricity at Work poster all to be located in all electrical switchrooms.
•Reference Y82.2260A

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.

290.020 FIXINGS:
•Standards - reference Y90.2010
•Plugs - reference Y90.2020
•Screws - reference Y90.2030
•Cast-in fixings - reference Y90.2040
•Shot fired fixings - reference Y90.2050
•Self adhesive fixings - reference Y90.2060
•Proprietary channel inserts - reference Y90.2070

290.030 WORKMANSHIP:
•Drilling - reference Y90.3010
•Proprietary fixings - reference Y90.3020
•Fixing to reinforced concrete - reference Y90.3030
•Fixing to brickwork - reference Y90.3040
•Fixing to timber rails - reference Y90.3050
•Fixing to hollow stud/tile/block wall
  •Reference Y90.3060A
•Fixing to concrete, brickwork or blockwork
  •Reference Y90.3070A
•Fixing to metalwork
  •Reference Y90.3080A
•Fixing to structural steelwork and concrete structures
  •Reference Y90.3090A

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PART 3 SPECIFICATION CLAUSES SPECIFIC TO V20.

300.000 PRODUCTS/MATERIALS

300.010 FUSE PILLARS:
•Application External lighting and CCTV
•Manufacturer and reference Lucy Oxford
  •Or approved equivalent
•Cables as schedule number Appendix 3 - Cable Schedules (to be completed in Stage F).
•Standard
  Comply with requirements of Electricity Supply Industry Specification ESI 37.
  •Provide housing with a degree of protection
    •to BS EN 60529 IP 45.
•Material
  •Cast iron.
•Terminations
  Make provision for termination and connection of cables and spare ways
  •as indicated on drawings.
•Access
  Supply front access pattern fuse pillars with insulated barriers or screens over all live metal and labelled for identification.
  •Access doors
    Fit fuse pillar access doors with internal hinges. Secure doors with quick acting barlock and high security padlock.
•Components
  •Isolating switches as per drawing
  •Busbars (phases, neutral & earth).
  •Fuse carriers.
  •Bases.
  •Cartridge fuse links in accordance with BS 88 (BS EN 60269).
•Ancillaries
  Mount inside each fuse pillar
  •set of isolator operating and locking off tools.
  •spare fuse tray, equipped with spare fuses.
•Finish
  Treat metal fuse pillars prior to final painting to prevent rust.
  •Unit to be coloured to Architects external specification
    After final painting treat interior with a cork based paint to reduce level of condensation by providing a thermal barrier between enclosure metalwork and internal air.
•Heater
  Equip fuse pillar with an anti-condensation heater rated at 65 watts complete with a switch, fuse, switching thermostat, high limit cut-off thermostat and all necessary wiring.
•Base unit
  Supply purpose made base unit for cable entry.

310.000 WORKMANSHIP

310.010 INSTALLATION:
Install fuse pillars in accordance with manufacturer's recommendations.

Deleted: Stage E Issue

BS APPENDIX

BS 4678-1:1971
Cable trunking. Part 1 Steel surface trunking.
Current, but obsolescent

BS 4678-2:1973
Cable trunking. Part 2 Steel underfloor (duct) trunking

BS 4678-4:1982
Cable trunking. Part 4 Specification for cable trunking made of insulating material

BS 5266-1:1999
Emergency lighting. Part 1 Code of practice for the emergency lighting of premises other than cinemas and certain other specified premises used for entertainment

BS 5266-2:1998
Emergency lighting. Part 2 Code of practice for electrical low mounted way guidance systems for emergency use

BS 5266-3:1981
Emergency lighting. Part 3 Specification for small power relays (electromagnetic) for emergency lighting applications up to and including 32 A

BS 5306-1:1976
Fire extinguishing installations and equipment on premises. Part 1 Hydrant systems, hose reels and foam inlets

BS 5306-2:1990
Fire extinguishing installations and equipment on premises. Part 2 Specification for sprinkler systems

BS 5306-3:2003
Fire extinguishing installations and equipment on premises. Part 3 Code of practice for the inspection and maintenance of portable fire extinguishers

BS 5839-1:2002
Fire detection and alarm systems for buildings. Part 1 Code of practice for system design, installation, commissioning and maintenance

BS 6651:1999
Code of practice for protection of structures against lightning

BS 88-2.2:1988
Cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c. Part 2.2 Specification for fuses for use by authorized persons (mainly for industrial application). Additional requirements for fuses with fuse-links for bolted connections

BS 88-4:1988
Cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c. Part 4 Specification of supplementary requirements for fuse-links for the protection of semiconductor devices

BS 88-5:1988
Cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c. Part 5 Specification of supplementary requirements for fuse-links for use in a.c. electricity supply networks

BS 88-6:1988
Cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c. Part 6 Specification of supplementary requirements for fuses of compact dimensions for use in 240/415 V a.c. industrial and

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commercial electrical installations

BS EN 60529:1992
Specification for degrees of protection provided by enclosures (IP code)

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V21 GENERAL LIGHTING

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide general illumination throughout the buildings and surrounding external area, in accordance with recognised design practice and guidelines.

100.020 DESIGN PARAMETERS
In accordance with CIBSE guidelines.
•Illuminance levels
  •Ensure the maintained illuminance levels meet but do not significantly exceed the CIBSE Code for Interior Lighting.
•Ensure the initial circuit luminous efficacy is in excess of 48 luminaire-lumens/watt for fixed lighting installations.
•Ensure the installed load for office lighting does not exceed 12 W/m^2.
•Ensure lighting scheme complies with the Building Regulations L1 and L2 as appropriate.

100.030 SYSTEM DESCRIPTION
Supply, install, test, commission and set to work the general lighting system including luminaires, lamps, automatic lighting control system, sensors, switches and interconnecting cabling.

Luminaires

Refer to Luminaire Schedule. All luminaires supplied c/w lamps.

Automatic Lighting Control System

Complete the detailed design, supply, install, test, commission and set to work a microprocessor based lighting control system to control all lighting in all areas, except plant rooms.

X.1 General Requirements

The lighting control system scope of works is based upon a system that provides maximum flexibility and control, a system that can be reconfigured without the need to rewire and a system that uses the addressable features inherent to DALI ballasts and controls without the need for traditional Lighting Control Modules or Area Controllers. The system will incorporate designed in spare capacity and not the unused paid for spare capacity associated with traditional systems. The lighting control system will enable ease of compliance with Part L of the building regulations.

Where specified in the luminaire schedule, luminaires shall incorporate control gear conforming to the DALI (Digital Addressable Lighting Interface) standard IEC 60929.
To each of these luminaires a DALI Lighting Control System shall provide control features to include:-

- Full digital control over the lighting range including Off
- Ballast detection feedback
- Lamp error feedback
- Broadcast control capability
- Automatic sub-addressing capability
- Time control

The lighting control system shall consist of multiple DALI sub-networks linked together to form a building-wide solution using powerful, intelligent Router Connectivity Modules connected by an Ethernet network.

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The DALI system shall be fully addressable, automated and digitally controlled and comprising the following major components:-

- DALI to Ethernet Router Connectivity Modules (RCM) providing luminaire and control plug-in connection to the system
- Optional DALI Slave Connectivity Modules to enhance power distribution
- Ethernet Switches mounted in the riser cupboard to enable floor to floor system connection
- DALI System supervisory, control, configuration and Graphical User Interface software
- Local DALI control devices to include sensors, scene plates, switch interfaces and other interfaces
- Local 'horizontal' power and DALI network cabling system between RCM's and luminaires

The lighting controls are to utilise time schedules, occupancy sensors, light sensors, switches and scene panels to control the lighting in the interior spaces on each floor.
It shall be possible to configure lighting with the following control functions:-

- Presence detection with automatic phased and timed Off control for groups of luminaires
- Absence detection with Manual On, Off, override by dim and automatic phased and timed Off control for groups of luminaires
- Manual control and override via switch plates
- Manual control via scene panels that include infra-red control
- Automatic constant light control in response to photo-cell measurement
- Synchronised time control
- Cascaded corridor hold control
- Programmable load shedding
- Alarm override via OPC or volt-free contact connection to 3rd party systems
- Addressable emergency light test and monitoring (using Tridonic EM-PRO Inverter modules)
- Interface with meeting room partitions
- Interface with blinds
- Interface with AV systems

It shall be a standard system feature that a lighting group consisting of any luminaire combination within the installation may be controlled by any combination of local control sensors or switches within the installation, this will be achievable at any time without the need for additional equipment. The lighting control system shall be supplied, commissioned, tested and set to work by one of the following named companies:-

Luxonic Lighting Plc
Priestley Road
Basingstoke
Hants. RG24 9JP

Or equal and approved

X.2 DALI System Parameters, General Installation and Cabling Requirements

X.2.1 DALI Explained

DALI standard EN60929 states that DALI ballasts from any ballast supplier that are manufactured to the standard, may be used and freely mixed within an installation.
Each DALI interface (ballast, transformer, LED driver, Relay, emergency inverter) has its' own unique address within its' DALI sub-network.
The protocol operates at a low speed of 1200 Baud and is therefore highly resistant to interference. The DALI network cabling can therefore be carried in the same cable or containment as the lighting power.
A DALI network comprises 2 - Extra Low Voltage, non-polarized wires and has free topology. The DALI network cabling does not require regular twists in the wires, therefore low cost 2-core 1.5mm^2 flex can be used as long as the cable insulation is rated for plenum ceilings.

Therefore, a common 5-pole, 5-core connector system can be employed to connect all luminaires and control devices together for power and DALI bus network.

X.2.2 DALI System Capacities

Each sub network shall enable up to 64-DALI devices to be connected subject to a maximum current load of 250mA. Device loads as follows:-

	DALI Load	Device Load
DALI Ballast, Transformer, Inverter, Relay	2mA	1
Router Connectivity Module	2mA	0
Multi or Switching Sensor	15mA	1
Scene Control Plate	10mA	1
Switch Mini Input Unit	10mA	1
Relay Module	2mA	4

X.2.3 Typical load model 1 – Speculative project

Qty	Product	mA Load	Device Load
28	DALI Standard luminaires	56mA	28
4	DALI Addressable Emergency luminaires	16mA	8
8	DALI Multi-Sensors	120mA	8
1	RCM	2mA	0
Total Loading (Spare Capacity)		194mA (22%)	44 DALI (31%)

X.2.4 Typical load model 2 – Fit-out project

36	DALI Standard luminaires	72mA	36
4	DALI luminaires with Self Test Emergency	8mA	4
10	DALI Multi-Sensors	150mA	10
1	RCM	2mA	0
Total Loading (Spare Capacity)		232mA (7%)	50 (21%)

X.2.5 DALI Network Cable Length Limit

In order to prevent excessive DALI network voltage drop, 1.5mm^2 conductor cross-section cable shall be used to a maximum of 300m total connected cable length. In the above 'Typical Load Model 2' the estimated cable length will be 150m and a high safety factor is inherently designed in. The cable type will be standard mains rated cable and will run with the mains cabling as apart of the 5-core DALI cabling system.

X.2.6 Installation

The electrical contractor shall fit the lighting control system, make all connections, pre-test the installation and make it available to the lighting control system supplier for commissioning. The contractor will then work with the controls supplier to project completion.
The electrical contractor shall ensure that the lighting control system is accurately installed against drawings with all of the following properly recorded and provided to the lighting controls supplier for the purpose of commissioning

- RCM reference numbers and locations
- As fitted DALI luminaire and control device drawings with referencing if applicable
- Horizontal and vertical spine Ethernet network cabling routes

All Ethernet bus cables shall be freely wire-able using radial, bus type or spur connections. Maximum Ethernet cable length will be 100m.

X.2.7 Horizontal Spine Network

The horizontal spine network connecting RCM's together is Ethernet. The topology of this network is generally a tree like topology with radials (branches) and sub radials (branches) connecting to Ethernet switches. Loop connections are not permitted.

Spine network wiring shall be Cat 5e (minimum) UTP cable, LSFOH sheath installed in IOCT basket. Bus wire sheath to be different colour to standard ICT cabling for ease of co-ordination and identification (colour T.B.C.).

X.2.8 Vertical Spine Network

The spine network simply uses a bus topology to connect in and out of Ethernet switches mounted at each level.

Spine network wiring shall be Cat 5e (minimum) UTP cable, LSFOH sheath installed in IOCT basket. Bus wire sheath to be different colour to standard ICT cabling for ease of co-ordination and identification (colour T.B.C.).

X.2.9 IP Addressing

The lighting control system DALI Routers and Ethernet switches are suitable for fixed IP addressing or Dynamic Host Control Protocol (DHCP). The routers automatically negotiate 10/100mb and auto detects crossover cabling. The Router system shall use minimal bandwidth and be suitable for inclusion to the clients IT network

X.2.10 DALI Luminaire and Device System Wiring

The DALI wiring system will be a plug and play 5-pole, 5-core system using 1.5mm^2 cores to carry Live, Neutral, Earth, DALI +ve and -ve from the RCM or SCM (if used). The wiring system will power all luminaires and controls whilst enabling communication between all DALI devices sharing the inherent DALI bus network. Luminaires will take their power from mains and connect to the DALI network; input devices operate at ELV and will take their power from the DALI wiring connected to the DALI Power Supply Unit at the RCM and communicate with other DALI luminaires and input devices through the inherent DALI network.
Each luminaire will be supplied complete with 0.5m, 5-pole, 5-core. 1.5mm^2 lead and plug together with a 5-pole 4-way 'H' connector block. 5-pole, 5-core, 1.5mm^2 Male to female interconnecting cables of standard lengths designed to keep cabling to a minimum to minimise wastage will link 'H' blocks in a daisy chain back to the RCM or SCM.
The loop in, loop out and luminaire tap-off cables take 3 of the 4 'H' block connection points leaving 1 connection point free for the additional plug-in connection of an input device such as a Multi-Sensor, Scene Plate or Mini Input Unit via a 5-pole, 2-core 1.5mm^2 lead & plug.
All interconnecting cables will be LSOH, all plugs will be 5-pole and compatible with the RCM or SCM plug system.

Each plug will incorporate strain relief.
The function of local control devices shall not be dependent on the point at which they are connected into the local DALI network.

X.3 System Components

X.3.1 DALI Router Connectivity Module

The heart of the DALI Lighting Control System will be the Router Connectivity Module (RCM).
The DALI RCM will physically connect and power 2-DALI sub-networks (A & B) each of up to 64 devices, 250mA of DALI load or 300m of DALI cabling using core sizes of 1.5mm^2 (whatever limit is reached first).
The RCM facilitates the connection of 4-same phase lighting feeds via a standard 12-core, 2.5mm^2 SWA cable connection. 2 Lighting feeds are used to power the lighting connected to DALI sub-network A and 2-feeds for DALI sub-network B. This will enable the lighting load to easily be spread through the ceiling void via a plug & play 5-core DALI wiring system. To facilitate ease of connection of the DALI wiring system, 2 – 5-pole panel mounted connectors will be provided per DALI network to each side of the RCM. Feeds 1 & 2 will power luminaires connected to DALI sub-network A and feeds 3 & 4 will power luminaires connected to DALI sub-network B.
This method of attaching the cabling system will enable the system to be installed into ceiling voids of <100mm depth.
The RCM will also facilitate the connection of 2-same phase (as lighting) fan coil feeds via a standard 7-core, 2.5 – 4.0mm^2 SWA cable connection. This will enable fan coils to be powered from separate MCBs back at the distribution board. This connection is optional as it is will also be possible to power fan coil controllers, subject to load from the Lighting circuits. To facilitate connection of the fan coil wiring system, 2 – 3-pole panel mounted connectors will be provided to each side of the RCM.
The RCM will enable devices on each connected DALI sub-network to seamlessly communicate with each other and with other DALI sub-networks devices (connected to other RCM's) by an installed Ethernet network and the DALI - Ethernet system software.
The RCM will be available with 2-variants for connection to an Ethernet network, a 5-port Ethernet Switch version for ease of connection to other RCM's via an installed Ethernet network or a 5-port Wireless Ethernet switch version for ease of install (subject to design/survey).
Both variants will enable the RCM's installed DALI Router to plug into the Ethernet Switch via a patch cable, enable loop-in, loop-out or radial Ethernet connection and always provide 1-free port for connection of the commissioning laptop PC via a physical cable or via WI-FI.
At the heart of the RCM is the DALI Router, which has 2 – protected DALI power supply units, 1 per DALI sub-network and an Ethernet to DALI interface. The DALI Router interface will load each DALI network with a load of 2mA, allowing 248mA of further load to be added to each sub-network.
Setup and programming of the DALI sub-networks will be from the Ethernet side and therefore this 248mA per DALI sub-network is free to use.
The RCM should generally be mounted centrally within the group of four lighting circuits that it supplies, it should be accessible to facilitate maintenance access to the pluggable connections within and external to the product.
The DALI Router will be din rail mounted and all connections will be pluggable for ease of maintenance.

X3.1.1 Router Software

Up to 4,000 Routers can be simultaneously connected to a high speed Ethernet backbone to form a 'Workgroup'
Up to 128 Devices can be connected to a Router (64 per sub-network)
A device can belong to up to 128 different scenes
A 'Workgroup' can have up to 64,000 DALI groups
Each Router can have up to 256 groups subject to the above
The DALI Router will have an OPC driver to enable software connection to other building services using OPC connectivity

The DALI Router will have a built-in Real Time Clock that will synchronise with all other DALI Routers
The DALI Router will have a powerful conditional control logic capability
The Router will 'self heal' with ballast and control failures

X.3.2 DALI Slave Connectivity Modules – Optional

A DALI Slave Connectivity Module (SCM) is utilised to provide ease of load spread across a building floor plate. This device takes the 2 – RCM lighting circuit feeds and DALI network via an interconnecting DALI cable set. The SCM then acts as a traditional spider box for up to 8-luminaire and input device daisy chains, 4-each for feeds 1 & 2.
This device reduces the number of luminaires in a daisy chain and allows more versatile spread of the lighting load.
2 – SCMs can be connected to a RCM if required, a built-in DALI network Status LED provides local visual confirmation of the DALI network status.
SCMs incorporate vertically mounted connectors and are suitable for ceiling void depths >150mm

X.3.3 Local Control Devices

X.3.3.1 General

Local control devices shall consist of switches, presence sensors, dimming photo-cells and Infra-red receivers and the like; these devices generally serve as inputs to the control system.
It shall be possible to disconnect and service all local control devices by access to luminaire 'H' blocks within the ceiling void.
Where control switches and sensors are required, each RCM loop (2-loops per RCM) shall provide sufficient capacity for simultaneous connection of up to 10 sensor, switch or scene plate devices based on 4-luminaires per control device and subject to luminaire loadings per circuit. The maximum quantities of these devices will vary depending on the number of luminaires and luminaire types they are designed to serve.

X.3.3.2 DALI Multi-Sensor

The system shall provide DALI Multi-Sensors that combine passive infra-red movement detection, light sensing and a multi-channel active infra-red receiver into a single unit. Functionality of the sensor is described below.
The sensor shall be mounted within the ceiling tile on a grid layout to provide complete coverage of the open plan and cellular spaces.
The sensor shall have a circular profile on the visible surface with a diameter of less than 65mm.
It shall be possible to install and remove the sensor from the internal surface only using as an example, a rotating spring clip mechanism. It shall be possible for the sensor to mount into ceilings of a thickness between 1mm and above.
To aid installation, the sensor will have a removable PCB mounted terminal block with loop-in, loop-out connections and a shroud with built-in cable clamp facility.
All sensor cables shall have core insulation and an outer sheath both of low smoke zero halogen construction.
The sensor shall be network based and powered from the connected DALI network with an effective network load of 15mA. The 2-core, 3m sensor cable will include a 5-pole DALI cabling system plug for connection to the nearest luminaire 'H' block
It shall be possible for a push-to-make retractive switch to connect to the back of the sensor via a 2-core cable as above. This connected switch can be used in conjunction with the operation of the sensor to override the automatic control or light level or used for absence detection purposes.
It shall be possible through the DALI system software to individually assign a Multi-Sensors PIR, Constant Light Controller, individual IR Control buttons or the connected push-to-make switch to control any group of lighting, e.g. the PIR controls 1-group, the Constant Light Controller another, the IR controller another and the connected switch another.

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Through the DALI – Ethernet system software it shall be possible to program any element of the PIR to control a single luminaire, a group of luminaires or all luminaires within the building to cater for the future fit-out requirements of the client.

Each multi-sensor shall provide a volt-free contact for connection to the BMS system for the purposes of occupancy control of the HVAC system. Final connection to the volt-free contact by BMS contractor.

X3.3.2.1 Passive Infra-Red Movement Detection

The DALI Multi-Sensor will include a passive infra-red movement detector to control any defined group of luminaires depending on the occupancy of an area and allows the space to be reconfigured or modified without changing the wiring. The sensor shall control the defined lighting group by using scenes programmed for the lighting group at commissioning.
The PIR will have a 3-stage switching arrangement whereby the 'On', 'intermediate' and 'Off' lighting scene levels can be determined. Transition to each scene shall be via a programmable fade time for comfort and this shall be in the range 0 to 90 seconds.
A primary PIR time delay shall be programmable between 1 and 85 minutes for the 'On' to 'Intermediate' time out period. With no occupancy and after the time delay period elapses the fade rate to the 'Intermediate'' level will commence.
A secondary PIR time delay shall be programmable between 20 seconds and 85 minutes for the 'Intermediate' to Off time out period. After the time delay period elapses the fade rate to the 'Off' level will commence.
A third 'Exit' timer will allow a group override switch to turn the lighting off and prevent the PIR element being active whilst this timer is operative. This will allow sensor override in meeting rooms and offices and allow a 'last one out' switch to turn the lighting off. During the Exit period the timer will reset to the 'Exit' time delay period whilst occupancy is detected.
It shall be possible to program the sensor for either Presence or Absence detection, determined by the setting for the 'On' Scene. If this were set to 'Not Used' the sensor would rely on a programmed switch to turn the lighting on. This switch could either be a push-to-make switch connected to the back of the sensor, a switch connected to a Mini Input Unit or perhaps a switch scene plate.
The PIR movement detector shall utilise quad element pyro-electric detectors in combination with a 360 degree multi-facet fresnal lens. At a mounting height of 2.7m the sensor cover a detection area of approximately 7m diameter at floor level.
When multiple sensors share a common control group these sensors shall cooperate with each other by retriggering all sensor timers within the group.
For commissioning purposes, the presence detector shall have a 20 second walk test timer facility.

X3.3.2.2 Light Sensing

The DALI Multi-Sensor shall include a 'constant light controller to control the light level of any defined group of luminaires according to the amount of available light in an area, typically luminaires adjacent to windows. When the luminaire group is on, the light level is raised or lowered depending on whether the light level determined by the light sensor is above or below its' programmed set point.
The constant light sensor set point for the group of luminaires shall be programmable via a laptop PC during commissioning, at the head-end PC or via a hand held infra-red programmer.
At switch on through occupancy, the constant light controller will turn the lighting level to the minimum light level set for the DALI load interfaces (e.g. ballast or transformer), if the lighting measured is below the sensors set point the lighting will be controlled up rapidly to achieve the set point. After this, the lighting will move up & down in subtle increments and will avoid chasing rapidly changing external light conditions.
It shall be possible to set the constant light controller to switch its' group luminaires off if they are at their set minimum level, the constant light controller has tried to dim the lighting down for circa 20 minutes and the set point is lower than the measured light level.
The light sensor shall have a 100 degree vision cone. For conditions whereby stray light up onto the ceiling has an adverse effect on the operation of the constant light controller, a light sensor shroud moulded into the rear of the Multi-Senor shall be removed and assembled to the front of the sensor. This shroud will limit the angle of vision to a 40 degree vision cone.

X3.3.2.3 Infra-Red Receiver and Controllers

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The DALI Multi-Sensor shall incorporate an active infra-red receiver to be used in conjunction with a hand held or wall mounted, battery powered controller.
It shall be possible to set the IR receiver to operate on 1 of 14-channels or off. By setting different channels to individual sensors, cross-talk between multiple hand-held controllers will be avoided in an open office environment where IR override is a requirement.
It shall be possible to determine a scene store time delay to enable constant light control levels to be set and programmed scene levels to be altered where the functionality assigned to the IR button enables 'Scene Store'. It shall also be possible to turn this feature Off.
It shall be possible to select any standard DALI command to be recalled from the press of a hand held control button, e.g. A multi-Sensor controls 4-lights for On and Off in an open plan or office work area. On entry to an area the Multi-Sensor automatically turns all the lighting On. The 4-Scene buttons can then be set to control individual lights for On/Off, Dim Up and Dim Down.
It shall be possible to program each button to have a corresponding fade rate of 0 to 90 seconds for scene recall.

The hand held controller will have a powerful dual transmitting element to enable long distance IR control.
The hand-held IR Scene controller will have 7-buttons, Scenes 1 to 4, Raise, Lower and a Toggle Max Level and Off button. It shall be possible to set the IR controller to operate on channels 1 to 14 and broadcast control

X.3.3.3 DALI Switching-Sensor

As an option, when light level sensing is not required e.g. deep internal spaces, corridors, toilets, etc. the system shall provide DALI Multi-Sensors that combine passive infra-red movement detection and a multi-channel active infra-red receiver only into a single unit. Functionality of the sensor is described below.
The sensor shall be mounted within the ceiling tile on a grid layout to provide complete coverage of the open plan and cellular spaces.
The sensor shall have a circular profile on the visible surface with a diameter of less than 65mm.
It shall be possible to install and remove the sensor from the internal surface only using as an example, a rotating spring clip mechanism. It shall be possible for the sensor to mount into ceilings of a thickness between 1mm and above.
To aid installation, the sensor will have a removable PCB mounted terminal block with loop-in, loop-out connections and a shroud with built-in cable clamp facility.
All sensor cables shall have core insulation and an outer sheath both of low smoke zero halogen construction.
The sensor shall be network based and powered from the connected DALI network with an effective network load of 15mA. The 2-core, 3m sensor cable will include a 5-pole DALI cabling system plug for connection to the nearest luminaire 'H' block
It shall be possible for a push-to-make retractive switch to connect to the back of the sensor via a 2-core cable as above. This connected switch can be used in conjunction with the operation of the sensor to override the automatic control or light level or used for absence detection purposes.
It shall be possible through the DALI system software to individually assign a Multi-Sensors PIR, Constant Light Controller, individual IR Control buttons or the connected push-to-make switch to control any group of lighting, e.g. the PIR controls 1-group, the Constant Light Controller another, the IR controller another and the connected switch another.
Through the DALI – Ethernet system software it shall be possible to program any element of the PIR to control a single luminaire, a group of luminaires or all luminaires within the building to cater for the future fit-out requirements of the client.

X.3.3.3.1 Passive Infra-Red Movement Detection

The DALI Multi-Sensor will include a passive infra-red movement detector to control any defined group of luminaires depending on the occupancy of an area and allows the space to be reconfigured or modified without changing the wiring. The sensor shall control the defined lighting group by using scenes programmed for the lighting group at commissioning.
The PIR will have a 3-stage switching arrangement whereby the 'On', 'intermediate' and 'Off' lighting scene levels can be determined.

A primary PIR time delay shall be programmable between 1 and 85 minutes for the 'On' to 'Intermediate' time out period. With no occupancy and after the time delay period elapses the 'Intermediate'' level will be recalled.
A secondary PIR time delay shall be programmable between 20 seconds and 85 minutes for the 'Intermediate' to Off time out period. After the time delay period elapses the 'Off' level will be recalled.
A third 'Exit' timer will allow a group override switch to turn the lighting off and prevent the PIR element being active whilst this timer is operative. This will allow sensor override in meeting rooms and offices and allow a 'last one out' switch to turn the lighting off. During the Exit period the timer will reset to the 'Exit' time delay period whilst occupancy is detected.
It shall be possible to program the sensor for either Presence or Absence detection, determined by the setting for the 'On' Scene. If this were set to 'Not Used' the sensor would rely on a programmed switch to turn the lighting on. This switch could either be a push-to-make switch connected to the back of the sensor, a switch connected to a Mini Input Unit or perhaps a switch scene plate.
The PIR movement detector shall utilise quad element pyro-electric detectors in combination with a 360 degree multi-facet fresnal lens. At a mounting height of 2.7m the sensor cover a detection area of approximately 7m diameter at floor level.
When multiple sensors share a common control group these sensors shall cooperate with each other by retriggering all sensor timers within the group.
For commissioning purposes, the presence detector shall have a 20 second walk test timer facility.

X.3.3.3.2 Infra-Red Receiver and Controllers

The DALI Multi-Sensor shall incorporate an active infra-red receiver to be used in conjunction with a hand held or wall mounted, battery powered controller.
It shall be possible to set the IR receiver to operate on 1 of 14-channels or off. By setting different channels to individual sensors, cross-talk between multiple hand-held controllers will be avoided in an open office environment where IR override is a requirement.
It shall be possible to determine a scene store time delay to enable constant light control levels to be set. It shall also be possible to turn this feature Off.
It shall be possible to select any standard DALI command to be recalled from the press of a hand held control button, e.g. A multi-Sensor controls 4-lights for On and Off in an open plan or office work area. On entry into an area the Multi-Sensor automatically turns all the lighting On. The 4-Scene buttons can then be set to control individual lights for On/Off.
Through software upgrade it shall be possible to enhance the switching sensor for dimming operation

The hand held controller will have a powerful dual transmitting element to enable long distance IR control.
The hand-held IR Scene controller will have 5-usable buttons, Scenes 1 to 4 and a Toggle Max Level and Off.

X.3.3.4 DALI Scene Panels

The standard DALI scene panel shall provide 4-scene, Raise, Lower and Off control as standard, with each lighting group scene being programmable via the DALI System software, via the scene panel itself or via the hand-held IR scene controller subject to this facility being set for operation during commissioning.
The scene plate shall fit into a standard back box size, with other variations to include 2, 5 and 8-button scene plates, sliders and rotary dimmers available in single or multi-gang configuration. All scene plate modules will include an IR receiver as standard.
All scene plate cables shall have core insulation and an outer sheath both of low smoke zero halogen construction.
The scene plate shall be network based and powered from the connected DALI network with an effective network load of 10mA. The 2-core, 5m sensor cable will include a 5-pole DALI cabling system plug for connection to the nearest luminaire 'H' block
It shall be possible to set the IR receiver to operate on 1 of 14-channels or off. By setting different channels to individual scene plates, cross-talk between multiple hand-held controllers and sensors will be avoided in an open environment.
It shall be possible to select any standard DALI command to be recalled from the press of a scene plate control button, e.g. A scene plate controls meeting room lighting for 4-scenes and Off but the

raise lower buttons are used to control window blinds or a motorised projection screen via a DALI Blind Controller or dim the lighting adjacent a LCD or plasma screen
Through the DALI – Ethernet system software it shall be possible to program any button of the scene panel to control a single luminaire, a group of luminaires or all luminaires within the building to cater for the future fit-out requirements of the client.

X.3.3.4 Mini Input Unit

The DALI Mini input unit will interface up to four volt-free, push to make or latching switches/Key-switches to the DALI sub-network.
This device is compact in design and is mounted behind a 3rd party switch plate in a standard back box.
The DALI Mini Input Unit will have 7-coloured wires as follows:-

Brown	Switch common	
Red	Switch 1	Pre-set for Scene 1 recall/store
Orange	Switch 2	Pre-set for Scene 2 recall/store
Yellow	Switch 3	Pre-set for Scene 3 recall/store
Green	Switch 4	Pre-set for Touch Max Level Control*
Blue	DALI +ve	
Violet	DALI –ve	

*Short press toggles lighting On to Max level and Off, long press toggles Raise and Lower

All connected Mini Input Unit cables shall have core insulation and an outer sheath both of low smoke zero halogen construction. The Mini Input Unit will connect to the network cable via a terminal block in the standard wall box.
The Mini Input Unit shall be network based and powered from the connected DALI network with an effective network load of 10mA. The 2-core, 5m cable will include a 5-pole DALI cabling system plug for connection to the nearest luminaire 'H' block.
It shall be possible to select any standard DALI command to be recalled from the press of a connected Mini Input Unit switch.
Through the system software it shall be possible to program any button of the scene panel to control a single luminaire, a group of luminaires or all luminaires within the building to cater for the future fit-out requirements of the client.

X.3.3.5 DALI Relay Module

The DALI Relay Module is required to provide On/Off control for non-dimmable, non-DALI loads such as standard electronic ballasts, cold cathode lighting, incandescent lamps, fans and motors.
The 4-addressable outputs are rated at 10A resistive or 5A inductive and will be suitable for control of lighting in core areas such as corridors, lobbies, toilets and stairs.
Where loads exceed the above limits the relay module can be used to control appropriately rated multi-pole contactors.
This product is din rail mounted and suitable for installation into a standard enclosure such as a consumer unit.

X.3.3.6 DALI Blind Controller

The DALI Blind Controller is required to provide Open/Close control of blinds in offices or meeting rooms or projector screen motors in meeting rooms.
This product as 2-pairs of relays for the control of 2-sets of blinds for Open/Close, or 1 set of blinds for Open/Close/Up/Down. The control philosophy for the relay pair will ensure that 230V can exist on 1 relay of a relay pair at any time, i.e. it will remove power from 1 relay in the pair before applying power to the other relay in the pair.
This product is din rail mounted and suitable for installation into a standard enclosure such as a consumer unit.

X.3.3.7 DSI and 1-10V Interface

X.3.3.8 DALI 8-Channel Input Unit

The DALI 8-channel Interface enables up to 8-volt free inputs such as switches or volt-free outputs from other systems such as a BMS or security system relays to be connected.

It shall be possible to select any standard DALI command to be recalled from this external contact open and closure.
Through the system software it shall be possible to program any contact closure to control a single luminaire, a group of luminaires or all luminaires within the building to cater for the future fit-out requirements of the client.

X.4 Further System Software Features

In addition to the software features already detailed in previous sections, the lighting control system shall also provide the following:

X.4.1 Intranet Browsing

It shall be possible to connect the Dali – Ethernet system to the clients' internal intranet to enable building occupants to control their local lighting via a software applet loaded onto individual PC's. The software applet will be opened by double clicking a Microsoft windows desktop shortcut. The applet will offer each user 4-preset light levels, raise, lower & Off. On activation of one of the screen buttons the local lighting to this workstation or cellular office will be programmed to respond accordingly.
Each personal PC connected to the lighting control system via the intranet will require a software license and commissioning time to set the appropriate lighting group for control.
This software applet can be used in co-operation with or replace local lighting controls, however, for the latter the general lighting will need to be timed On & Off for core operational hours with corridors responding to local control devices.
Allocation of IP addresses for the lighting control system RCM's will need to be agreed with the clients' IT representative.
The installed system does not require this functionality, however the system shall have this capability for future addition by the Client.

X.4.2 BMS Interface

The lighting control systems RCM's will incorporate an OPC driver. OPC stands for OLE (Object Linking & Embedding) for Process Control and is similar to OLE used in Windows environments.
This driver will enable other systems such as HVAC, Fire, Access and Security incorporating the same OPC technology to seamlessly integrate with the lighting control system.

X.4.3 General Features

Each luminaire shall be individually addressable and the system shall provide as a minimum the following functions:

- Dimming control via a digital DALI control signal (actioned centrally, via local control devices or as part of daylight linking control.
- Local switching via a possible variety of control devices
- Central time schedule switching
- Linking facility to hold on access route lighting.
- Automated testing of emergency lighting.

It shall be possible to configure every addressable luminaire and sensor from the software and program all configurations without the need to access devices locally in any way for the purposes of changing manual settings or addresses

X.4.2. DALI System Software

The DALI – Ethernet System Software shall be graphics based and operate within the Microsoft Windows© environment, it shall be capable of multi-tasking with other windows applications.
The system shall allow luminaires to be joined and built into named groups that can be controlled by any control sensors within the system using simple drag and drop programming tools.
The display will indicate the status of all luminaires and control sensors on that floor and shall have a refresh rate of no more than 10 seconds. It shall be possible to select each device to immediately display further information including: percentage luminaire output, historical presence detection, photocell reading and switch status. It shall also be possible to select a switch plate or infra-red control and issue a command as though generated manually at the device.
The Software Pack shall provide central control (both switching and dimming functions) and management functions for the entire lighting installation of the building down to the level of each luminaire. It shall provide the facility for software grouping of luminaires across all DALI sub-networks, timed event sequencing and linking of groups to hold on access route lighting.

X.4.3 Software Package, License and Support and Head-End PC

The controls provider will install and test the DALI – Ethernet System software on the central PC manager. As standard a "single PC" license will be provided, where additional local remote access PCs are required these should be quoted for.
A comprehensive user manual shall be provided to permit the Client to understand the programming features and undertake simple lighting reconfiguration (adding luminaries, changing functional groups, changing scene settings etc.)

Provide front-end PC c/w Lighting Control System Software for use as the LCS front-end.

A Central PC Manager for the System shall be provided and shall consist of a standard PC/AT with a network card fitted in a PCI slot. The PC shall have the following minimum specification:

Two 64-bit dual core processor
4GB RAM
80 GB Hard Disc Drive
SVGA Colour Monitor; 15" screen
Spare PCI slot
Microsoft Windows XP operating system
Microsoft Mouse (or compatible)
USB System Interface Card
Broadband Modem. (To be connected to dedicated phone line)

X.4.4 Remote Dial Up Package

A separate cost shall be supplied for a remote dial up facility whereby the controls provider will be able to remotely access the system for future maintenance purposes, where this feature is required the electrical contractor shall co-ordinate the provision of a suitable modem connection point.
The modem connection must be broadband.

X.4.5 Automated Emergency Lighting Testing

The system shall provide for automated emergency lighting testing in accordance with BS 5266
This will consist of DALI EM PRO devices provided for each emergency luminaire.
Testing of the emergency lighting shall be made available at the riser via key switches to manually test on a zone basis, via local key switch for localized testing and via software for automatic time-based regular testing.
Reporting facilities at the front end will identify ballast failure together with lamp failure.
This facility will allow quick replacement of failed components and fulfils the end-user's Health & safety obligations.

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X.5. Drawings, Pre- Commissioning, Commissioning and Maintenance

X.5.1 Drawings

The electrical contractor shall ensure that the controls system provider is provided with AutoCAD© format files showing the building, partitioning and lighting layout as required. At the appropriate time, the contractor shall give a clear written instruction for the controls provider to begin preparation of system configuration files based on a given set of drawings, the system provider may charge for variations made after or without this instruction.
The final software configuration shall be based on the electrical contractor's final record drawing of the lighting installation.

X.5.2 Control Regime

In order to complete the lighting control configuration the controls provider shall be provided with a clear written statement of the initial control regime required, this may be detailed or on a "general guideline" basis however the system provider may charge for variations made after this submission.

X.5.3 Commissioning

The system shall be commissioned using the DALI – Ethernet System Software that shall be used to demonstrate correct system operation during witnessing.
The system shall be capable of being fully commissioned by reference to numbered drawings.
The system may be programmed from a PC loaded with the DALI – Ethernet System Software and connected to the Ethernet network
Once commissioned, the system shall be capable of automatically validating that all sensors are operational, the graphical interface shall be capable of indicating any sensors that are not operational without the need to stimulate the sensor locally.
Where the electrical contractor intends to implement a phased commissioning of the lighting controls this should be provided to the controls provider to quote against, outside of this structure the controls provider will be able to charge on a "time on site" basis.

X.5.4 Maintenance

The lighting controls specialist shall allow for a comprehensive update on each of the floors to incorporate client changes, partition modifications etc up to 3 months after the granting of Practical Completion for that floor, if required this will be chargeable a the time.
The lighting controls provider will offer a maintenance contract to the building occupier, this shall include services for on site response, remote dial-up and configuration data backup.

Training

Provide training to Client's site based maintenance staff on the operation of the LCS and software. Extent of training TBC.

Wiring Details

Provide power supplies to the luminaires in all areas (except plant rooms) via plug-in connections to DCMs and RCMs. Arrange with the luminaire manufacturer to provide all luminaire flexes complete with Wieland connectors for connection to lighting control modules.

DCMs and RCMs capable of accepting dual supplies from separate sources (Essential and Non-Essential supplies) and distributing Essential and Non-Essential supplies to general and emergency luminaires.

Install power supplies to luminaires in plant areas via metal trunking and conduit containment system. Install plug-in ceiling rose with flexible cable as final connection to each luminaire.

Install power supplies to external lighting comprising multi-core XLPE/SWA/LSF cables installed in underground ducts throughout their lengths. Install final connections to fittings in accordance with

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manufacturer's recommendations and so as to maintain IP rating of fittings.

Install a key switch at each distribution board to provide emergency lighting test facility.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with "Putty Pads". Install Putty Pads in strict accordance with manufacturer's instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.040 CONTROL REQUIREMENTS
Provide software linking such that the stair, corridor and entrance foyer lighting are ON when any room lighting is ON.

Provide local switching to each area.

Install flush-mounted multi gang momentary action retractive switches (2 way-centre off) as indicated on the drawings to control local lighting.

Light switches to plant areas shall comprise surface mounted metal clad momentary action retractive switches.

Provide automatic daylight compensation and switching via PIRs to all luminaires in perimeter Office and Write Up areas (time lapse to be confirmed). Provide local override switches to Office/Write Up areas.

Switch toilet lighting via PIRs with 30 minute time lapse.

Install a double gang 2 way-centre off retractive switch in Entrance foyer to control all lighting in circulation areas.

Provide scene setting system to Lecture Theatre, fully interfaced with the AV system. Provide 8-scene control, controlled via touch screen panels mounted on the lectern, in the Projection Room and at each entrance to the Lecture Theatre (3-scene control only).

Provide scene setting system to Meeting Rooms and Seminar Rooms, fully interfaced with the AV system. Provide 8-scene control, controlled via touch screen panels mounted adjacent to the room entrance and adjacent to the main screen.

Provide fully automated lighting control system to provide dusk/dawn simulation to rooms as identified in the drawings. System shall be fully user programmable via touch screen panels located in each room.

A detailed schedule of time scheduling and automatic lighting controls operation shall be agreed with the CA prior to implementation. It is anticipated this will incorporate as a minimum:

- at the end of each working day all lighting automatically switches to 50% output for a period of 30 minutes then switches off (with the exception of night lights). Operation of a local override switch brings lighting back on to full output in that area.
- all corridor and stair lighting on during normal working hours or when any building lighting on;
- external lighting time scheduling;
- scene setting requirements, etc.

100.050 SYSTEM SCHEMATICS
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100.060 SYSTEM DRAWINGS
(63) series

C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE
V21
GENERAL LIGHTING

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20

271.000 LV SWITCHGEAR AND DISTRIBUTION BOARDS

271.010 GENERAL:
Comply with work section general clauses reference Y71.1000 and those detailed below.
Supply LV switchgear and Distribution Boards as specified in section V20.

272.000 CONTACTORS AND STARTERS

272.010 GENERAL:
Comply with work section general clauses reference Y72.1000 and those detailed below.
•Supply contactors and starters as specified in work section V20

273.000 LUMINAIRES AND LAMPS

273.010 GENERAL:
Comply with work section general clauses reference Y73.1000 and those detailed below.
•Supply luminaires and lamps as schedule reference Appendix A
  •Location at the end of this specification.

273.020 LUMINAIRES:
•Lamp efficacy - reference Y73.2005
•General purposes - reference Y73.2010A
•General purposes, with safety glass - reference Y73.2010B
•Special applications - reference Y73.2010C
  •Emergency lighting
    •Reference Y73.2020A
  •Exit signs - reference Y73.2030
  •Hazardous areas

•Reference Y73.2040A
•Installation in potentially explosive areas
Reference Y73.4070
•Signs and high voltage installations.
•Reference Y73.2050A
•Installation - reference Y73.4090
•Reference Y73.2010#
•Luminaire light output ratio (LOR) - reference Y73.2015

273.030 LAMPHOLDERS:
•General
•Reference Y73.2060A
•Tungsten fittings - reference Y73.2070
•Mounting
•Reference Y73.2080A

273.040 CONTROL GEAR AND COMPONENTS:
•Compatibility
•Reference Y73.2090A
•Circuit losses - reference Y73.2095
•Fluorescent lamp ballasts and starters
•Reference Y73.2100A
•Discharge lamp ballasts and starters
•Reference Y73.2110A
•Capacitors
•Reference Y73.2120A
•Supply terminals - reference Y73.2130
•Fuse - reference Y73.2140
•Interference - reference Y73.2150
•Remote gear - reference Y73.2160

273.050 LAMPS:
•Types of high efficiency lamp for non-daylight areas
Reference Y73.2165
•Tungsten filament lamps
•Reference Y73.2170A
•Fluorescent lamps
•Reference Y73.2180A
•Tungsten halogen lamps - reference Y73.2185A
•High pressure mercury vapour lamps - reference Y73.2190
•Metal halide lamps - reference Y73.2195
•High pressure sodium vapour lamps - reference Y73.2200
•Low pressure sodium vapour lamps - reference Y73.2210
•Transformers for LV luminaires - reference Y73.2220Z
•Lamp manufacturer - reference Y73.2230

273.060 SUPPORT SYSTEM:
•Conduit
•Steel - reference Y73.2240A
•Installation
Support from conduit - reference Y73.4120
Suspension - reference Y73.4160
Connections to luminaires - reference Y73.4220
•Direct to conduit
•Terminal box - reference Y73.4230A
•At luminaire - reference Y73.4230B
•Conduit suspension - reference Y73.4270

•Chain
•Cadmium plated steel - reference Y73.2260A
•Installation
Suspension - reference Y73.4160
Suspension by chain - reference Y73.4180
Connections to luminaires - reference Y73.4220
•Rod or chain suspension - reference Y73.4280
•Wall brackets
•Reference Y73.2280A
•Installation
Installation of wall mounted fittings - reference Y73.4050
•Height 1800mm centre

273.070 COLUMNS AND BOLLARDS:
•Steel - reference Y73.2300A
•Finish as shown on drawings/schedules colour to be approved by the architect
•Columns and bollards installation
•Reference Y73.4210A

273.080 LUMINAIRES AND LAMPS ACCESSORIES:
•Track lighting
•Reference Y73.3010A
•Class, poles and current rates as indicated on drawings/schedules refer appendix A

273.090 LUMINAIRES AND LAMPS WORKMANSHIP - GENERAL:
•Orientation - reference Y73.4010
•Cleanliness - reference Y73.4020
•Material of supporting surface - reference Y73.4060
•Luminaires in areas with infra-red control system
Reference Y73.4080
•Installation of extra low voltage tungsten halogen lamps - reference Y73.4100
•Support - reference Y73.4110
•Support by direct fixing
•Reference Y73.4140A
•Support in suspended ceiling
•Reference Y73.4150A
•Equipment fixing detail drawings
•External luminaire fixing, standard detail E630EFD001
•Wall-mounted luminaire behind pelmet, standard detail E630EFD002.
•Connections to luminaires - reference Y73.4220
•MICS cable - reference Y73.4290
•Lighting switches on different phases
•Separate - reference Y73.4300A
•Phase barrier - reference Y73.4300B

273.100 LUMINAIRES AND LAMPS WORKMANSHIP - RECESSED FITTINGS:
•Installation of recessed fittings
Reference Y73.4030
•Installation of semi-recessed fittings
•Manufacturer's details - reference Y73.4040A
•Connections to luminaires - reference Y73.4220
•Recessed fittings
•Plug and socket - reference Y73.4260A
•Terminal box - reference Y73.4260B

273.110 LUMINAIRES AND LAMPS WORKMANSHIP -
•Support - reference Y73.4110

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- Support from trunking - reference Y73.4130
- Connections to luminaires - reference Y73.4220
  - Direct to trunking
    - Terminal box - reference Y73.4240A
    - At luminaire - reference Y73.4240B
  - Suspended from trunking - reference Y73.4250

274.000 ACCESSORIES FOR ELECTRICAL SERVICES

274.010 GENERAL:
Comply with work section general clauses reference Y74.1000 and those detailed below.
- Supply accessories for electrical services as section V20

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
- Supply earthing and bonding components as specified in section W51

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
- Carry out testing and commissioning of electrical services as section V20

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
- Supply identification - electrical as specified in section V20

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
- Carry out fixing to building fabric as specified in work section V20

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
- Carry-out off-site painting and anti-corrosion treatment as work section V20

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PART 3 SPECIFICATION CLAUSES SPECIFIC TO V21

300.000 GENERAL

300.010 SYSTEM REQUIREMENTS:
Select lighting control equipment suitable to meet system objectives requirements.

300.020 INSTALLER SELECTION:
Engage lighting control equipment specialist to develop the design, supply, install, commission and set to work the lighting control system.
Luxonic
ECS Philips
Luxmate
Apex Lighting Controls
Simmtronic

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or approved equivalent.

300.030 ELECTROMAGNETIC COMPATIBILITY:
Ensure all equipment and systems are installed to provide electromagnetic compatibility within the systems and with any other systems installed in the same location.

300.060 LIGHTING CONTROL EQUIPMENT SCHEDULES:
Supply lighting control equipment in accordance with schedule reference Appendix 2 - Lighting Control System Schedule

310.000 PRODUCTS/MATERIALS

310.010 LIGHTING CONTROL EQUIPMENT:
- Type Automatic microprocessor based DALI system

Manufacturer and reference
Luxonic
ECS Philips
Luxmate
Apex Lighting Controls
Simmtronic

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Or approved equivalent

310.020 SENSORS FOR LIGHTING CONTROL:
- Connection to controller
  - Remote via bus cable
- Passive infra red movement detector & photocell
  - Beam coverage
    - 360°
  - Switch off delay time (min) 15
    - Adjustment from head-end or system connectivity point.
- Time lapse
  - Interval (min) 15
    - Resetting
  - Switch type
    - Push button
    - Retractive
- Photoelectric cell daylight sensor
  - Switch off light level (lux) 600
  - Switch on light level (lux) 300

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•Level signal to controller
•Digital
•Adjustment by central controller
•Switch off delay time (min) 5
•Mounting surface
•Protection to BS EN 60529 IP31

310.021 EQUIPMENT TO BE INCLUDED
Lighting Control supplier to include for PC as noted above and software to operate lighting control system.

Lighting Control computer to be located in Control room.

All emergency tests shall be from central controller (PC).

310.040 INFRA RED REMOTE CONTROL TRANSMITTERS:
•Type Hand held unit.
Standard - BS 7693.
•Programming
•Group address selector
•Selector switch
•Switch functions
•On
•Off
•Group selector
•Set scene presets
•Power supply
•Primary battery cells
•Ancillaries
•Wall-holder
•Mounting wall mounted holster

310.060 REGULATING HF BALLASTS:
Standard - BS EN 61347-2-3 and BS EN 60929.

320.000 WORKMANSHIP

320.010 WORK ON SITE:
Ensure that all building works are completed and service connections are provided,
•By others.

320.020 INSTALLATION:
Install, commission and set to work lighting control equipment in accordance with manufacturer's recommendations and BS 7671. Install infra-red transmission systems and co-ordinate the installation of infra-red systems in the same area in accordance with BS 7693.

320.030 QUALITY CONTROL:
Handle, store and install equipment and components of the lighting control system in accordance with the manufacturer's recommendations.
•Obtain all equipment and components from a single source.
Inspect all equipment and components on delivery, before fixing and after installation, and reject and replace any that are defective.
Record all commissioning, measurements and tests.

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BS APPENDIX

BS 7671:2001
Requirements for electrical installations. IEE Wiring Regulations. Sixteenth edition

BS 7693:1993
Guide to uses of infra-red transmission and the prevention or control of interference between systems

BS EN 60529:1992
Specification for degrees of protection provided by enclosures (IP code)

BS EN 60929:2004
A.C. supplied electronic ballasts for tubular fluorescent lamps. Performance requirements

V22 GENERAL LV POWER

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide general power for socket outlets, fixed power installations and mechanical services as detailed in the drawings.

100.020 DESIGN PARAMETERS
BS7671: 2001 - IEE Wiring Regulations.

100.030 SYSTEM DESCRIPTION
Install local distribution boards in the interstitial space, service risers, switchroom and plant spaces as detailed on the drawings.

Use MCB distribution boards for all areas.

Install galvanised steel trunking to contain power cables for lighting and general power, as detailed in the drawings. Suspend from the slab on proprietary hangers on screwed rod. Allow all offsets, bends, etc. required to co-ordinate containment system with structure and other services.

Install surface mounted dado trunking to all laboratory areas, as detailed on the drawings. Fix dado trunking above and below lab benches to backing boards provided by lab furniture manufacturer. Liaise with lab furniture manufacturer to ensure provision of backing boards meets requirements of trunking system.

Install double droppers and feeders to all rooms in Equipment/Instrument zone, i.e. each length of trunking fed by separate dropper and feed to enable easy removal of any length of trunking.

Install power supplies to trunking mounted outlets using minimum 4mm^2 single core LSF insulated cables in the ceiling void trunking and steel conduit connections to trunking droppers.

Install emergency power shut-off buttons to isolate non-essential circuits in areas identified on drawings. Essential circuits remain live. Install controls and contactors as shown on the drawings.

Install RCD protection to all laboratory circuits. RCD provision provided at distribution board as part of MCBs. Combined MCB/RCD units to take a singe DB way.

Install power supplies to wall mounted flush sockets and fused connection units using minimum 4mm^2 single core LSF insulated cables in the ceiling void trunking and 20mm Dia. flush, galv. steel conduit.

All small power circuits shall be installed as radial circuits. No ring main circuits shall be permitted.

Install power supplies to serve underfloor busbar systems in minimum 10mm^2 multi-core XLPE/SWA/LSF insulated cables in the floor void. Install 63A SP&N busbar system with full size neutral and earth bar and the facility for casement earth at each tap-off. Install tap-offs at 300mm centres.

Install flush 3/4 compartment floor service boxes as detailed in the drawings complete with 4No. switched 13A 3-pin socket outlets and 4No. RJ45 Cat 6 outlets.

Install connections from busbar to floor boxes in pre-wired 3000mm long flexible LSF sheathed kopex from unfused tap-off point.

Install power supplies to lifts comprising multi-core XLPE/SWA/LSF cables with connector plug outlet at top of shaft (final position and type of outlet TBA with Lift trade contractor).

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Install power supplies to mechanical plant comprising multi-core XLPE/SWA/LSF cables with switch disconnector adjacent to plant item.

Install all plant area outlets as a surface metal-clad installation.

Install power supplies to serve fan coil units and associated controls using 4mm^2 single core LSF insulated cables in the cable trunking and 20mm Dia. galv. steel conduit. Install a switched fused connection unit with neon indicator fixed to trunking in the ceiling void. Final connection to mechanical plant in multi-core flex.

Install power supplies to serve CCTV cameras using 4mm^2 single core LSF insulated cables in the cable trunking and 20mm Dia. galv. steel conduit. Install a switched fused connection unit with neon indicator fixed to trunking in the ceiling void. Final connection in multi-core flex.

Install power supplies to serve access control points using 4mm^2 single core LSF insulated cables in the ceiling void trunking and 20mm Dia. galv. steel conduit. Install a switched fused connection unit with neon indicator fixed to trunking in the ceiling void. Final connection in multi-core flex.

Install insect killers as indicated in the drawings comprising wall-mounted white polyester coated metal finish electric grid unit c/w 2No. 18UVA-GS safety coated black light lamps, large capacity glue board with long-life adhesive, approved to EN 60335-2-59, UL-listed 24NZ, as Insect-O-Cutor Model IND35.

Fixings to Sealed Labs

Use double sided tape where required as per 3M 4941 product family, 3M 20mm x 2.3mm conformable double sided tape (for large items, 3M 15mm x 1.1mm VHB double sided tape (for small items). Prepare surfaces and install tape in strict accordance with manufacturer's instructions. Liaise with 3M to ensure correct tape selection for each application.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with "Putty Pads". Install Putty Pads in strict accordance with manufacturer's instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.060 SYSTEM DRAWINGS
(62)series

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20

262.000 BUSBAR TRUNKING

262.010 GENERAL:
Comply with Work Section general and Common clauses reference Y62.1000 and those detailed below.
•Supply busbar trunking as specified in section V20

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20.

274.000 ACCESSORIES FOR ELECTRICAL SERVICES

274.010 GENERAL:
Comply with work section general clauses reference Y74.1000 and those detailed below.
•Supply accessories for electrical services as section V20.

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20

C0605 The New LMB Building Project V22
Electrical Specification GENERAL LV POWER
Revised Stage E Scheme Including Agreed VE

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282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20.

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
•Carry-out off-site painting and anti-corrosion treatment as work section V20.

V32 UNINTERRUPTIBLE POWER SUPPLY

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide an uninterruptible Power Supply (UPS) system comprising 250 kVA at 0.8 power factor, static UPS module, located in the electrical plantroom on Level 1. The UPS module shall include a valve regulated lead acid battery, complying with the appropriate British Standard (BS6290 Part 4) and heavy duty, steel racks; the battery systems each being sized to give a 10 minute autonomy period at full load output.

100.020 DESIGN PARAMETERS

The Electricity Supply Regulations.

BS 7671: 2001 - Requirements for Electrical Installations, including all amendments

EN 50091

EN 60950

BS 6290

Energy Networks Association ER G5/4-1

Temperature – UPS room 5°C minimum, 25°C average and battery room 20°C nominal.

Humidity – 0 to 95% without condensing

Noise - the overall maximum noise level from the UPS modules shall not exceed 77 dBA at 1 metre.

100.030 SYSTEM DESCRIPTION

Design, supply, install, test, commission and set to work the UPS system comprising static UPS system c/w input/output/bypass panel, and all associated interconnecting cabling and protection.

The scope of the works includes the supply, installation, testing, commissioning and setting to work of the UPS modules, and the system as a whole. The extent of the works comprises the following:-

A: UPS module.

B: Valve regulated, lead acid batteries and racks.

C: DC circuit breaker (DCCB).

D: All DC cabling, including battery inter-connectors.

E: All control signal and sensing cables between DC circuit breakers and UPS module.

F: All AC power cabling and control cabling between the UPS modules and paralleling input/output switchboard.

G: Input/output/ bypass switchboard.

Each UPS module shall be of the internally redundant series on-line static type, rated for continuous duty and consist of 2 modules; i.e. rectifier / battery charger / inverter / converter / static switch module and standby battery module with steel stands. The system configuration and rating to be in accordance with

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the particular requirements of specification and include all necessary protective devices and accessories to automatically ensure continuity of supply, together with batteries, switchgear and full facilities for local and remote alarms and indicators. The equipment and components shall comply with the latest relevant British Standard code of practice. The UPS modules shall be installed in the designated electrical plantroom area, as shown on the drawings. No rear access shall be required to the UPS modules. Cable entry and exit into and from the UPS modules shall be from either top or below. The batteries for each UPS module shall be located as shown on the drawings. Each UPS module shall have its own dedicated battery, capable of delivering constant output power of 250kVA at 0.8 power factor for a minimum period of 10 minutes.

Interlocks.

A single Castell key interlock shall be provided for the UPS internal auto-bypasses such that the manually operated external bypass switch can only be closed when both auto-bypasses are engaged and the UPS modules are disengaged.

To achieve this the UPS manufacturer shall incorporate a captive key system, whereby the key is only released on transferring a UPS module into auto-bypass operation. The released key can then be inserted into the external manual bypass switch, allowing it to be closed.

Power Walk In.

During periods of mains restoration a system of power walk in for all modules shall be implemented. The walk in period shall be adjustable. The battery recharge shall also be controlled and phased in a similar manner to the power walk in so that the magnitude of the overall peak recharging current is kept to an acceptable level.

Input Current Limitation.

It shall be possible to limit the input current drawn by the UPS module to a pre-determined maximum. The battery charge shall be controlled by the UPS relative to the temperature. The system of temperature-compensated float voltage control shall be implemented to ensure maximum life from the batteries.

Interfaces.

The UPS module shall pick up all controls, alarms and shut downs so that a full history of events is stored. Details of alarms (remote and local) and monitoring are given in the schedules.

System Configuration.

Internally Redundant UPS Module

The UPS system shall be rated at 250 kVA with internal redundancy comprising 1 series on-line static UPS module. The UPS module shall be rated at 250 kVA full load rating at 0.8 power factor on a 400 volts / 3 phase / 50 Hz supply. Batteries to support the full load output of 250 kVA at 0.8 power factor for a period of 10 minutes.

The UPS system shall provide complete electrical isolation (galvanic isolation) of the output (load) circuits from the input (mains) supply in normal operating mode. During battery operation all the mains inputs must be automatically isolated. The rectifier path for each UPS module shall be of a 12 pulse design. Under normal running conditions, when the mains supply is within specified tolerance, the input harmonic current to the module shall not exceed 2% independent of the load distortion. The parallel path shall comprise a static switch and choke. Any load current distortion arising from non-linear computer and communication loads shall have no effect on the input current distortion of the UPS modules. Under normal operating conditions, the modules shall satisfy the requirements of G54 at their input terminals.

Protection.

The UPS module will have built-in protection against over- and under-voltage and power line surges, over-voltage introduced at the output terminals by parallel sources, load switching and circuit breaker operation

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¶
Operation.¶
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The rectifier charger to be a solid state assembly for the conversion of incoming AC power to DC power, which is then fed directly to the converter unit. The inverter converts the DC power to AC power, which supplies the critical load. The inverter operates as a machine commutated inverter, which draws the active power required to run the rotary converter from the DC circuit. The inverter control circuit shall be of the speed control loop with secondary current control type. Upon failure of the primary AC supply, input power for the inverter is automatically supplied from the batteries with no interruption of the supply to the critical load. Phase control shall be superimposed on the speed control. During normal operating conditions, that is when the mains voltage is in the specification of the nominal +/-8% and Hz nominal +/-1%, the power to the load shall be supplied from the static switch / choke / rotary converter path. This mode of operation shall offer galvanic isolation and full power conditioning through the rotary converter set, as should the rectifier / inverter path.¶
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Deleted: The UPS modules shall be of the rotary type, incorporating a brush-less, synchronous motor generator set, mounted on a single shaft and supported in 2 bearings. The UPS modules shall be configured in a series on-line design. The generator winding of each motor generator set shall carry the full load current under all normal operating conditions. The rotor of ... [19]
Deleted: The UPS system shall be redundant in design, having internal redundancy. Internal redundancy is achieved when each single module (rated for the system load) incl ... [20]

in the distribution system, sudden changes in output load, permanent damage to itself and the connected load for all predictable types of failures within the UPS. Fast acting current limiting devices shall be used to protect against failure of solid state devices. Internal failures in a power converter causes a module to select the next available power path and, in the event of an alternative power path not being available switch off and transfer its load to the auto bypass.

Storage Battery (mounted on steel battery racks).

The battery shall be of the heavy duty industrial type, designed for 10 minute standby power service. The cells shall be as indicated. The rating is based on an operating temperature of 20°C and the Ah capacity sufficient to supply the required duty.

Type of cell - valve regulated, lead acid, Standard BS6290 Part 4, design life 10 years, autonomy at full load 10 minutes, 250kVA at 0.8 power factor lag to lead, ambient temperature 20°C controlled.

Battery Isolation.

Each UPS battery shall be supplied with a separate, floor-mounted circuit breaker in a purpose-made, steel enclosure to provide battery isolation.

Control and Indicating Panel.

The UPS module shall be fitted with an integral control and indicating panel. The mimic diagram and alarm indicators shall remain live after tripping of the UPS module to facilitate the tracing of a malfunction. A single line diagram of the UPS module shall be on the control panel. The controls, instrumentation and indicators shall be depicted in their exact position on the single line diagram.

Instrumentation and Control.

All control circuits shall be digital and free from ambient / environmental change and drift. The UPS module shall have the following door-mounted Touch Screen control functions

- emergency off
- start
- auto-bypass
- illuminated mimic diagram showing operating states of all power paths and major components, i.e.

- available / ready.
- operating / on.
- fault / tripped.
- analogue % load indicator, 0 - 150%.
- display and selection controls as described below.

By the use of touch screen the following information as a minimum is to be clearly displayed on the cubicle door :-

- date and time.
- hours run meter.
- recording, storing and display of the last 200 events in discreet 10 millisecond steps.
- all input voltages, currents and frequencies.
- all output voltage currents and frequencies.
- Kilowatt load.
- bus voltages and battery information.

At a programmable time interval the control system shall automatically test the voltage / time characteristics of the battery measured with the parameters stored at commissioning time. Should the battery fail to meet the stored performance data, an alarm (volt-free contact) must be set for the BMS.

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The UPS system shall meet the following general operating criteria.¶
¶
. Input characteristics - input voltage (continuous) 400 volts +/-8%.¶
. Input voltage (transient) 400 volts -20%.¶
. Input frequency (rectifier) 50 Hz +/-5%.¶
. THD rectifier operation less than 11%.¶
. THD static switch path operation less than 3%.¶
. Power factor (rectifier path) 0.84 inductive at normal voltage.¶
. Power factor (static switch path) 0.95 inductive at normal voltage.¶
Module rating 150kVA at 0.8 power factor lagging to 0.8 power factor leading without derating 120 kW.¶
. Output voltage 400 volts +/-1% steady state, 400 volts +/-5% dynamic at 50% load step.¶
Output frequency 50 Hz +/-1% mains controlled, +/-0.1% rectifier / inverter controlled.¶
¶
Modules are to operate satisfactorily without the use of input and output filters (no power capacitors are to be incorporated in the UPS design) and should be capable of operating with non-linear loads of crest factors up to 10:1 without de-rating. The UPS modules shall be . capable of operating correctly with 100% unbalanced load currents and output power factors of 0.8 lag to 0.8 lead without derating the unit. Proof of 0.8 lead is to be supplied.¶

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Contacts for Customer Remote Indication.

10 potential-free contacts shall be available on the UPS module for connection to a remote management system.

Digital Indication.

The following digital indications are to be available:-

- DC bus voltages.
- DC battery charge / discharge current.
- Measurement of module input and output voltages line to line.
- Measurement of current in each of the 3 output phases.
- Measurement of UPS input frequency and output frequency.

Alarm and L.E.D. Indication.

All alarm functions shall be capable of being programmed for instant or delayed response, latched or self-reset operation. All alarm functions shall sound an audible alarm and an alarm accept button shall be fitted to reset the alarm.

A new alarm shall pick up the common alarm and initiate the audible alarm. All alarm functions to be capable of being linked to the BMS system via the 10 fully-programmable volt-free contacts. L.E.D.s indicate on the mimic diagram the status of the circuits on the UPS module, including state of breakers. The following alarms shall be provided:-

- Fuse failure.
- Overload shutdown.
- Low battery.
- Battery on load.
- Control voltage.
- Battery circuit breaker open.
- Mains failure.
- Load on bypass.

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Auto bypass.

Each UPS module shall be equipped with an automatic bypass. The bypass shall consist of a motorised circuit breaker, the control of which is from the UPS modules control boards.

Overload Capacity.

Without the use of automatic bypass and when in rectifier / inverter path mode, 10% overload for 60 minutes, 25% overload for 10 minutes, 50% overload for 2 minutes. All overloads must be met at 40°C ambient.

Short Circuit Currents.

In order to be able to clear downstream faults the UPS modules must have a sub-transient reactance less than 7.5% and should be able to supply a peak current at nominal voltage of 14 x rated current for 10 milliseconds into a 3 phase short circuit on battery operation with the mains not present. Clearing of a fuse rated at 25% full load current without transfer into bypass should be possible.

Switchboard

Provide an of LV switchboard comprising all input/output and bypass switchgear. The scope of the works includes the supply, installation testing and commissioning of the system as a whole.

The floor standing cubicle switchboard shall be of rigid sheet steel construction and be manufactured and tested in accordance with BSEN60439/1 form 4 type 6 and shall comply with clause 271.031 in section V20.

Information to be provided with Tender.
The manufacturer shall complete a full schedule for the UPS and LV switchboard detailing compliance with the requirements of this specification. Any variation shall be separately identified. Failure to indicate or state any variations shall be deemed to indicate full compliance with the intent of this specification.

Manufacturers.

The uninterruptible power supply equipment shall be manufactured by the following:-

APC
Emerson
Chloride

Installation:

The whole UPS system shall be installed by the specialist contractor.

Testing and Commissioning:

Provision to be included for works testing and on-site testing and commissioning. All tests shall be witnessed by the client and / or his representative. Submit for approval a complete set of testing and commissioning schedules. All schedules shall be fully detailed to enable comprehensive recording and monitoring of all test results and verification of correct modes of operatives in all respects.

Works testing and on-site testing shall be carried out in a number of stages.

Works Testing:

Provide manufacturer's standard equipment checks and test certificates and results. All tests shall be carried out according to EN50091 Part 1.

Part 1

Static Measurements:

The following parameters are to be measured during this test.

- Measured values
- Mains 1.
- Input voltage - U12-U23-U31.
- Input current - I1-I2-I3.

- Input power (kW), apparent power (kVA), power factor.
- Input frequency.
- Input current harmonic distortion.
- Mains 2.
- Input voltage -U12-U23-U31.
- Input current - I1-I2-I3.
- Input power (kW), apparent power (kVA), power factor.
- Input frequency.
- Input current harmonic distortion.

Output.

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¶
. . - . Excitation: voltage, current. ¶
. . - . Motor voltage.¶
. . - . Motor current.¶
. . - . Power factor.¶
. . - . DC link - voltage, current, DC power.

C0605 The New LMB Building Project V32
Electrical Specification UNINTERRUPTIBLE POWER SUPPLY
Revised Stage E Scheme Including Agreed VE

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- Output current I1-I2-I3.
- Output voltage U1-U2-U3-U12-U23-U31.
- Output voltage L1-L2-L3, phase to phase and phase to neutral.
- Output power (kW), apparent power (kVA), power factor.
- Output frequency.
- Phase L1 to neutral.
- Output voltage.
- Harmonic distortion.
- Phase L1 to phase L2.
- Output voltage.
- Harmonic distortion.

Losses (total input power - output power).

- Efficiency (output power / input power), analysis up to the 28th harmonic.
- Input current phase L1.
- Output voltage phase L1 to neutral.
- Output voltage phase L1 to phase L2.

Static Measurements.

Test of the measurement equipment in bypass mode.

Static measurements in normal operation.

Output power factor 1.

0% load.
50% load.
75% load.
100% load.

Output power factor 0.8.

50% load.
100% load.
150% load.

Input voltage deviation.

100% load power factor 1.
Mains voltage -8%.
Mains voltage +8%.

Load Steps.

Load steps in normal operation.

Output power factor 1.
Load Step 0% to 50% load.
Load step 50% to 0% load.
Load step 50% to 100% load.
Load step 100% to 50% load.

Mains Voltage Deviation.

Mains failure normal operation 100% load, power factor 1.

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¶
. The following values are to be recorded during these tests:-¶
¶
. . - . Measured values.¶
. . - . Generator voltage L1 to neutral.¶
. . - . Generator voltage L2 to neutral.¶
. . - . Calculated values.¶
. . - . Generator voltage L1 to L2 (RMS).¶
. . - . Generator frequency.¶

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Mains failure at nominal voltage.
Mains recovery at nominal voltage.

Site Testing.

The loadbank for site testing shall have a total capacity equal to 200kW. The loadbank shall be of the resistive type.

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Stage 1 - Module Function Tests:

Check all instrumentation is operating correctly with secondary calibrated and certified instruments.

Stage 2 - Operation Modes:

With the UPS module operating on full load, carry out the following tests to the supply input and output:-

TEST 1 - Mains Supply.

Confirm proper operation during mains supply conditions, i.e. alarm and status conditions, interfaces with BMS, synchronism with the supply, synchronism with all modules, integrity of common control signal cable.

TEST 2 - Mains Failure.

As test 1, supply from batteries.

TEST 3 - Mains Supply Restoration.

As test 2.

Stage 3 - Battery System:

With the UPS units operating at full load, carry out the following tests connected to the outputs:-

Battery Autonomy.

Whilst simulating a mains failure, check battery autonomy period in full with a timer.

Quality Assurance

The UPS manufacturer shall have at least 5 years experience producing UPS modules. The UPS module shall be tested at the factory for proper operation. The UPS module shall be functionally tested and tested under full load. The UPS manufacturer shall have a fully documented quality control program. Copies of the test reports and quality control documentation shall be provided on request. All Equipment shall be new and of current design and manufacture. Technicians performing all specified services shall be trained, certified, and authorised by the UPS manufacturer.

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Submittals

Provide outline and installation drawings showing all exterior dimensions, cable accesses, shipping splits, and clearances. Show sizes, weights, and relationships between individual shipping units, the location and designation of all field wiring terminations, the maximum number and permissible size range of power conductors that can be accommodated for each power termination, heat rejection, air flow, and location of air inlets and outlets. Provide electrical, mechanical, and environmental specifications for the proposed equipment. Also include this information in the bid. Provide a paragraph by paragraph response to these specifications in sufficient detail to clearly show all deviations. Also include this information in the bid. Provide electrical one-line drawings showing all power and control wiring between Equipment units.

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Manuals

Provide 2 sets of user manuals (1No. hard copy, 1No. electronic copy) containing safety, handling, storage, installation, operating, and normal maintenance instructions. The manuals should also contain specifications, requirements, descriptions, and features for all equipment.

Warranty
All Equipment shall be warranted for repair or replacement due to defects in materials or workmanship for 1 year from commissioning or 18 months from shipment, whichever occurs first.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.050 SYSTEM SCHEMATICS
(61) series

100.060 SYSTEM DRAWINGS
(61) series

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20.

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20.

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20.

272.000 CONTACTORS AND STARTERS

272.010 GENERAL:
Comply with work section general clauses reference Y72.1000 and those detailed below.
•Supply contactors and starters as specified in work section V20.

274.000 ACCESSORIES FOR ELECTRICAL SERVICES

274.010 GENERAL:
Comply with work section general clauses reference Y74.1000 and those detailed below.
•Supply accessories for electrical services as section V20.

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51.

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20.

282.000 IDENTIFICATION - ELECTRICAL

C0605 The New LMB Building Project V32
Electrical Specification UNINTERRUPTIBLE POWER SUPPLY
Revised Stage E Scheme Including Agreed VE
Deleted: Stage E Issue

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20.

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
•Carry-out off-site painting and anti-corrosion treatment as work section V20.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO V32

300.000 PRODUCTS/MATERIALS

300.010 PACKAGED UPS SYSTEMS:
Manufacturer and reference
- Liebert Emerson NX
- APC Symmetra
- Chloride 90-NET

Standard
- BS EN 62040-1-1.
- BS EN 62040-1-2.

- Environment
  - Normal.
- System type
  - Static, double conversion on-line
- Installation
  - Permanently connected.
- Efficiency 97% at full load
- Input specification
  - Normal.
  - Rated values
    - ac input voltage (V) 400V /415V
    - Mains 1 = +10% / -15% continuous, -20% short time
    - Mains 2 = +/- 8%
    - Frequency
    - Mains 1 = +/- 5%, Mains 2 = +/- 1%
    - Number of phases 3 phase 4 wire
    - Input current (A) to suit load
    - Maximum current, Mains 1 with rated charge current and discharged battery = 500A
    - Input current total harmonic distortion <3% current THD for normal operation at rated linear load
    - Power factor 0.8 lag to 0.8 lead
    - All pole isolation in emergency
    - Standby generation characteristics operate on mains failure
- Output specification
  - Rated values
    - Output voltage (V) 400/415V
    - Voltage tolerance +/- 5%
    - Output voltage distortion <3%
    - Number of phases 3 phases 4 wire
    - Non linear load output current (A) no limit at rated kVA
    - Nominal frequency (Hz) and tolerance +/- 1% when mains connected
    - Maximum relative harmonic content 1.5% voltage THD line to line at rated linear load
    - Phase angle displacement tolerance 120 degrees +/- 1 degree balanced load; +/- 3 degree 50% unbalanced load
    - Permissible power factor range lag to lead no limit
    - Fault clearing capability 14 times peak rated current for at least 10 milliseconds without bypass
    - Overload capability 10% for 1 hour, 25% for 10 minutes; 50% for 2 minutes
    - Current limit identification.
- UPS switches
  - Mode
    - Transfer.
- UPS system arrangement
  - Series On-line.

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C0605 The New LMB Building Project V32
Electrical Specification UNINTERRUPTIBLE POWER SUPPLY
Revised Stage E Scheme Including Agreed VE

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- Bypass
  - With.
- UPS rating and performance 250kVA
- Duty
  - Period of autonomy 10 minutes
- Location
  - Provide equipment suitable for unattended operation indoors.
- Single-unit system
  Provide UPS equipment comprising one integrated unit for independent operation.
- Enclosure
  Provide rigid steel free standing floor-mounted enclosure. Comply with BS EN 60529, degree of protection.
  - IP31.
- Access
  Full size lockable doors to give access to all compartments. Provide two sets of keys.
- Finish
  Remove rust and scale. Apply anti-corrosive primer and
  - stoved epoxy powder coating.
  - two-coat paint system.
- Colour
  - RAL 9006
- Ventilation
  Provide cooling fans to permit unit to operate at full rated load with one fan out of service.
- Earth terminal - brass, minimum size ISO M10.
- Noise
  Limit external noise level to 75 dBA, measured 1m from each surface of the enclosure.
- Components
  - Transformer-rectifier - reference V32.300.020
  - Bypass system - reference V32.300.030
  - Switchgear - reference V32.300.040
  - Electrical protection - reference V32.300.050
  - Instruments - reference V32.300.060
  - Control and indication - reference V32.300.070
  - Inverters - reference V32.300.080
  - Batteries and chargers - reference V32.300.090

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300.020 TRANSFORMER-RECTIFIER:
- Manufacturer and reference as UPS manufacturer
- Standard - BS EN 60146.
  Provide continuously rated unit to supply full rated input load of the inverter plus maximum battery charging current. Include double wound input transformer.
- Duty
  - 12-pulse transformer/rectifier for outputs over 100kVA.
  Incorporate phase-shifting of input supplies to multi-unit systems to reduce total harmonic current drawn from mains supply.

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300.030 BYPASS SYSTEM:
- Manufacturer and reference as UPS manufacturer
- Automatic bypass
  Provide automatic static switch bypass to transfer load to bypass supply when output of inverter deviates from specified limits. Inhibit operation of bypass if inverter output is not in synchronism with bypass supply.

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300.040 SWITCHGEAR:
- Manufacturer and reference UPS manufacturer
  - Or approved equivalent
- Standard
  - Miniature circuit-breakers to BS EN 60898-1.

•Residual current operated circuit-breakers to BS EN 61008 and BS IEC 1008-2-2.
•Moulded case circuit-breakers to BS EN 60947-2.
•Air-break switches, disconnectors, switch disconnectors and fuse combination units to BS EN 60947-3.
•Contactors to BS EN 60947-4-1.

300.050 ELECTRICAL PROTECTION:
•Manufacturer and reference UPS manufacturer
•Or approved equivalent
•Incorporate protection against damage due to
Overload and short-circuit on the output.
Failure of internal components.
Overheating due to failure of internal fans.
•Output protection
Provide d.c. output protection by fuse combination unit to BS EN 60947-3 with fuses to BS EN 60269-1 and BS 88.
•Input protection
•Provide a.c. input circuit-breaker to
•BS EN 60898-1.
•BS EN 60947-2.
•Provide fuse combination unit to BS EN 60947-3 with fuses to BS EN 60269-1 and BS 88.
•Solid-state power component protection
•Fast-acting current-limiting devices.
•Fuses complying with BS 88-4.

300.060 INSTRUMENTS:
•Manufacturer and reference as UPS manufacturer.
•Provide flush mounted instruments in dust and moisture resistant cases.
•Standard
•Digital instruments to BS EN 60073.
•Instruments
•Input supply voltmeter.
•For 3-phase provide phase-phase and phase-neutral selector switch.
•Input supply ammeter with phase-phase and phase-neutral selector.
•Output supply voltmeter with phase-phase and phase-neutral selector switch.
•Output ammeter with phase-phase and phase-neutral selector switch.

300.070 CONTROL AND INDICATION:
•Emergency power-off
•Mimic diagram
Include on each unit a mimic diagram of the main circuit incorporating indicator lights, push-buttons, instruments and alarms to indicate the status of the system.
•Colour
Colour indicator lights and pushbuttons in accordance with BS EN 60073.
•Indicator lights
Incoming supply available.
Battery on boost charge.
Open/closed state of all circuit-breakers.
•Bypass ON/OFF.
•Transfer to bypass inhibited.
•Alarms
•Incoming supply failure.
•Battery discharged.
•Battery charge failure.
•Battery circuit-breaker or isolator open.
•Overload.
•Cooling fan failure.
•Equipment over temperature.

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C0605 The New LMB Building Project V32
Electrical Specification UNINTERRUPTIBLE POWER SUPPLY
Revised Stage E Scheme Including Agreed VE

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•Output outside limits.
•Load on bypass supply.
•Remote alarm/indication panel
•Visual indication.
•Visual alarm.
•Audible alarm.
•Load on UPS system.
•Load on bypass supply.
•Transfer to bypass inhibited.
•System alarm indication.
•Unit alarm indication (for multi-unit systems only).
•Output outside limits.
•System or unit overload.
•Communication and software.
•Shutdown signal to computer or network
•Operating system to be included operating system for thin blade servers.
•RS232/RS485 communications link to BMS system.

300.090 BATTERIES AND CHARGERS:
•Type VRLA 10 minute duration
•Manufacturer and reference as UPS manufacturer
•Battery type
•Lead/acid valve regulated to BS EN 60896-2.
•Connections
Provide intercell and output connections shielded with impact resistant plastic to prevent inadvertent contact.
•Instruments - comply with BS EN 60051-1.
•Battery voltmeter.
•Battery ammeter to indicate charge/discharge current.
•Battery housing
•Supply ventilated steel battery cubicle with acid-resistant finish.
•Battery installation class to BS 6133
•Class A.
•Class B.
•Class C.
•Protection/isolation
•Provide battery on-load switch disconnector with air circuit breaker.
•Provide battery on-load switch-disconnector with fuses.
•Charger
•Provide current-limited constant-voltage charging system from
•separate charger.
Comply with battery manufacturer's recommendations for current limit and fault voltage.
Include overcurrent and overvoltage protection.
•Provide earth fault detection and alarm where battery and charging system are not connected to earthed system.
•Limit step load on mains after supply restoration to 50% of full load followed by gradual transfer of load from battery to mains over a period of one minute.

310.000 WORKMANSHIP

310.010 INSTALLATION:
Install equipment in accordance with manufacturer's recommendations.

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BS APPENDIX

BS 6133:1995
Code of practice for safe operation of lead-acid stationary batteries

BS 88-2.2:1988
Cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c. Part 2.2 Specification for fuses for use by authorized persons (mainly for industrial application). Additional requirements for fuses with fuse-links for bolted connections

BS 88-4:1988
Cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c. Part 4 Specification of supplementary requirements for fuse-links for the protection of semiconductor devices

BS 88-5:1988
Cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c. Part 5 Specification of supplementary requirements for fuse-links for use in a.c. electricity supply networks

BS 88-6:1988
Cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c. Part 6 Specification of supplementary requirements for fuses of compact dimensions for use in 240/415 V a.c. industrial and commercial electrical installations

BS EN 60051-1:1999
Direct acting indicating analogue electrical measuring instruments and their accessories. Part 1 Definitions and general requirements common to all parts

BS EN 60073:2002
Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuators

BS EN 60146-1-1:1993
Semiconductor convertors. Part 1-1 General requirements and line commutated convertors. Specifications of basic requirements.
Partially superseded by BS EN 50328:2003

BS EN 60146-1-3:1993
Semiconductor convertors. Part 1-3 General requirements and line commutated convertors. Transformers and reactors.
Partially superseded by BS EN 50329:2003

BS EN 60146-2:2000
Semiconductor convertors. Part 2 General requirements and line commutated convertors. Self-commutated semiconductor converters including direct d.c. converters

BS EN 60269-1:1999
Low-voltage fuses. Part 1 General requirements

BS EN 60529:1992
Specification for degrees of protection provided by enclosures (IP code)

BS EN 60896-2:1996
Stationary lead-acid batteries. General requirements and methods of test. Part 2 Valve regulated types

BS EN 60898-1:2003
Circuit-breakers for overcurrent protection for household and similar installations. Part 1 Circuit-breakers for a.c. operation

C0605 The New LMB Building Project V32
Electrical Specification UNINTERRUPTIBLE POWER SUPPLY
Revised Stage E Scheme Including Agreed VE

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BS EN 60947-2:2003
Specification for low-voltage switchgear and controlgear. Part 2 Circuit-breakers

BS EN 60947-3:1999
Specification for low-voltage switchgear and controlgear. Part 3 Switches, disconnectors, switch-disconnectors and fuse-combination units

BS EN 61008-1:1995
Specification for residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs). Part 1 General rules

BS EN 61008-2-1:1995
Specification for residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs). Part 2-1 Applicability of the general rules to RCCBs functionally independent of line voltage

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V40 EMERGENCY LIGHTING

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide emergency illumination in the event of local or main power failure.

100.020 DESIGN PARAMETERS
BS 5266.
The Building Regulations

100.030 SYSTEM DESCRIPTION
Supply, install, test, commission and set to work the emergency lighting system comprising self-contained emergency luminaires and exit signs and general luminaires fitted with integral maintained or non-maintained nickel-metal hydride battery (NiMH) packs of 3 hour duration. With the exception of the Lecture Theatre and associated escape routes, all exit signs shall be externally illuminated and provided by others. Emergency luminaires shall be positioned to suit locations of exit signs.

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Emergency lighting key test switches shall be provided adjacent to each distribution board.
Refer to Luminaire Schedule. All luminaires supplied c/w lamps.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.040 CONTROL REQUIREMENTS
Emergency lighting to operate automatically on power failure.

Automatic testing facility via lighting control system (refer to section V21 for details) and local key test facility.

100.060 SYSTEM DRAWINGS
(63) series drawings.

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20.

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20

273.000 LUMINAIRES AND LAMPS

273.010 GENERAL:
Comply with work section general clauses reference Y73.1000 and those detailed below.
•Supply luminaires and lamps as schedule reference Appendix 1 - Luminaire Schedule
  •Location At the end of this specification.

273.020 LUMINAIRES:
•Type LED & T5 lamps
•Lamp efficacy - reference Y73.2005
•General purposes - reference Y73.2010A
•General purposes, with safety glass - reference Y73.2010B
•Special applications - reference Y73.2010C
  •Emergency lighting
    •Reference Y73.2020A
  •Exit signs - reference Y73.2030
  •Hazardous areas
    •Reference Y73.2040A
•Luminaire light output ratio (LOR) - reference Y73.2015

273.030 LAMPHOLDERS:
•General
  •Reference Y73.2060A
•Tungsten fittings - reference Y73.2070
•Mounting
  •Reference Y73.2080A

273.040 CONTROL GEAR AND COMPONENTS:
•Compatibility
  •Reference Y73.2090A
•Circuit losses - reference Y73.2095

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•Fluorescent lamp ballasts and starters
  •Reference Y73.2100A
•Discharge lamp ballasts and starters
  •Reference Y73.2110A
•Capacitors
  •Reference Y73.2120A
•Supply terminals - reference Y73.2130
•Fuse - reference Y73.2140
•Interference - reference Y73.2150
•Remote gear - reference Y73.2160

273.050 LAMPS:
•Manufacturer and reference As per Luminaire Schedule
  •Or approved equivalent
•Types of high efficiency lamp for non-daylight areas
  Reference Y73.2165
•Fluorescent lamps
  •Reference Y73.2180A
•Tungsten halogen lamps - reference Y73.2185A
•High pressure mercury vapour lamps - reference Y73.2190
•Metal halide lamps - reference Y73.2195
•High pressure sodium vapour lamps - reference Y73.2200
•Low pressure sodium vapour lamps - reference Y73.2210
•Lamp manufacturer - reference Y73.2230

273.060 SUPPORT SYSTEM:
•Conduit
  •Steel - reference Y73.2240A
  •Installation
    Support from conduit - reference Y73.4120
    Suspension - reference Y73.4160
    Connections to luminaires - reference Y73.4220
    •Direct to conduit
      •At luminaire - reference Y73.4230B
      •Conduit suspension - reference Y73.4270
•Rod
  •Cadmium plated steel - reference Y73.2250A
  •Installation
    Suspension - reference Y73.4160
    Suspension by rod - reference Y73.4170
    Connections to luminaires - reference Y73.4220
    •Rod or chain suspension - reference Y73.4280
•Chain
  •Cadmium plated steel - reference Y73.2260A
  •Installation
    Suspension - reference Y73.4160
    Suspension by chain - reference Y73.4180
    Connections to luminaires - reference Y73.4220
    •Rod or chain suspension - reference Y73.4280
•Wall brackets
  •Reference Y73.2280A
  •Installation
    Installation of wall mounted fittings - reference Y73.4050
    •Height TBC
•Ball and socket - reference Y73.2290
  •Installation
    Suspension - reference Y73.4160
    Suspension by ball and socket - reference Y73.4200

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    •Height TBC

273.090 LUMINAIRES AND LAMPS WORKMANSHIP - GENERAL:
•Orientation - reference Y73.4010
•Cleanliness - reference Y73.4020
•Material of supporting surface - reference Y73.4060
•Luminaires in areas with infra-red control system
  Reference Y73.4080
•Installation of extra low voltage tungsten halogen lamps - reference Y73.4100
•Support - reference Y73.4110
•Support by direct fixing
  •Reference Y73.4140A
•Support in suspended ceiling
  •Reference Y73.4150A
•Equipment fixing detail drawings
  •External luminaire fixing, standard detail E630EFD001
  •Wall-mounted luminaire behind pelmet, standard detail E630EFD002.
•Connections to luminaires - reference Y73.4220
  •MICS cable - reference Y73.4290
•Lighting switches on different phases
  •Separate - reference Y73.4300A
  •Phase barrier - reference Y73.4300B

273.100 LUMINAIRES AND LAMPS WORKMANSHIP - RECESSED FITTINGS:
•Installation of recessed fittings
  Reference Y73.4030
•Installation of semi-recessed fittings
  •Manufacturer's details - reference Y73.4040A
•Connections to luminaires - reference Y73.4220
  •Recessed fittings
    •Plug and socket - reference Y73.4260A
    •Terminal box - reference Y73.4260B

273.110 LUMINAIRES AND LAMPS WORKMANSHIP -
•Support - reference Y73.4110
•Support from trunking - reference Y73.4130
•Connections to luminaires - reference Y73.4220
  •Direct to trunking
    •Terminal box - reference Y73.4240A
    •At luminaire - reference Y73.4240B
  •Suspended from trunking - reference Y73.4250

274.000 ACCESSORIES FOR ELECTRICAL SERVICES

274.010 GENERAL:
Comply with work section general clauses reference Y74.1000 and those detailed below.
•Supply accessories for electrical services as section V20.

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51.

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
•Carry-out off-site painting and anti-corrosion treatment as work section V20.

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PART 3 SPECIFICATION CLAUSES SPECIFIC TO V40.

300.000 GENERAL

300.010 EMERGENCY LIGHTING SYSTEM:
•Standard

BS 5266-1.
BS EN 1838, BS 5266-7
ICEL 1006.

Authorities - Cambridge City Council

•Power source
  •Battery-powered emergency lighting system.
  •Self contained emergency luminaires.
•Mode of operation
  •Maintained changeover system.
  •Non-maintained operation.

300.020 ILLUMINATION OF SIGNS:
•Type Internally illuminated exit signs to Lecture Theatre and associated exits.
•Application Above or to side of exits
  Illuminate exit, emergency exit and escape route signs so that they are legible at all times, by
  •lamps contained within sign.
  •Luminaire external to signs.

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310.000 PRODUCTS/MATERIALS

310.010 LAMPS FOR EMERGENCY LIGHTING:
Manufacturer and reference
• As per Luminaire Schedule

310.020 SELF-CONTAINED EMERGENCY LIGHTING LUMINAIRE SYSTEM AND EQUIPMENT:
•Standard - BS EN 60598-2-22.
•Categories
  •Non-maintained.
  •Maintained.
•Batteries for self-contained luminaires
  •Nickel Metal hydride cells
•Type
  •Self-contained luminaire.
  •Self-contained illuminated sign.
•Ancillaries
  •Red LED luminaire healthy indicator

310.060 ANCILLARIES:
Provide ancillaries in accordance with the appropriate standards and regulatory authority requirements.
•Accessible test switch.
  •adjacent to each DB.

320.000 WORKMANSHIP

320.010 INSTALLATION:

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Install, test and commission emergency lighting system in accordance with BS 5266-1 and ICEL 1003.

320.020 SELF-CONTAINED LUMINAIRES:
Ensure self-contained luminaires are not installed where temperatures are likely to exceed manufacturers recommended maximum.
Ensure fluorescent luminaires are not used at temperatures below that specified by manufacturer.

320.030 EQUIPMENT:
Install equipment in accordance with manufacturer's recommendations.

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V41 STREET/AREA/FLOOD LIGHTING

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide illumination to external car parks, access roads, pedestrian routes, cycle sheds and service yard.

100.020 DESIGN PARAMETERS
BS 5489, Part 1: 2003.
BS EN 13201, Part 2: 2003.
CIBSE guidelines

100.030 SYSTEM DESCRIPTION
Supply, install, test, commission and set to work the external lighting system comprising column mounted street and area lighting luminaires, bollard luminaires, ground recessed uplighters, wall mounted street and area lighting luminaires, feature luminaires, surface mounted luminaires to cycle sheds, time clock, photocells, external feeder pillars and interconnecting cabling.

Refer to Luminaire Schedule for details of luminaires.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.040 CONTROL REQUIREMENTS
Controlled via contactor which is controlled via DALI relay control module on automatic lighting control system. External lighting on programmable time schedule and by external photocells.

100.060 SYSTEM DRAWINGS
(63) series.

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20

273.000 LUMINAIRES AND LAMPS

273.010 GENERAL:
Comply with work section general clauses reference Y73.1000 and those detailed below.
•Supply luminaires and lamps as schedule reference Appendix A - Luminaire Schedule and in compliance with section V21.

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51.

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20.

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20.

C0605 The New LMB Building Project V41
Electrical Specification STREET/AREA/FLOOD LIGHTING
Revised Stage E Scheme Including Agreed VE

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290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
•Carry-out off-site painting and anti-corrosion treatment as work section V20.

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PART 3 SPECIFICATION CLAUSES SPECIFIC TO V41.

300.000 PRODUCTS/MATERIALS

300.030 LIGHTING CONTROL EQUIPMENT:
- Street lighting
  - Photoelectric controller to BS 5972 in each luminaire.
  - Contactor and solar time switch control for groups of luminaires.

310.000 WORKMANSHIP

310.010 INSTALLATION:
Install equipment for street, area or flood lighting in accordance with manufacturer's instructions.

310.020 LAMP POST CABLING DETAIL DRAWINGS:
- Internal cabling, standard detail E906LPC001.
- External cabling 01, standard detail E906LPC002.
- External cabling 02, standard detail E906LPC003.

C0605 The New LMB Building Project V41
Electrical Specification STREET/AREA/FLOOD LIGHTING
Revised Stage E Scheme Including Agreed VE

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BS APPENDIX

BS 5972:1980
Specification for photoelectric control units for road lighting

BS 873-3:1980
Road traffic signs and internally illuminated bollards. Part 3 Specification for internally illuminated bollards

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V42 STUDIO/AUDITORIUM/ARENA LIGHTING

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
To provide internal specialist studio lighting rail system to the Visual Aids suite.

100.020 DESIGN PARAMETERS:
In accordance with CIBSE guidelines.
BS 7671: 2001 - Requirements for Electrical Installations, including all amendments

100.030 SYSTEM DESCRIPTION
Install Bowens Hi-glide studio lighting rail system in Visual Aids Studio. System comprises 2No. 4.5m long parallel fixed support rails and 3No. 3.5m long floating rails plus all support and fixing accessories. Provide 4kW SP&N supply connection to each floating rail (connection type and quantity TBC with Client).

Specialist luminaires provide by Client post-completion.

100.060 SYSTEM DRAWINGS:
2053-E-(63)-120.

C0605 The New LMB Building Project V42
Electrical Specification STUDIO/AUDITORIUM/ARENA LIGHTING
Revised Stage E Scheme Including Agreed VE

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20.

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20.

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20.

274.000 ACCESSORIES FOR ELECTRICAL SERVICES

274.010 GENERAL:
Comply with work section general clauses reference Y74.1000 and those detailed below.
•Supply accessories for electrical services as section V20.

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20.

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20.

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
•Carry-out off-site painting and anti-corrosion treatment as work section V20.

W10 TELECOMMUNICATIONS

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide a system which will provide telephone features and facilities throughout the building by means of a Voice over Internet Protocol (VoIP) telephone system.

To coordinate and interface with the Client and their VoIP specialist vendor and provide necessary attendances during the Contract.

100.030 SYSTEM DESCRIPTION
The Main Contract shall include for the provision of all passive elements of the ICT system (refer to section W70 for details).

VoIP system to be specified by the Client's IT Manager and procured direct by the Client through the Project budget. VoIP system shall be installed during the Main Contract works by the Client's specialist vendor.

The Main Contractor and all associated Sub-Contractors shall make due allowance for all attendances required to allow the VoIP equipment to be procured and installed in accordance with the Main Contract programme.

The Main Contractor (and all associated Sub-Contractors) shall meet with the Client ICT Manager and their specialist vendor at key points within the Contract to ensure that adequate provision is made within the programme to allow the timeous installation of the VoIP equipment.

The Client and their specialist vendor shall ensure that the provision of the VoIP equipment does not adversely affect the Main Contract works or programme and shall provide all information necessary to allow the Main Contractor (and all associated Sub-Contractors) to plan and programme the works.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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W15 FACILITIES FOR THE DISABLED

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
To provide disabled refuge communication systems at all disabled refuge points providing duplex communication between the refuge and the building control point.

To provide disabled persons alarm systems in all disabled persons toilets and changing facilities providing local and remote visible and audible indication of alarm.

To provide hearing assistance systems in the Lecture Theatre, Library, main reception desk and meeting and seminar rooms as identified on the drawings.

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100.030 SYSTEM DESCRIPTION:

1. Disabled Refuge Call System
Each Disabled Refuge location shall be provided with a means of two way voice communication between the Refuge location and a central control location to enable Fire Officers and Building Management to keep in contact with disabled people assigned to assemble there in an emergency until it is possible to move them to safety.

The system shall be simple to use and shall generally comprise of a central control exchange, a central equipment enclosure, a wall-mounted two-way call point at each Disabled Refuge, and all necessary interconnecting cabling.

In addition to providing a two-way voice link between each Refuge and the Exchange, the system shall provide continuous monitoring of all component parts, including cabling, and shall provide instantaneous fault indication at the central location.

The system shall be designed and installed to ensure full compliance with all relevant standards, including BS 5588, Part 8: 1999 and BS 5839, Part 9: 2003.

1.1 System Components & Description

1.1.1 Central Exchange

The central exchange shall comprise a control panel and the main equipment enclosure.

The central control panel shall be fitted with a master telephone handset for communication to each remote location. An illuminated momentary push switch shall be provided on the panel for each Disabled Refuge location. Each momentary switch shall be identified with the location of the Refuge served, e.g. "1NW" shall identify the Disabled Refuge at level 1 in the North West escape stair. Final wording of refuge indication TBA with CA prior to ordering. All identification on the control panel shall be engraved.

The finish and aesthetics of the central exchange and main equipment enclosure shall be agreed with the CA prior to ordering. Details of the proposed finishes shall be submitted with the Tender.

When a call is requested from a Refuge, the telephone handset shall ring and the relevant illuminated switch shall flash in synchronisation with the ringing tone. The call shall be answered by lifting the handset and pressing the relevant illuminated switch. The ringing tone shall stop and the switch shall be solidly illuminated.

Communication shall be semi-duplex, with the master handset always given priority by means of voice operated switching. When a controller is speaking, sound from the Refuge shall automatically be muted. When the controller stops speaking sound from the Refuge location shall be automatically

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restored.

Pressing the relevant momentary switch shall clear calls. All calls shall be reset at the central exchange.

In the event of multiple calls to the exchange, the handset shall ring and all calling Refuge switches shall flash in synchronisation with the ringing tone. Acceptance of one call, by pressing its momentary switch, shall cancel the ringing tone and the other calling stations shall continue to flash at the ringing pattern rate. Remaining calls shall be answered by pressing the relevant momentary switch after the preceding call has been cleared.

The system shall be enabled such that should a call be made from the central exchange to a remote call point, it is possible to listen to the remote station without its local call button being pressed.

1.1.2 Refuge Call Points

Each Disabled Refuge shall be provided with a flush recessed stainless steel engraved two-way call point complete with a flush stainless steel momentary push button, an illuminated reassurance indicator and a loudspeaker.

Pressing the "call" switch shall make a call to the central exchange. The reassurance indicator shall illuminate to indicate the call has been registered. Two-way communication shall then be possible when the call is answered at the central exchange.

1.1.3 System Cabling

All system cabling shall be soft skin fire performance cables and shall comply with the requirements of Section V20 but additionally meet with the detailed requirements of BS 6387's Categories C, W and Z.

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Cable terminations shall be as recommended by the cable manufacturer and be of the moisture proof type.

All system cabling shall be selected and installed to suit the requirements of the system. The Contractor shall seek clarification and confirmation from the system manufacturer of the required cable types, connections and system configuration.

All cabling shall be terminated at the central equipment enclosure.

The loop resistance shall not exceed 100 Ohms.

Cabling between the main equipment enclosure and each remote call point shall comprise a minimum of two pair, 4 core screened 1.5mm^2 LSF insulated cable (sheath colour TBC to comply with cable colour coding system).

Cabling between the main equipment enclosure and the central exchange shall comprise a minimum of eight pair, 16 core screened 1.5mm^2 LSF insulated cable (sheath colour TBC to comply with cable colour coding system).

1.1.4 Power Supply Unit and Battery

The system shall be powered from a 230V a.c. single-phase supply to the main equipment enclosure. An unswitched 5 Amp fused connection unit complete with indication shall be provided at a suitable location adjacent to the equipment enclosure.

All system components shall operate at low voltage and the system shall be provided with an internal means of converting to 12V d.c.

The system shall be provided with a battery back up supply providing a minimum duration of 3 hours in the event of a mains power supply failure.

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1.2 Fault Monitoring & Reporting

1.2.1 General

All system components shall be continuously monitored for correct operation and any faults shall be immediately registered and reported at the central exchange.

1.2.2 Fault Reporting

The system shall be provided with a resettable fault sounder and two illuminated fault indicators at the central exchange and a normally energised volt-free contact within the main equipment enclosure to enable remote fault reporting.

The system shall be connected to the BMS system so that power supply faults are registered and recorded immediately at the BMS front end.

The fault sounder can be reset by pressing the "silence fault" switch. All other indicators shall remain active until the fault is rectified.

1.2.3 Line Faults

Failure of any cabling to a remote unit shall be indicated as a line fault condition and shall result in activation of the fault sounder and illumination of the fault LED which shall flash in synchronisation with the sounder. The faulty line shall also be illuminated at the exchange in synchronisation with the fault LED. Failure of further lines shall reactivate the sounder and associated line LEDs.

1.2.4 Power Supply Faults

The system shall be monitored for both mains and battery supply faults.

In the event of mains failure, the fault sounder shall activate and the fault LED shall illuminate on the central exchange. A "mains fail" LED mounted on the power supply circuit board in the equipment enclosure shall also illuminate.

In the event of battery or battery charger failure, fault indication shall be as with a mains supply failure except a "battery fail" LED shall illuminate on the power supply circuit board.

In the event of total power failure, the volt-free contact shall change state, thereby indicating the fault to the BMS system.

1.2.5 Other Faults

The main enclosure shall also be provided with circuit board mounted LEDs on the control card to indicate a connection failure to the control panel and/or disconnection of any plug-in card. Detection of these faults shall activate the fault sounder and fault LEDs at the central exchange.

1.3 Testing & Commissioning

The system shall be fully tested and commissioned either by the system specialist or in full accordance with their requirements and recommendation

2. Disabled Person Toilet Call System.

Supply, install, test, commission and set to work disabled persons alarm system at each disabled persons WC and changing facility comprising:

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- power supply and control unit in accessible ceiling;
- pull chord(s) in room;
- reset unit in room;
- illuminated and audible indicator in adjacent corridor.

Each alarm can only be reset from within room.

Indication shall be by audible and visual indicator mounted locally outside room.

Install central indication panels at Reception desk and Security Control Room to provide visual and audible indication of each alarm independently. Panel to comprise brushed stainless steel face plate complete with LED indication and buzzer for each alarm. Panel to be engraved identifying each alarm location.

The central panel shall provide a staff paging function via the Integrated Security Management System. The Disabled Person Alarm system vendor shall liaise with the Security systems vendor to determine all necessary interfaces and shall provide all system requirements to provide the paging function.

Interconnecting wiring to be in soft-skin fire-rated cable, in accordance with section V20.

3. Hearing Assistance Systems.

Hearing assistance systems shall be provided as follows:

Lecture Theatre - Fixed Audio Frequency Induction Loop System (AFILS) comprising amplifier unit, radio microphone, and single turn induction loop at ceiling level.

Library - Fixed Audio Frequency Induction Loop System (AFILS) comprising amplifier unit, radio microphone, and single turn induction loop at ceiling level. Miniature desk mounted fixed AFILS comprising amplifier, microphone and induction loop.

Reception - Miniature desk mounted fixed AFILS comprising amplifier, microphone and induction loop.

Seminar Rooms- Fixed Audio Frequency Induction Loop System (AFILS) comprising amplifier unit, radio microphone, and single turn induction loop at ceiling level.

Meeting Rooms - Fixed Audio Frequency Induction Loop System (AFILS) comprising amplifier unit, radio microphone, and single turn induction loop at ceiling level.

Provide 2No. portable hearing assistance systems for use by visitors.

The specialist vendor shall carry out all surveys necessary to assess the requirements of each system and shall design, supply, install and set to work each Hearing Assistance system. Particular care shall be taken to avoid interference and cross-talk where systems are installed in adjacent areas.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.050 SYSTEM SCHEMATICS:

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(67) Series

100.060 SYSTEM DRAWINGS:
(67) Series

C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE
W15
FACILITIES FOR THE DISABLED
Deleted: Stage E Issue

PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS:

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20.

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20.

274.000 ACCESSORIES FOR ELECTRICAL SERVICES

274.010 GENERAL:
Comply with work section general clauses reference Y74.1000 and those detailed below.
•Supply accessories for electrical services as section V20.

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51.

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20.

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20.

290.000 FIXING TO BUILDING FABRIC

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290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
•Carry-out off-site painting and anti-corrosion treatment as work section V20.

C0605 The New LMB Building Project W15
Electrical Specification FACILITIES FOR THE DISABLED
Revised Stage E Scheme Including Agreed VE
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PART 3 SPECIFICATION CLAUSES SPECIFIC TO W15

300.000 GENERAL:

300.010 ELECTROMAGNETIC COMPATIBILITY:
Ensure all equipment and systems are installed to provide electromagnetic compatibility within the systems and with any other systems installed in the same location.

300.020 DISABLED ALARM SPECIALIST:
Engage a specialist to develop the design, supply, install, commission and set to work the disabled alarm systems.
•Specialist

C-TEC
Wandsworth

or approved equivalent

300.021 DISABLED REFUGE COMMUNICATION SYSTEM SPECIALIST:
Engage a specialist to develop the design, supply, install, commission and set to work the disabled refuge communication systems.
•Specialist

TG Baker
Baldwin Boxall
C-Tec
Wandsworth

or approved equivalent

300.022 HEARING ASSISTANCE SYSTEM SPECIALIST:
Engage a specialist to develop the design, supply, install, commission and set to work the hearing assistance systems.
•Specialist

TG Baker
C-Tec

or approved equivalent

310.000 PRODUCTS/MATERIALS:

310.001A AUDIO FREQUENCY INDUCTION LOOP SYSTEM (AFILS):
Type A - Fixed AFILS with radio microphone
Application - Lecture Theatre
Amplifier
AFILS amplifier
Mounted within AV equipment rack
Rating
ET450
Inputs
3x XLR
2x microphone
1x mic line
slave audio in
linked to Lecture Theatre AV system (details TBC)
Outputs

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audio out - post compressor
Indication
compression level
output current
loop status
power supply
Induction Loop
Single turn induction loop at ceiling level
Microphone
Radio microphone - lapel clip

310.001B AUDIO FREQUENCY INDUCTION LOOP SYSTEM (AFILS):
Type B - Fixed AFILS with radio microphone
Application - Meeting Rooms, Seminar Rooms, Library
Amplifier
AFILS amplifier
Mounted within accessible ceiling void, riser, cupboard or interstitial space.
Rating
ET450
Inputs
3x XLR
2x microphone
1x mic line
slave audio in
linked to AV system in Meeting and Seminar Rooms (details TBC)
Outputs
audio out - post compressor
Indication
compression level
output current
loop status
power supply
Induction Loop
Single turn induction loop at ceiling level
Microphone
Radio microphone - lapel clip
Microphone
4No boundary microphones - ceiling mounted.

310.001C AUDIO FREQUENCY INDUCTION LOOP SYSTEM (AFILS):
Type C - Portable AFILS Loop amplifier
Application 2No units to be supplied within Tender
Amplifier
Portable PET loop amplifier
Inputs
2x microphone
Induction Loop
Internal
Microphone
Internal
accessories
PSU and charger
carry case

310.001D AUDIO FREQUENCY INDUCTION LOOP SYSTEM (AFILS):
Type D - Fixed Miniature Desk mounted AFILS
Application Main Reception, Library desk
Amplifier
Miniature AFILS amplifier

Deleted: Stage E Issue

Under counter mounted
Inputs
1x microphone
Outputs
audio out to loop
Induction Loop
Single turn induction loop under counter
Microphone
desk/counter mounted
accessories
PSU

310.010 DISABLED ALARM CONTROL:
•Application Remote Call Indicator Panel
Manufacturer and reference

C-TEC
Wandsworth

Or approved equivalent

•Method of displaying calls
  •Individual lamp for each call point.
  •Emergency flashing
  •Type of lamps
    •LED RED
•Audible warning of calls sounder
•Connection of control unit to paging system via Integrated Security Management System

310.020 DISABLED ALARM CONTROL POWER SUPPLY UNIT:
Manufacturer and reference

C-TEC
Wandsworth

Or approved equivalent

•Input
  •Mains 230V 50Hz
  •Integral battery
•Output
  •dc
  •Nominal 24 Volts

310.030 CALL AND RESET UNIT:
•Manufacturer and reference

C-TEC
Wandsworth

Or approved equivalent.

•Mounting
  •Ceiling mounted pull cord
    •Orange coloured with integral call reassurance buzzer and LED
  •Wall mounted Call / Rest Push button
    •Flush.
•Facilities

Deleted: Stage E Issue

- Call push
  - Push button
    - Colour RED
  - Illuminated by LED RED
  - wall mounted call / rest unit
- Reassurance lamp
  - LED amber or red lens.
  - with buzzer
- Reset
  - Integral with unit.

310.040 SLAVE INDICATION UNITS:
- Manufacturer and reference

C-TEC
Wandsworth

- Or approved equivalent.

- Mounting
  - Wall mounting
    - Flush.
    - Brushed stainless steel, each alarm system individually identified, engraved label to each alarm.
- Facilities
  - Indication of calls audible and visual
  - Paging function via ISMS

310.050 OVER DOOR/CORRIDOR LAMP AND LOCAL SOUNDER UNIT:
- Mounting
  - Wall Above door
- Lens
  - Material
    - Polycarbonate.
  - Colour
    - Amber.
- Sounder buzzer

320.000 WORKMANSHIP:

320.010 WORK ON SITE:
Ensure that all building works are completed and service connections are proved,
- By others.

320.020 INSTALLATION:
Install, commission and set to work facilities for the disabled in accordance with the manufacturer's recommendations and the appropriate standard.

320.030 QUALITY CONTROL:
Handle, store and install equipment and components of the facilities for the disabled in accordance with the manufacturer's recommendations.
- Obtain all equipment and components from a single source unless otherwise instructed.

Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Record all commissioning measurements and tests.

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W20 RADIO/TV/CCTV

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide a CCTV system monitoring selected areas around the building, as shown on drawings. The CCTV system shall form part of the Integrated Security Management System (refer to section W40).

100.020 DESIGN PARAMETERS
BS EN 50132: 2001 - CCTV surveillance systems for use in security applications
NACOSS Code of Practice for CCTV NACP 20.

100.030 SYSTEM DESCRIPTION
Complete the detail design, supply, install, commission and set to work a CCTV system comprising cameras, monitors, control and recording equipment and all interconnecting wiring.

Cameras

Cameras shall generally be 0.4lux 12.5mm lens high-resolution colour semi-recessed dome type cameras.

Fully functional pan tilt and zoom cameras shall be as described above and complete with control and telemetry equipment in the camera housing.

External cameras shall meet the requirements described above but shall be complete with discrete environmental housings with internal heaters, mounted on suitable wall brackets or columns.

Control and Recording Equipment

The CCTV operating and recording equipment shall be located in the Security Control Room, and the main Reception desk and shall comprise of the following:-

Deleted: and the Reception Office

§ Multiplexer unit with integral digital hard disk recorder capable of recording at a minimum of 24No. frames per second (Security Control Room);

Deleted: 3

§ 17 inch 750 lines resolution colour monitors and full function keyboard controller (Security Control Room);

Additional control and monitoring facilities will be provided as follows:

§ 17 inch colour monitor and full function keyboard controller (Reception Desk);

Deleted: § 17 inch 750 lines resolution colour monitors and full function keyboard controller (Reception Office);

Refer to system schematic for quantities of equipment.

The Reception Desk monitor and keyboard shall be installed at the Main Reception desk and shall allow monitoring and full control of cameras monitoring car park entrances and visitor parking.

The CCTV Contractor is required to provide early dimensional and layout information on all equipment to allow the design of the reception desk and CCTV equipment console(s).

The digital recorder shall incorporate time and date generators which shall superimpose time and date information on the recorded images. It shall be possible to assign the time and date display to any corner of the displayed image.

Playback facilities shall include still, slow and frame shift modes. All playback displays shall be stable and have a high resolution.

All time, date and operating mode data shall be protected against mains failure for at least 72 hours.

The CCTV shall interface with the Intruder Detection and Alarm system and the Access Control system to enable incident capture of each system.

Interconnecting Wiring

System devices shall be connected to a patch panel in the local interstitial comms room on each level via Cat 6 structured cabling from a local RJ45 outlet by each camera. Each patch panel port shall be connected to a port on a dedicated CCTV switch in each comms room and shall be connected to the building LAN fibre backbone. RJ45 outlets, Cat 6 cable, patch panel and fibre backbone by ICT contractor. CCTV switch by security contractor.

Interconnecting cabling between local field devices by Security contractor.

Deleted: The CCTV system shall be interfaced with the building-wide ICT system in LSF insulated Category 6 structured cabling with unique coloured sheath (refer to section V20)

Additional Items

- detail design of system;
- site commissioning tests;
- on site training for Client's maintenance staff.

Scope

The installation content in respect of this tender will comprise the supply and installation of all cabling, cameras, mounting brackets, control, recording and monitoring equipment in the site control room.

The works to include the inspection, testing, commissioning and setting to work of the complete system.
All main containment to be installed by electrical contractor, Security systems contractor to provide all necessary HDG conduit containment from the nearest ELV containment system to the equipment point as required. All wiring by security systems specialist contractor. All commissioning and demonstrations by security systems specialist contractor.
Provide a CCTV system to carry out surveillance of the building exterior and selected interior spaces all as shown on the system drawings.
External cameras shall be switchable monochrome / colour and shall be either be fully functional external domes or fully functional standard housing units as shown on the system drawings.
.
Each camera shall be individually cabled back to the main matrix and achieve the test resolution required. In addition the fully functional cameras will have individual control cables.

Provide facilities to monitor and take control of all local cameras. The CCTV Management System equipment shall be a fully integrated part of the Integrated Security Management System (ISMS). Refer to section W40 for details of ISMS.

Video motion detection forms part of the digital recording systems on site and will require programme visits to perfect the installation.
Provide any hardware or software required to program, or commission, the system functions onsite, under this contract.

The Tenderer shall provide within his tender return a separately identified cost option for all CCTV cameras to be TCP/IP cameras utilising IP based CCTV solution from Indigovision Ltd/American Dynamics utilising ASIC MPEG4 compression technology. This cost option shall be a fully costed proposal including all suitable control equipment for a CCTV IP solution meeting the technical requirements of this specification.

100.040 CONTROL REQUIREMENTS

GENERAL

The CCTV Management System shall be micro processor based using an industry standard control computer together with video switching and control input/output sub racks. The system shall provide a high degree of flexibility to ensure compatibility with both current and future operational requirements.

It shall be capable of supporting a second hot standby (on-line) control computer, using an auto changeover unit. This shall function with no human intervention.

The system shall be capable of networking, such that, multiple systems are linked together via data and video trunk connections. The system shall be capable of performing control functions from one node, via operator keyboards, on another node. Up to 99 network nodes shall be capable of being connected together, each with the capability of bi-directional video trunking. Refer to the tender drawings for video trunking capacity.

The system shall support one or more Graphical User Interfaces (GUI). It shall support all keyboard functions, and support full dynamic graphical mapping, including icons and feedback indicators. It shall be based on Microsoft Windows® and use touch screen control.

CONFIGURATION

The configuration of this system shall be:-

Video inputs 100 (multiple of 8 or 32)
Video outputs (with text) 32 (any number)
Alarm inputs (low level) 24 (multiple of 8)
Control outputs 8 (multiple of 8)
PTZ sites (presets)
PTZ sites (no presets)
Local keyboards
Remote keyboards
DVR control from keyboard yes
DVR control from GUI yes
Camera fail detection all inputs
Dynamic Cable Equalisation yes
High Level Interface yes to Access control and Intruder alarm
High Speed Domes (presets) yes
High Speed Domes (no presets) yes To respond from alarms

MINIMUM SPECIFICATIONS

The CCTV Management System shall conform to the following specifications:

Video

Cross point matrix Full Open (free from hardware restrictions)
Inputs 32(n) (expandable up to 2048 per network node)
Outputs (n) (expandable up to 256 per network node)
Bandwidth to 7 MHz (± 1 dB)
to 12 MHz (± 3 dB)
Noise (weighted) better than 67 dB
Cross talk better than 64 dB at 4.43 MHz
Differential Gain < 1%
Differential Phase <1°
50 Hz Tilt <0.5%
Pulse/Bar < 0.5% K (2T)
Volts in 0.5 to 2.0 VPP
Bounce Sync. and picture < 2%

Electrical

Power Supply 240 VAC
Temperature Range -10ºC to 55ºC
Standard Keyboard data RS232 @ 1200 or 9600 baud
Enhanced Keyboard data RS232 @ 9600 or 19.2K baud

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Sub rack data RS232 @ 9600 or 19.2K baud

DISK BASED STORAGE

All system configuration parameters shall be stored on hard disk to provide indefinite back up time should mains power be disconnected. Systems offering battery backed memory will not be considered.

All changes to system parameters, both at operator and technician level shall be automatically written to disk.

The system shall boot up automatically from the hard drive upon power restoration and load all stored system parameters into RAM. The hard drive shall not be accessed under normal system operation. The hard disk drive shall only be read upon system boot, and only written to when changes are made to the system configuration or an entry is made to the system error log file.

MODULAR CONSTRUCTION

The construction of the system shall be completely modular to enable system expansion without redundancy The system parameters shall be expandable by simply inserting additional video switching or I/O modules into the sub racks. Once the capacity of the sub rack has been reached, further expansion shall be possible by adding additional sub racks.

DISTRIBUTED PROCESSING

The system shall incorporate distributed, parallel processing in order to minimise system response times. Each sub rack shall incorporate a dedicated sub rack controller module.

DISTRIBUTED HARDWARE

The system shall support distributed hardware such that video and I/O sub racks may be located remotely from the control computer, thus minimising system cabling.

CONTROL COMPUTER

The system computer shall be 19" rack mounted. The minimum specifications shall be:

Two 64-bit dual core processor
4GB RAM
80 GB Hard Disc Drive
SVGA Colour Monitor; 15" screen
expandable to 32 x RS232 asynchronous ports
battery backed Real Time Clock
composite video output
Spare PCI slot
Microsoft Windows XP operating system
Microsoft Mouse (or compatible)
USB System Interface Card
Broadband Modem. (To be connected to dedicated phone line)

OPERATING SOFTWARE

The CCTV Management System operating software shall be field proven over a minimum period of 3 years. Custom software will not be considered.

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The operating software shall include the following features:-

Menu Manager

The system shall include a detailed menu manager. Menu access shall be individually restricted dependent on the privilege level assigned to the operator. The system shall provide 99 individual operator log on codes, each with definable access privileges.

Menu selections shall include:
SIGN ON keyboard operators
SIGN OFF keyboard operators
ENABLE/DISABLE video inputs
LOCK/UNLOCK scan sequences
LOCK/UNLOCK video input controls
LOCK/UNLOCK video outputs
LOCK/UNLOCK user macros
ENABLE/DISABLE alarm inputs
SET CLOCK change PIN number
STATUS information
SYSTEM configuration

User Macros

The system shall include 99 User Macros which may be created, stored and executed by the CCTV operator. User macros shall be executable with only three key presses. User macros shall store 20,000 individual key presses in total. It shall be possible for the operator to select a programmable pause within each macro sequence.

Macro Library

The CCTV Management System shall support a macro library of 50,000 commands and include Nested Conditional Logic programming such that execution of a macro may be conditional upon the status of any combination of conditions within the system including, but not limited to:-
status of any alarm input or combination of inputs
status of any control output or combination of outputs
video inputs or outputs currently selected
camera failed or video low
time/date
operator logged on
timer status
or any other system variable

Scan Sequences

The system shall support 999 scan sequences, available on all output channels. Each scan sequence may include up to 99 camera entries. Any of the scan sequences shall be available to any video output, either at commissioning or during operation. All scan sequences shall be stored on the floppy disk drive.

Guard Tours

The system shall also support Guard Tours where a scan sequence may be tagged to run from start to finish and then halt automatically.

Monitor Blanking

The system shall provide monitor blanking such that where a monitor display remains static (no change in input selection or PTZ activity) for a predefined period of time, the monitor shall automatically revert to a synchronised black source. Any keyboard key press shall instantly return the

Deleted: Stage E Issue

monitor to the previous video source selection.

Dynamic Video Source Numbering

The system shall provide dynamic video source numbering irrespective of the physical input connections.

Source Grouping

The system shall support source grouping of video inputs such that video inputs may restricted for viewing on specific monitors or by specific operators. The system shall support 50 video source groups.

Error Log File

During boot up or running of the CCTV Management System, any detected error, warning, hardware reset/failure shall be identified and recorded to the error log file resident on the floppy disk drive. The error log shall include full hardware addressing details of the module/s concerned. It shall also be possible to log operator sign on/off, menu access, alarm transactions and intentional system misuse.

LOGGING PRINTER

The CCTV Management System shall be capable of supporting an optional logging printer.

HIGH LEVEL INTERFACE

The CCTV Management System shall support a High Level Interface to access control, intruder alarm, staff attack systems, pager systems and fire detection and alarm system. These high level interfaces will enable the full integration of these support systems.

OPERATOR KEYBOARD

Provide standard and/or enhanced operator keyboards, in accordance with the following clauses, to locations as indicated in the tender drawings.
Standard Operator keyboards shall:
have tactile and audible feedback from button press
include an internal WATCHDOG circuit
be housed in a low profile, aesthetically pleasing ABS case
include a full mechanical movement joystick for control of PTZ cameras
include an equipment control keypad for control of peripheral equipment including VCRs, Motion Detectors, Frame Stores and Video Printers.
include user programmable MACROs.
be fully programmable such that all keyboard keys may be redefined at commissioning in order to meet the specific operational requirements of the site, including custom made LEXAN® overlays.

The system shall support 99 operator keyboards, each with individual system identities and 99 operator log on codes, each with selectable access priorities.

PROGRAMMING KEYBOARD

All system commissioning configuration shall be entered using a separate standard QWERTY keyboard.

MIMIC PANELS

The CCTV Management System shall support interactive mimic panels via RS232 communications.

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VIDEO SUB RACKS

Video switching sub racks shall be standard 19" rack mounted, Eurocard format. Each video sub rack shall accept a minimum of 32 video inputs. The sub rack shall accept both video output and text insertion modules.

ON LINE SERVICEABILITY

The CCTV Management System modules shall be on line serviceable such that it is possible to remove and replace modules without the need to power the system down or take it off line.

SYSTEM DIAGNOSTICS

All sub rack modules shall feature diagnostic LEDs to the front edge of the printed circuit boards. The LEDs shall indicate data flow and input/output status.

VIDEO SWITCHING MODULES

The system shall incorporate separate video switching modules for each video output channel. Each module shall include a readily accessible (from the front of the equipment rack) 75 Ohm video test point to the leading edge of the circuit board to enable the output of the module to be viewed on a standard test monitor or oscilloscope.

Video switching modules shall provide full DC restoration in order to maintain picture contrast and eliminate 50 Hz ripple on incoming video signals.

TEXT INSERTION MODULES

Provide Text Insertion Modules for each video output channel. The text shall be multiplexed into the current video source providing a superimposed display. The text display, shading and background modes shall be selectable to ensure maximum readability. A selectable display time-out shall be available.

Five lines of eighteen characters of text shall be available for each output.

The location of text on the video output shall be definable, to more than 100 locations on the screen, under the system configuration editor.

Each module shall include a readily accessible 75 Ohm video test point to the leading edge of the circuit board to enable the output of the module to be viewed on a standard test monitor or oscilloscope.

The modules shall include dynamic cable equalisation, assignable to any selected input, to compensate for RG-59B/U coaxial cable losses for lengths of up to 500 metres.

The system shall be capable of supporting hidden text, whereby if a text data stream is inserted into the video waveform and recorded on a VCR, upon replay, this text can either be revealed or concealed on the monitor view.

VERTICAL INTERVAL SWITCHING

The system shall provide vertical interval switching of synchronised video inputs. That is all video switching shall occur within the vertical interval.

BLACK PAUSE SWITCHING

The system shall provide Black Pause Switching such that non synchronised video sources may be selectable without visible frame roll. The Black Pause interval shall be variable between zero and infinity.

CAMERA FAIL DETECTION

All video inputs shall be continuously monitored for both video low and video fail conditions. Each condition shall be managed as a separate alarm for each video input. A programmable delay shall be provided such that PTZ cameras may be panned across areas of low light without raising a low level video alarm.

I/O SUB RACKS

Input/Output sub racks shall be standard 19" rack mounted, Eurocard format. Alarm input modules, control output modules and PTZ transmitter modules shall be located within the I/O sub rack/s.

ALARM INPUT MODULES

Each alarm input module shall provide 8 alarm inputs. Inputs shall be configurable as normally open, normally closed, latching, toggling or direct (follows the state of the input). System action response time, that is the time taken from the leading edge of an alarm input activation to the selection of a video switching action or a control output, shall not exceed 100 milliseconds under any circumstances.

CONTROL OUTPUT MODULES

Each control output module shall provide 8 optically isolated, or DPST relay control outputs. Outputs shall be configurable as normally open, normally closed, latching, toggling or momentary.

DVR CONTROL

The system shall provide dynamic control of Digital Video Recorder functions from the system keyboards. Control of DVRs shall be available by either directly selecting the desired DVR, or alternatively by simply selecting the record key on the keyboard, the system shall automatically select the camera currently being viewed on the operator monitor to a pre-defined DVR and select the DVR output to the currently selected monitor.

Auxiliary I/O

Provide an auxiliary I/O expansion board for each site receiver, where required. Each I/O expansion board shall provide 7 additional alarm inputs and 8 relay outputs.

Lightning Protection
Site Receiver data inputs shall include 3.5 kV transformer isolation.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contract with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

100.050 SYSTEM SCHEMATICS
(67) Series

100.060 SYSTEM DRAWINGS
(67) Series

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20.

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20.

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20.

274.000 ACCESSORIES FOR ELECTRICAL SERVICES

274.010 GENERAL:
Comply with work section general clauses reference Y74.1000 and those detailed below.
•Supply accessories for electrical services as section V20.

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51.

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20.

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20.

290.000 FIXING TO BUILDING FABRIC

C0605 The New LMB Building Project W20
Electrical Specification RADIO/TV/CCTV
Revised Stage E Scheme Including Agreed VE

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290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
•Carry-out off-site painting and anti-corrosion treatment as work section V20.

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PART 3 SPECIFICATION CLAUSES SPECIFIC TO W20.

300.000 GENERAL

300.090 CCTV SYSTEM:
- Standard
  - BS 8418.
  - BS EN 50131-1.
  - BS EN 50132-7.
- Third party quality assurance standard.
  - NACOSS - NACP20
- CCTV system coverage

  Ensure system provides effective and adequate viewing of areas indicated on the drawings at light levels
  - bright sunlight down to
    - 0.4 lux.
  - internal daylighting down to 100 lux.
  - night viewing down to 0.5 mlux if necessary with use of image intensifier.

300.100 CCTV SYSTEM SPECIALIST:
Engage a CCTV specialist to develop design, supply, install, commission and set to work a complete CCTV system.
- Engage a single approved Security Systems Specialist to develop design, supply, install, commission and set to work an integrated security system encompassing all systems within this specification.

300.130 ELECTROMAGNETIC COMPATIBILITY:
Ensure all equipment and systems are designed and installed to provide electromagnetic compatibility within the system and with any other systems installed in the same locations, and comply with BS EN 55020 where applicable.

310.000 PRODUCTS/MATERIALS

310.001 CCTV CAMERA COLUMNS:
Type – cameras to be mounted on external lighting columns. Provide all necessary brackets and accessories, finish to match lighting columns. Liaise with lighting column vendor to coordinate requirements. Lighting columns are 6m high root mounted tapered aluminium columns.

310.180 CCTV CAMERA HOUSING:
- Type - Internal Discreet Surveillance Mini-Domes
- Application Fixed or Fully Functional Internal Cameras
- Provide factory built pre-wired assembly consisting of:
  - Camera All cameras will have a minimum of 460 lines horizontal
  - Lens varifocal 18:1 zoom lens and 4x digital enhancement
  - Receiver/driver unit
  - Pan/tilt mechanism for fully functional cameras
  - Housing
- Connection for factory built assembly
  - powder coated aluminium back box with single connector for power, data and video
- Supports
- Mounting
  - Ceiling
    - Surface
  - Wall
    - Corner mounted
  - Cabling access concealed

Deleted: varifocal

Deleted: Stage E Issue

- On electrical access mounted box
  - Conduit entry to rear

Housings
- Cameras in housing
  - Single
- Protective housing for internal use

  Domed fully sealed assembly, with rubber gaskets, to prevent ingress of dust, smoke and moisture. fixed lower hemisphere with rotating internal black mask to disguise camera position, optically true, tinted Lexan lower hemisphere, with a maximum loss of 1 f /stop
  low profile back box requiring a ceiling clearance of less than 180 mm
  - include an integral site receiver within the dome

Tamper resistant kit
- Access panel

  incorporate a single quick release mechanism for the pan /tilt assembly and site receiver
  - maintenance free mechanical assembly

  Viewing window optically true, tinted Lexan lower hemisphere
- Light loss through viewing window
  - 1 f/stops maximum
- Pan and tilt mechanism
- Bearings incorporate dual sealed bearings for both pan and tilt
  - Electrical connections powder coated aluminium back box with single connector for power, data and video
- Control
  - Pan
    - 360° continuous rotation
  - Tilt

    0 (horizontal) to 90° (vertical) tilt angle
  - Pre-set electrical pan and tilt limit stops software controlled limits
  - Pan speed remotely controlled variable speed: 2 to 300 degrees per second
  - Tilt speed remotely controlled variable speed: 2 to 150 degrees per second
  - Pan and tile speed variable
  - Pre-set scenes incorporate 99 stored Presets for pan, tilt, zoom, focus and iris
- Control from remote location
  - Zoom
  - Focus
  - Iris control provide remotely controlled manual iris
  - Back light compensation

  incorporate 99 stored Presets for pan, tilt, zoom, focus and iris provide a maximum preset call time of less than 0.85 seconds for both pan and tilt. provide consistently repeatable Preset accuracy of better than 0.1 degrees.
  - include a FlashBack function, which allows the operator to toggle between the current and previous dome positions with a single keystroke. The previous position will be continuously, dynamically updated. These two positions will be independent of the 99 preset positions.
  - backlash shall be less than 0.1 degree

  Power supply

310.181 CCTV CAMERA HOUSING:
- Type - External Discreet Surveillance Domes
- Application Fully Functional External Dome Cameras
- Provide factory built pre-wired assembly consisting of:

  Camera Dome cameras with colour / monochrome switching capability will be installed.
  All cameras will have a minimum of 460 lines horizontal.
  - Lens varifocal 18:1 zoom lens and 4x digital enhancement
  - Receiver/driver unit

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- Pan/tilt mechanism for fully functional cameras
- Housing

Mounting bracket

- On wall or pole

- Connection for factory built assembly
  - powder coated aluminium back box with single connector for power, data and video
- Supports
  - Column mounted
    - Mounted on lighting columns with appropriate brackets
  - Lightning protection dome site receiver data inputs shall include 3.5 KV isolation transformer for lightning protection
- Mounting
  - Wall
  - Cabling access concealed
  - On electrical access mounted box
    - Conduit entry to rear

Fixed to columns via appropriate brackets

Housings

- Cameras in housing
  - Single

Tamper resistant kit

- Weatherproof housing complete with internal heater thermostat, to protect camera over the temperature range -10/+2
- Enclosure protected to BS EN 60529 IP 65
  - fully sealed dome assembly, with rubber gaskets, to prevent ingress of dust, smoke and moisture. fixed lower hemisphere with rotating internal black mask to disguise camera position, optically true, tinted Lexan lower hemisphere, with a maximum loss of 1 f /stop
- Access panel

incorporate a single quick release mechanism for the pan /tilt assembly and site receiver

- maintenance free mechanical assembly

Viewing window optically true, tinted Lexan lower hemisphere

- Light loss through viewing window
  - 1 f/stops maximum
- Defogging kit
- fitted with sunshades where installed externally
- Pan and tilt mechanism
  - Motors heavy duty
  - Bearings incorporate dual sealed bearings for both pan and tilt
  - Operating position
    - Universal
  - Electrical connections powder coated aluminium back box with single connector for power, data and video
- Control
  - Pan
    - 360° continuous rotation
  - Tilt

0 (horizontal) to 90° (vertical) tilt angle

- Pre-set electrical pan and tilt limit stops software controlled limits
- Pan speed remotely controlled variable speed: 2 to 300 degrees per second
- Tilt speed remotely controlled variable speed: 2 to 150 degrees per second
- Pan and tile speed variable
  - Pre-set scenes incorporate 99 stored Presets for pan, tilt, zoom, focus and iris
- Control from remote location
  - Zoom

Deleted: Stage E Issue

- Focus
- Iris control provide remotely controlled manual iris
- Back light compensation

incorporate 99 stored Presets for pan, tilt, zoom, focus and iris provide a maximum preset call time of less than 0.85 seconds for both pan and tilt. provide consistently repeatable Preset accuracy of better than 0.1 degrees.

- include a FlashBack function, which allows the operator to toggle between the current and previous dome positions with a single keystroke. The previous position will be continuously, dynamically updated. These two positions will be independent of the 99 preset positions.
- backlash shall be less than 0.1 degree

Power supply

310.200 MONITORS:

- Type 17" TFT colour monitor
-
- Manufacturer and reference

JVC

Or approved equivalent

- Standard
  - Colour
- LCD flat screen TFT
  - Viewable area 17"
    - Viewing angle manufacturers standard
      - Adjustment
      - horizontal / vertical
- Input
  - 1 volt peak to peak composite video, negative synchronisation
  - 75 ohm unbalanced terminated or unterminated
  - High impedance
  - Looped through video
  - Y/C video
- Programming
- Front panel controls
  - On/off switch
  - Brightness
  - Contrast
  - Vertical hold
  - Horizontal hold
  - Colour balance
  - Audio volume
  - manufacturers standard
- Rear or security panel controls
  - Vertical height
  - Vertical linearity
  - High impedance 75 ohm switch
- Performance
  - Linearity
  - Synchronisation internally derived
  - Scanning 625 lines 25 fps
  - Input impedance
  - Frequency response
  - Resolution

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•Integral loudspeakers
•Mounting as shown on the system drawings
•Wall or ceiling fixing complete with brackets
•Desktop
•Purpose built control desk with other equipment
•wall fixing complete with brackets
•Environment dry
•Power supply 240V 50Hz

310.210 VIDEO RECORDERS AND PRINTERS:
•Type 24 Hour
Application
• DVDR for real time recording
• VCR for production of permissible evidence
•Standard
•BS EN 50132-7.
•BS EN 55020
•Equipment
•Digital recorder
•CD ROM writer
•Hard disk recording
•Integral with
•Multiplexer
•Digital recorder facilities
•Recording to hard disk
Storage capacity
Digital storage requirements on all cameras recording 4cif resolution at 24pfs over a 31 day time period. The quality of recording shall be extended or reduced via scheduling, video motion detection or the external red wall units. Final configuration shall require programming visits to perfect the installation.

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In the event of alarm preset the relevant camera will be recorded in live mode automatically.
All recording will be stored on the systems integral hard drive not on separate tape of any format.
•

Multiple units as required to meet the total storage capacity requirements.
•Simultaneous recording and playback
•Date/time and camera search
•Frame by frame review
•Raster generator
•SCSI port
•Software
•Audio recording
•Facilities
•Date time injection
•Continuous recording
•Continuous recording controlled by external time switch
•Programmable recording
•Alarm recording
•Time lapse recording
•External switching device
•Continuous recording with reversion to time lapse recording, for duration of trigger signal and timed out
•Continuous recording for pre-set period up to 5 minutes or duration of trigger signal with reversion to quiescent
•Speed search

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•Advance frame by frame
•Noise free frame hold
•Integral tuner for Band IV/V
•Fully programmable
•Mounting
•Rack mounted
•Power supply 230V 50Hz

310.215 CCTV VIDEO SWITCHING UNIT:
•Facilities
•Sequencing switch
•Freeze on camera manually selected
•One monitor sequencing, other selected, sequencing or alarm call up
•One monitor sequencing, other on selected camera.
•Alarm mode sequencing
•External alarm seize of camera
•Alarm mode reset
•Alarm output
•Alarm interface
•Manual selection of camera and monitor
•Motion detection by external sensor at camera, with monitor seize
•Motion detection by digital analysis of monitor screen or video signal.
•External alarm activation of slow rate video camera, with camera selection, picture resolution, recorded control and alarm time picture freeze and record
•Video input with looping output
•75 ohm
•Features
•Camera
•Monitors
•Recorders and printers
•Video gain
•On screen programming
•Camera identity injection unit
•Date and time injection unit
•Video processing
•Four quadrant processor
•Digitisers
•Screen flicker and alias suppression
•Inputs
•Monochrome
•Colour
•Output
•Memory array
•Automatic gain control
•Each input channel separately, adjustable
•Video loss detection
•On screen video loss message
•Internal synchronisation
•Automatic termination
•Monitor outputs
•Recorder output
•Alarm connection
•Password protected programming
•Mounting
•Rack mounted
•Power supply 230V 50Hz

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310.216 CCTV VIDEO MOTION DETECTOR:
- Facilities
  - Integrated with:
    - Switching
    - Multiplexing
  - Channels
  - Image programming algorithm
  - Digital training technology
  - Detection points
  - Allowance for monitor scans
    - Over scan
  - Effect elimination
    - Camera vibration
    - Changes in cloud cover
    - Activity
      - Precipitation
      - Leaf movement
  - Alarm indicator
    - Audible
    - Visual
    - Alarm contacts
    - On screen
  - Cameras
    - Indoor
    - Outdoor
    -
  -
- Mounting
  - Rack mounted
- Power supply 230V 50HZ

310.217 CCTV VIDEO MULTIPLEXER:
- Outputs
  - Multiplexed to recorder
  - Playback
  - Multi-screen modes
    - Camera selection
    - Cameos
    - Quarter screen
    - Matrix
    - Quad displays
- Characteristics
  - Video signals
    - NTSC
    - PAL
    - EIA RS-170
    - CCIR
  - Automatic gain control
  - Reduction of on screen flicker and aliasing
  - Programming of operational sets
    - Time of day
    - Day of week
  - Titling injection
    - Time
    - Date
    - Camera identity
  - Motion detection

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  - Synchronisation from recorder
- Features
  - Programming
    - On screen
  - Camera sequencing
  - Multi-screen mode sequencing
    - Action or alarm call-up
  - Video loss
    - On screen indication
    - Contact closure
  - Freeze function
  - Alarm output contacts
  - Operation access
  - Camera security lockout
  - Encoding of playback
  - Control of cameras
    - Keyboard
  - Control of slave multiplexers
- Mounting
  - Rack mounted
- Environment
- Power supply 230V 50HZ

310.218 CCTV VIDEO AND DATA TRANSMISSION SYSTEM:
- Mounting
  - Rack mounted
- Power supply 230V 50HZ

310.219 CCTV NOTIFICATION SIGNS:
Application signs to be located discreetly as follows:
- At main entrances
- On external elevations - allow 4No.
- Final locations of signs to be agreed

Provide CCTV notification signs as current legislation and industry recommendations:-
- Wording To be Agreed but Data protection Act compliant
  - Lettering font and size to be agreed
- Material Plastic
- Mounting Wall/window

320.000 WORKMANSHIP

320.015 CCTV SYSTEM INSTALLATION:
Install the CCTV system in accordance with the manufacturers recommendations and
- BS EN 50132
- NACOSS - NACP20

320.025 CCTV SYSTEM DEMONSTRATION:
Demonstrate that the CCTV system meets the specified requirements and record results. Handover CCTV and documented demonstration results to user.
Carry out demonstration using test objective as:
- NACOSS NACP20 Appendix B
- BS EN 50132-7 Annex A

320.026 CCTV SYSTEM DOCUMENTATION:
Prepare record documents as NACOSS NACP20 section 5.4 and hand over to the user.

320.030 TRAINING:
Train the personnel responsible for operating the system.

•CCTV system

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W21 PROJECTION

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide electro-optic systems for the projection and display of information and visual material, with audio back-up, in the Lecture Theatre and selected Seminar and Meeting Rooms.

100.030 SYSTEM DESCRIPTION
The specification of the Audio Visual systems is to be left until the latest stage possible to ensure state-of-the-art equipment is procured and may be carried out post-contract by the Client.

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¶

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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W30 DATA TRANSMISSION

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide a system which will facilitate the transmission of data throughout the building by means of a Local Area Network, LAN, data network or network.

100.030 SYSTEM DESCRIPTION
The Main Contract shall include for the provision of all passive elements of the ICT system (refer to section W70 for details).

All active ICT equipment shall be provided by the Client and shall be installed during the Main Contract works by the Client's specialist vendor.

The Main Contractor and all associated Sub-Contractors shall make due allowance for all attendances required to allow the active equipment to be procured and installed in accordance with the Main Contract programme.

The Main Contractor (and all associated Sub-Contractors) shall meet with the Client ICT Manager and their specialist vendor at key points within the Contract to ensure that adequate provision is made within the programme to allow the timeous installation of the active equipment.

The Client and their specialist vendor shall ensure that the provision of the active equipment does not adversely affect the Main Contract works or programme and shall provide all information necessary to allow the Main Contractor (and all associated Sub-Contractors) to plan and programme the works.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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W40 ACCESS CONTROL

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide electronically controlled access to the building and to specific areas within the building.

To provide an Integrated Security Management System (ISMS).

100.020 DESIGN PARAMETERS
BS 7671: 2001 - Requirements for Electrical Installations, including all amendments.
BS EN 50133-1:1997 - Alarm systems - Access control systems for use in security applications. Part 1 System requirements

100.030 SYSTEM DESCRIPTION
Complete the detail design, supply, install, commission and set to work a PC-based access control and security management system comprising an electronic access control system throughout the building providing electronically controlled access to all external access points of the building, selected internal areas, secure areas of the bicycle store and access roads to and within the site.

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Refer to sections W20 and W41 for details of other security systems to be interfaced to integrated system.

The system shall comprise head-end PC, networked door access controllers to each access control point, electronic reading devices, access cards, card making and programming facilities, locking devices, access barriers and all interconnecting wiring.

The access control system shall interface to all other building security systems and shall provide a head-end graphical interface for control and monitoring of all security systems.

System Manufacturer and Reference

The access control system shall be the same protocol as the system in use at other local MRC sites and shall comprise the C*Cure 800 (Model 30) system by Software House/Tyco and shall be complete with all necessary ancillaries and licences to meet the specification.

Head-end PC

A new front-end PC c/w monitor, keyboard, mouse and colour printer shall be provided as part of the Access Control package and shall be located within the Security Control Room. The access management system shall be loaded with dynamic door access graphics including floor plans. Graphics shall be issued for approval prior to installation.

The access management system software and workstation shall be capable of networking to any off site facility.

All system components (proximity readers, keypads, status contacts, etc.) shall be fully addressable from the access management system.

The system shall be capable of assigning time profiles to each door to allow individual doors to function when required.

The system shall allow users to be added to/deleted from the system by means of an administration reader adjacent to the PC.

Door Access Controllers

Individual reading devices and locks shall be connected to local door controllers located above ceilings adjacent to the door being served.

Electronic Reading Devices

Reading devices shall be based upon programmable contact less smart card technology.

Provide 3No. reading devices free issue to the Lift package trade contractor for installation in specific lift cars. Provide input/output point for each lift such that reading devices form part of the building-wide access control system. Liaise with the Lift contractor to agree requirements. Final connection to lift systems by Lift contractor.

Access Cards

The card technology shall be based upon programmable contact less smart card technology.

A compliment of 1000No. cards shall be provided at handover.

Card Generator/Programmer

Facilities shall be provided to enable new cards to be created, assigned and programmed on site by the User. Existing cards shall be capable of being reassigned and reprogrammed on site by the User.

Locking Devices

All locking devices shall be supplied by others as part of the Ironmongery package. The Specialist Sub Contractor shall liaise with the Ironmongery Sub Contractor to ensure that the locks provided meet the requirements of and are compatible with the access control system.

Locks shall generally comprise face-to-face mag locks, shear locks, shoot bolts, electric strike and solenoid handle locks and shall be selected to suit the application.

All access controlled doors shall fail secure unless specifically noted otherwise.

Door Entry System

Provide door entry system to the locations shown on the drawings with hierarchy of operation as defined in the system schematics.

Interconnecting Wiring

System controllers shall be connected to a patch panel in the local interstitial comms room on each level via Cat 6 structured cabling from a local RJ45 outlet by each door and from each patch panel to the ISMS server via Cat 6 structured cabling and RJ45 outlet c/w IP address in the comms room. RJ45 outlets, Cat 6 cable, patch panel by ICT contractor.

Interconnecting cabling between controllers and local devices by Security contractor.

The Electrical Contractor shall supply and install a concealed or flush conduit containing system outlet box and draw wires for use by the Specialist Contractor. The Electrical and Specialist Contractors shall liaise and agree on all necessary containment requirements.

The lateral distribution of all cables shall be via cable basket located in the interstitial levels.

From the cable basket, 20mm diameter galvanised conduit shall be run concealed to access control points.

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Additional Items

- detail design of system;
- site commissioning tests;
- on site training for Client's maintenance staff.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.040 CONTROL REQUIREMENTS

Integrated Security Management System (ISMS)

The Integrated Security Management System (ISMS) shall be a modular, networked access control system capable of handling large proprietary corporations with multiple remote sites, alarm monitoring, video imaging, badging, paging, guard tour, digital video servers and CCTV switcher control. The system shall allow for easy expansion or modification of inputs, outputs, and remote control stations.

The system control at the central computer location shall be under a single software program control, shall provide full integration of all components, and shall be alterable at any time, depending upon the facility requirements. Reconfiguration shall be accomplished online through system programming, without hardware changes.

The software program shall be a true 32-bit, 3-tier client/server, ODBC compliant application based on Microsoft tools and standards. The software program shall operate in the current range-topping operating environments. Workstations shall be able to operate in the current range-topping Windows operating environment.

The software program shall consist of multiple servers including, but not limited to, Database Server, Communications Server, and Client Workstation Server. The Servers shall be capable of being installed on one or more PCs across a network providing a distribution of system activities and processes.

The database architecture shall be MSDE with Service Pack 4 as standard, or approved equivalent.

The system shall have the capability to communicate with the control panels via LAN/WAN connections utilising industry standard TCP/IP communication protocol. The system shall provide encryption via the TCP/IP connection.

Physical hardware may be filtered by operator level. The filter shall allow operate, edit, view or no access to the hardware.

The software program shall use Abstract Devices (ADV) for representing hardware devices in the system. The ADVs shall be used in Floor Plans to provide the user interface to control and monitor the system, and shall also be used in the Data Trees to organize, display and control system information.

The system shall support both manual and automatic responses to alarms entering the system. Each alarm shall be capable of initiating a number of different actions, such as camera switching, activation of remote devices, door control, and activation of WAV files.

The system shall provide both supervised and non-supervised alarm point monitoring. Upon recognition of an alarm, the system shall be capable of switching and displaying a view from either the CCTV camera that is associated with the alarm point. The system shall be capable of arming or disarming alarm points both manually and automatically, by time of day, and by day of week.

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Access control functions shall include validation based on time of day, day of week, holiday scheduling, site code and card number verification, automatic or manual retrieval of card-holder photographs, and access validation based on positive verification of card or card and PIN.

Camera functions such as pan/tilt, lens control, limits, and home position shall be supported by the system. Unless specific programming dictates otherwise, an operator shall be able to control these functions for all cameras so equipped.

Live video from a CCTV system shall be able to be displayed on the computer screen. The live video window shall allow the user to change its size and location on the computer screen. Video controls (pan, tilt, zoom, camera/monitor selection) shall be able to be sent to the CCTV system

Alarm events with defined priorities shall be able to pop-up automatically in an Alarm event window for operator attention. The pop-up shall display the name of the event (reader, alarm point, card-holder or system alarm), time, date, if a card event; the card number, type of event and card-holder name. An event counter shall also display the number of times the event was reported to the Alarm event monitor prior to Acknowledgement or Clearing the event. Event instructions shall be made available by double clicking on the event.

The Alarm event window shall allow the operator to initiate a physical response to the event as well as a written response. Responses shall include but not be limited to: acknowledge, clear, open a pre-programmed floor plan, energise, de-energise, pulse, time pulse, add comment, retrieve event video, bring up live video, shunt or un-shunt.

Assigned passwords shall be possible to define the levels of system operation for each individual operator. System operation for individual operators shall include, but not be limited to, restricted time periods for login and default language selection at login. Operator actions range from no view or control rights to basic monitoring to full control of the system including programming.

The system programming shall be user friendly, and capable of being accomplished by personnel with no prior computer experience. The software shall utilize drop boxes for all previously entered system-required data. The programming shall be MENU driven and include online "Help" or "Tutorial" information, as well as online data entry examples. The Help shall be available by using the F1 key. When using the F1 help access, the help menu will provide detailed information relative to the operation that the user is performing without the need to key in additional search parameters.

After installation, the client shall be able to perform hardware configuration changes. These hardware configuration changes shall include, but not be limited to, door open time, door contact shunt time, point and reader names, when and where a card-holder is valid, and the ability to add or modify card databases as desired without the services of the security system specialist.

Equipment repair shall be able to be accomplished on site, by module replacement, utilising spare components.

All control components shall utilise "Distributed-Processing" concepts. The distributed processing shall include the ability to download operating parameters to any field panel, thus allowing the field panel to provide full operating functions independent of the access control system computer.

The final interface requirements shall require to be developed by the successful contractor, however tenderers should identify a suitable provisional allowance within their tender return.

100.050 SYSTEM SCHEMATICS
(67) Series

100.060 SYSTEM DRAWINGS
(67) Series

C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE
W40
ACCESS CONTROL

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20.

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20

274.000 ACCESSORIES FOR ELECTRICAL SERVICES

274.010 GENERAL:
Comply with work section general clauses reference Y74.1000 and those detailed below.
•Supply accessories for electrical services as section V20

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51.

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20.

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20.

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
•Carry-out off-site painting and anti-corrosion treatment as work section V20.

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PART 3 SPECIFICATION CLAUSES SPECIFIC TO W40

300.000 GENERAL

300.010 SYSTEM REQUIREMENTS:
Select security detection components and equipment, suitable to meet system objectives requirements.

300.020 ACCESS CONTROL SPECIALIST:
Use an access control specialist for design development, supply, installation and testing and commissioning of complete access control installation in accordance with BS EN 50133-1.
Access Control Specialist
• Engage a single Security Systems Specialist to develop design, supply, install, commission and set to work an integrated security system encompassing all systems within this specification.

300.030 RECOGNISED FIRM:
Engage a firm recognised by the National Approval Council for Security Systems to carry out the work on the access control system to the appropriate NACOSS Codes of Practice.
•Category of Recognition
Certificated.

300.040 ELECTROMAGNETIC COMPATIBILITY:
Ensure all equipment and systems are installed to provide electromagnetic compatibility within the system and with any other systems installed in the same location.

300.050 LEVEL OF SECURITY:
Arrange the access control system at the access point to provide the indicated level of security.
•System facilities
  •Monitored.
  •Access point held open alarm.
  •Standby power 8 hours standby
•Access method
  •Unique token.
  •system card
  •PIN.
  •Refer to drawings for location of access methods.
•Code arrangement and type.
  •Alphanumeric
  •UK IIN to BS 7227.
  •Number of PIN characters
    •4.
  •Individual code to each door.

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300.060 ACCESS CONTROL SYSTEM:
•Type: PC-based access control and security management system
•Manufacturer and reference: Software House/Tyco C*Cure 800 Model 30
Arrange the access control system to provide,
•control of readers from central point on head-end PC located in Security Control Room.
•monitoring of system equipment as below
•
The following functional capabilities are considered essential for the system described in this specification. The capabilities are to be considered standard, without the need for add-on software or hardware. The access control system shall allow the distribution of system functions such as monitoring and control and graphical user interface etc. across the network to allow maximum flexibility and performance. The architecture shall include support of various Wide Area Networks using standard hardware and software to link nodes into a single integrated system. The network

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protocol used shall be an industry standard. The system shall also support remote configuration and operation using standard dial-up modems

1. SYSTEM CAPACITIES

1.1. The System shall require one master control file server station and be able to support a minimum of 20 additional concurrent (logged on) control locations, badging stations, or workstations, utilizing LAN/WAN network software and hardware.

1.2. The system software shall be capable of being installed on more than 100 PCs, but only the number of users allowed by the licensing agreement shall be permitted to be logged on at any given time.

1.3. The system software shall not use a hardware dongle unless required by the system hardware and then only on the PC where the database server resides. No dongles shall be required at any workstations.

1.4. Overall control of the access control, CCTV, paging, and alarm monitoring shall be through software control, which provides complete integration of the security components.

1.5. The file server station shall operate in both a programmed and a manual mode.

1.6. Capacities in a direct connect configuration shall be 512 readers, 250,000 card holders, 2,500 online inputs, 2,500 outputs, or a maximum of 64 CCTV switchers supporting 999 cameras and 99 monitors per switcher.

1.7. Capacities in a remote connect configuration shall be up to 250 remote dial-up sites, 31,000 card readers, 250,000 card holders, 124,000 alarm inputs, and 186,000 relay outputs.

1.8. The software shall not require installation of any modules or any other upgrading to achieve above stated capacities.

2. BASIC SYSTEM CAPABILITIES

The following functional capabilities are considered essential for the system described in this specification. The capabilities are to be considered standard, without the need for add-on software or hardware.

2.1. GENERAL

2.1.1. All databases will have the ability to ADD, DELETE, REPORT, VIEW or EDIT information.

2.1.2. Provide storage of all system transactions in a retrievable file.

2.1.3. Log all events by time and date.

2.1.4. Provide capability to store all or selected system transactions to a disk file.

2.1.5. Provide ability for CUSTOMER to make system configuration changes such as, but not limited to door open time, door contact shunt time, point and reader names, when and where a card-holder is valid, and the ability to add or modify card databases at any time.

2.1.6. Support "Global Anti-pass-back", allowing card-holder to enter/exit any card reader

2.1.7. Duress feature where when a PIN is used in conjunction with a card read, the number of digits are selected at the keypad where the PIN number is a value of one different from the normal PIN.

2.1.8. Provide mode of system operation that stores system commands that were not accepted by the hardware.

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2.1.9. Provide mode of system operation that requires the operator to enter a response to an event when acknowledging it from the alarm view window.

2.1.10. Provide mode of system operation that allows acknowledged alarms to be automatically cleared.

2.1.11. Provide mode of system operation where un-acknowledged events will cause the computer to continuously emit a pulsating beep until all un-acknowledged alarms are acknowledged. A momentary silence feature shall allow the beeping to cease for up to 60 seconds. The silence feature shall also provide a visual count down to when the beeping will begin again.

2.1.12. Provide mode of system operation where when an acknowledged, but not cleared event will be reissued requiring acknowledgement when the event changes to an alarm or trouble state.

2.1.13. Provide mode of system operation that does not allow the operator to clear an alarm prior to it being restored to normal.

2.1.14. Provide ability for manual operator control of system output relays. The manual functions shall include the ability to energise, de-energise, return to time zone, or pulse the output relay. The pulse time shall be a programmable setting.

2.1.15. Provide ability for manual operator control of system doors. The manual functions shall include the ability to Lock, Un-Lock, Shunt, Un-Shunt and Return to Time Zone.

2.1.16. Provide ability to automatically display stored "video image" of card-holder, and switch real-time camera from CCTV or digital video server to card reader location for specific card usage.

2.1.17. The card-holder "video image" pop-up shall be activated based on a priority level set to the card-holder or reader. Information in the pop-up shall include, but not be limited to the cardholder's primary image a live video pop-up showing the person who initiated the pop-up, entrance name, time, date, card-holder name, and status. User shall be able to display up to 40 note fields. The size of the pop-up(s) shall be adjustable by the operator.

2.1.18. Support multiple card reader technology including:

a Proximity
b Wiegand effect
c Biometrics
d Magnetic stripe
e Bar Code
f Keypad
g Card/keypad (PIN)
h High-speed long range Vehicle ID
i Smart Card

2.1.19. Provide a means for scheduled automatic backups of any or all database system files. A means to restore these files from a simple menu shall exist.

2.1.20. Provide the ability to address up to 64 serial communication ports, where each port can be configured for either hardwired or dial-up. When configured for dial-up, any one port can support multiple dial-up locations.

2.1.21. Communication from the access control server to the remote control panels shall be selectable. Communication options shall be via LAN/WAN using an IP address for direct connection to the remote RS-485 converter via network interface card. When using IP addressing it shall be un-acceptable to use a communication port converter device on the communication server side of the transmission. A minimum of 64 such IP connections shall be allowed.

2.1.22. All commands and updates to the panels shall be verified and shall automatically retry if communications have failed.

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2.1.23. Provide the ability to select ACK/NAK communication feature by communications port for either dial-up or hardwire.

2.1.24. Provide a system scheduler that shall automatically:

a Call remote locations to retrieve history transactions and update panel information, including time and date.
b Activate or deactivate cards locally or at remote dial-up sites.
c Initiate a pre-programmed command event/action.
d Synchronize system to controller time.
e Frequency shall be defined as Never, Now, Once, Hourly, Daily, Weekly, Once per 2 weeks, and Monthly.

2.1.25. Provide drop boxes for all system-required information that the user has previously entered.

2.1.26. Provide the ability to initiate a page to a paging system based on a transaction state. A transaction state shall be defined as but not limited to Normal, Alarm, Trouble, Ajar, Trace, Not Found, Anti-Passback Violation, PIN Violation, Time Zone Violation, Site Code Violation and System Alarms including Panel Com, Panel Power Failure, Modem Pool, Guard Tour, and Tamper.

2.1.27. A host grant mode of operation shall exist that requires the host computer to grant accesses to "valid" cards. An alternate host grant mode shall allow the card access information to be downloaded along with unlocking the door for "valid" cards.

2.2. CARD DATABASE

2.2.1. Cardholder information shall include unique card number up to 16 digits and optional Personal Identification Number.

2.2.2. Allow multiple cards per card-holder.

2.2.3. Provide 40 user definable fields.

2.2.4. Provide special card options that include, but are not limited to:

a Time zone reference, which defines valid time.
b Visitor use, which provides a specified activation date and expiration date (spanning years).

2.2.5. Provide a card "Trace" function. The Trace function shall allow normal access control, but will provide a tracking alarm at the system monitor.

2.2.6. Provide ability to store digital images of card-holder or other digital images such as property or family members. Up to 99 such images shall be associated with the card-holder.

2.2.7. Provide ability to store a written signature of the card-holder or other signatures such as family members. Up to 99 such signatures shall be associated with the card-holder.

2.2.8. Provide the ability to prioritise specific card usage from 1 to 99 with separate priority options for Anti-pass-back, Trace, PIN Violation, Normal, Not Found, Expired, Host Grant, Site Code and Time Zone card activities or violations.

2.2.9. Allow the user the ability to assign an operator message per card event state.

2.2.10. Upon editing card information, the updated information shall be sent automatically to the appropriate access control panel, when hardwired, with no other user intervention. If the port is dial-up, the entry will be stored on disk and shall be updated when connection is made to the remote loop. If the scheduler is used, then card updates shall be sent based on scheduling.

2.2.11. In a traditional (Wiegand) 5-digit card database, the numbers 0 and 65,535 shall not be valid

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card numbers as some devices transmit these numbers on an improper read.

2.2.12. In a 16-digit card database, the number 0 shall not be a valid card number as some devices transmit this number on an improper read.

2.3. ACCESS LEVELS

2.3.1. Provide the ability to define specific times of access.

2.3.2. Provide the ability to define specific readers for access.

2.3.3. Provide the ability to define groups of relays, in elevator control applications, defining access to selected floors.

2.3.4. Provide a template of a defined access level detail, where changes can be made to the template and saved as a new access level detail.

2.3.5. Provide an access control tree structure that allows groupings of entrances. User shall have the ability to group program all entrances on the branch or make specific changes to individual entrances.

2.4. CAMERA CONTROL

2.4.1. Provide ability to interface to a microprocessor-based matrix video switcher via a system communication port or LAN connection.

2.4.2. Provide ability to manually switch any camera in the system to any monitor in the system.

2.4.3. Provide ability to automatically switch any camera in the system to any monitor in the system based on any alarm point or system alarm.

2.4.4. Provide ability to manually control the pan, tilt, and lens functions (zoom, iris and focus).

2.4.5. A "live view" from the CCTV switcher shall be displayed on the system computer. The view shall include pan, tilt, zoom, camera/monitor selection, and the ability to send user programmed information to the video switcher. The ability to change the size and location of the view shall exist.

2.5. ALARM MONITORING - ALARMS ONLY VIEW

2.5.1. Report alarm point activity.

2.5.2. Provide colour for each specific alarm point action of "Alarm", "Normal" and "Trouble", conditions.

2.5.3. Provide the ability to access the default floor plan graphic for any active alarm point by a right click option.

2.5.4. Provide ability to bypass alarms in the system.

2.5.5. Execute alarm notification in all modes of operation.

2.5.6. Provide ability to acknowledge any alarm, card, or reader activity based on priority.

2.5.7. Provide display of system activity with the higher priorities displayed at the top of the list with identical points stacked with a frequency count of each point's change of state.

2.5.8. Provide ability for the operator to acknowledge and clear alarms from display. Prior to acknowledgment, the user shall be allowed to enter a response per alarm. The system shall offer a means to require acknowledgement of an alarm before it can be cleared.

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2.5.9. Provide a display of the most current transactions in real time.

2.5.10. Provide the ability for dynamic alarm monitoring of alarm points in real time on the system computer's video display terminal.

2.5.11. Provide an alarm view filter that is structured as a tree allowing the operator to select individual devices or groups of devices to be viewed.

2.5.12. Provide a "System" alarm upon a loop integrity violation.

2.5.13. Provide a "Panel Not Responding" alarm if communication to a panel is lost.

2.5.14. Provide real time printing of alarms as they occur by line printing with a dot matrix printer or provide printing of alarms, one page at a time, using typical Windows page printing.

2.6. ALARM MONITORING/SYSTEM CONTROL - TREE VIEW

2.6.1. Provide the ability for dynamic alarm monitoring of alarm points in real time on the system computer's video display terminal

2.6.2. Provide colour and icon shapes for each specific alarm point action of "Alarm", "Normal" and "Trouble",

2.6.3. The control tree shall be created by the user and allow for manual of control of all system devices. By right clicking on a device in the tree the operator be able to initiate the appropriate action from a pick list. Actions shall include but not be limited to: Acknowledge All Alarms, Clear All Alarms, Send Time & Date, Send Camera Titles, Camera to Monitor Switch, Control Camera P/T/Z, Focus, Iris, Run Command File, Lock, Unlock, Shunt, Unshunt, Pulse, Timed Pulse, Restore to Time Zone, Initialise, Cancel Initialisation, Buffer, Unbuffer, Connect Remote and Disconnect Remote from remote site.

2.7. OPERATOR DATABASE

2.7.1. The software shall allow the assignment of operator levels to define the system components that each operator has access to view, operate, change or delete.

2.7.2. Provide the ability to log operator actions in the history files.

2.7.3. Provide default language to be used based on operator's login.

2.7.4. Provide specified time periods that the operator can log in.

2.8. PANEL

2.8.1. Provide ability to program Action Messages and assign an alarm event priority. A specific action message may be displayed for each alarm, system alarm (communication, ground fault, power, panel reset, low voltage, panel tamper), card, or reader usage state. States shall include but not be limited to: Poll Response Alarm, Poll Response Normal, Primary Power Failure, Primary Power Normal, Tamper Switch Alarm, Tamper Switch Normal, Anti-Passback Violation, Card Not Found, Door Normal, Door Alarm, Door Trouble, Door Ajar, Host Grant Card Downloaded, Host Grant Door Unlocked, Invalid Pin, Invalid Time zone or Trace Card.

2.8.2. Provide ability to program descriptions, shunt times, and momentary shunt times for all system alarm points.

2.8.3. Provide ability to program descriptions, pulse times, and energise times for all system output relays used for door control and other auxiliary functions.

2.8.4. Provide ability to program descriptions for all system card readers.

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2.8.5. Monitor both supervised and non-supervised alarm points with the ability to select by point which point shall be supervised and define if the point is a normally closed or normally open point contact.

2.8.6. Provide ability to interlock any alarm point condition to an output relay.

2.8.7. Provide ability to interlock any alarm point condition to another alarm point.

2.8.8. Provide ability to interlock any alarm point to switch a camera to a system monitor.

2.8.9. Provide ability to program alarms and associate incoming alarms with related outputs.

2.8.10. Provide a programmable "delay" setting up to 255 seconds for all system alarm points. The system shall not report the alarm condition until the delay setting has expired.

2.8.11. Allow for up to 8 different site codes to be used in the system.

2.9. REPORTS

2.9.1. Provide reporting capability for printing of selected system transactions from the disk files by specific time and date selection, range from time and date to time and date, or from start time to end time each day of the selected date range.

2.9.2. Provide feature to generate a history report for an alarm point(s) state. An alarm point state shall be defined as Normal, Alarm, Trouble, or Ajar.

2.9.3. Provide feature to generate a history report of system alarms. A system alarm state shall be defined by panel and include any of the following information: communication, ground fault, power, panel reset, low voltage, panel tamper, and loop communication.

2.9.4. Provide feature to generate a history report for a card(s) state. A card state shall be defined as Normal, Trace, Not Found, Anti-Passback Violation, PIN Violation, Time Zone Violation, Site Code Violation, or Expired card. Additional search criteria shall include cardholders that meet up to at least 3-note field restriction and filter the report with defined reader location(s).

2.9.5. Provide feature to generate a history report for system operator(s) activities. The report shall include time, date, operator name the device associated with the action and the type of action performed by the operator. Activities shall include but not limited to: acknowledged and cleared transactions, camera control, door and relay control such as unlock, lock; door and input control such as shunt, unshunt; login, logout, panel initialisation, panel buffer and panel unbuffer.

2.9.6. Provide complete database reporting of all data programmed into the system data files.

2.10. TRACKING/MUSTER REPORT

2.10.1. A tracking feature shall allow the system operator to identify an area and the person(s) in that area.

2.10.2. Areas shall be defined by readers representing an IN or OUT read status.

2.10.3. An area defined as an exit shall remove the person from the tracking area.

2.10.4. A Muster area shall be defined by a reader(s) used to "muster" individuals in the event of an emergency.

2.10.5. Reports can be generated for the defined muster or tracking area.

2.10.6. Reports can be generated for all muster or tracking areas in the system.

2.10.7. Tracking areas can include "nested" areas. Nesting allows for various reports from a large

area to smaller areas within the large area.

2.10.8. A Tracking and Muster area screen shall be continually updated with the most recent card activity, therefore minimizing the time required generating a report.

2.10.9. A history-priming feature shall load history activities for the defined amount of hours when the software is started. This priming feature shall be implemented in the event that the system computer is offline when a muster call is initiated, thereby allowing the implementation of the tracking and muster features of the software. The history priming time shall be operator selectable in 1-hour increments up to 99 hours.

2.11. TIME ZONES

2.11.1. Time zone definitions shall include Starting time, Ending time, Days of the week, and Holiday override.

2.11.2. Time shall be definable in either AM/PM or 24-hour (military) time.

2.11.3. Minimum time zones that can be assigned to a panel shall be 63.

2.11.4. Maximum time zones that can be defined in a system shall be unlimited.

2.12. FLOOR PLAN GRAPHIC

2.12.1. Provide the ability to import floor plan graphics stored in a WMF format.

2.12.2. Provide the ability to associate all ADVs to floor plan graphics allowing the user to control and monitor the system.

2.12.3. Provide the ability to link floor plan graphics together in a hierarchy fashion.

2.12.4. Allow multiple floor plan views to be displayed simultaneously.

2.13. REMOTE LOCATIONS

2.13.1. Provide capability to place remote control panels in an offline mode. In the offline mode, the remote control panels shall retain all panel history events. The amount of historical events shall be limited to the panels buffer capacity.

2.13.2. Provide capability to place remote control panels in an offline mode where the remote panel will automatically call to the communications computer to report system alarms or upload buffered events.

2.13.3. Ability to manage at least 250 remote locations.

2.13.4. Provide a user-definable schedule that will automatically add cards to any number of sites.

2.13.5. Provide system time schedules that the computer will use to automatically start uploading or downloading information to the remote sites. Information to be sent to the panel shall include, but not be limited to, card database changes, time, date, and buffer condition. Information received from the panel shall include all buffered events. While connected to the remote site, the system software shall poll, verify, and report any loss of panel communication. If a site's communication time is longer than expected, the system will automatically adjust the time schedule to allow all selected sites to be updated.

2.13.6. Attaching a site to an auto-dial schedule will allow the system to automatically dial the remote site at a predetermined time. The auto-dial schedule is programmed with the ability to dial Once, Now, Hourly, Daily, Weekly, Two Weeks, Monthly, or Never to the remote site.

2.13.7. Provide the ability for the operator to program when the next scheduled update will occur,

C0605 The New LMB Building Project W40
Electrical Specification ACCESS CONTROL
Revised Stage E Scheme Including Agreed VE

based on time and date.

2.13.8. Communication to remote dial-up sites shall be accomplished through the use of password protection. The remote site provides the system with a site ID; the system responds with the appropriate password. No commands or transactions occur until the communication link is verified.

2.13.9. The System shall be able to receive or send information to remote access control panels on demand.

2.13.10. The ability to configure how many redial attempts from the remote location shall be definable from 1 to 5.

2.13.11. The ability to pause between redial attempts shall be programmable from 1 to 120 seconds.

2.13.12. The ability to pause before disconnecting shall be programmable from 1 to 30 seconds.

2.13.13. Communication rates shall be 9600 or 19.2k baud.

3. SPECIAL SYSTEM FUNCTIONS

The manufacturer of the system shall provide in the system software the following unique applications as standard:

3.1. ID BADGING SYSTEM/VIDEO IMAGE SYSTEM

3.1.1 An ID Badging suite shall be provided. Access control system database to be SQL compliant.

3.2. NETWORKING

3.2.1. Provide networking capabilities (LAN or WAN) as a standard feature, as defined by licensing, not as an installed software upgrade.

3.2.2. Provide 1 Server and licensing for 5 (minimum), 10, and 20 user workstation configurations.

3.2.3. Provide the ability for a network system to support concurrent users up to the license limit, i.e., one station adding cards and making badges, another station monitoring alarms, yet another running data base reports, another controlling door openings and alarm shunting, and so on.

3.2.4. The workstation shall have the same UI (user interface) functionality, as the Server except the workstation shall not be able to perform database maintenance functions.

3.3. ELEVATOR CONTROL

3.3.1. Control access to specific floors by specific card number.

3.3.2. Control access to floors by time of day, day of week, and holiday overrides.

3.3.3. A minimum of 32 groups of floors shall be supported per elevator control reader.

3.4. WIZARD

3.4.1. Provide a wizard that guides the administrator through the process of adding access control hardware. System functions the wizard shall address include, but not limited to:

a Default time zone selections
b Communication port selection
c Type of panel communications converter
d Type of access control panel
e Door unlock times (from pre-selected time zones)

f Time the door shall remain unlocked based on valid card use

3.4.2. The wizard shall also allow the administrator to assign names to the access control devices being added.

3.4.3. Provide a wizard that allows batch loading of card numbers in the system. System functions the wizard shall address include, but not limited to:

a Starting number
b Ending number
c Activation date

3.4.4. The wizard shall also provide a report preview that can be printed summarizing what was done during the Wizard programming session.

4. SYSTEM PRODUCTS

4.1. GENERAL

4.1.1. The quantities of components shall be determined and installed by the CONTRACTOR based on the requirement to provide a fully operational Integrated Security Management System (ISMS), as per the intent of the specification, and as shown on the drawings and recommended by the MANUFACTURER.

4.1.2. Communication between components co-located shall be via coaxial cable, CAT 5 or shielded twisted pairs.

4.1.3. The system shall operate under Windows XP, 2000 or NT Service Pack 6a. Communication between satellite stations and the master file server station shall be in accordance with conventional Windows XP, 2000, NT Service Pak 6a LAN/WAN operation using TCP/IP protocol.

4.2. FRONT END SYSTEM

4.2.1. The master file server station, stand-alone stations, and workstations shall be IBM-compatible desktop (full-size) personal computers (PCs). The requirements for the PC shall be scaled according to system application requirements.

4.2.2. Standard PC configuration shall be used for systems with 1-100 readers, 1-5,000 cardholders, and 2 communication ports.

4.2.3. For performance PC system configurations that require high availability, the manufacturer shall be consulted for appropriate custom PC system configuration.

4.2.4. Computer Specifications

Standard PC Specification:
a CPU shall be a 1.8GHz Intel Pentium III processor or higher
b RAM shall be 4 GB or more
c Hard disk shall be an 80 GB SCSI or larger (Increased drive capacity shall be required in badging applications depending on image compression.)
d CD/DVD drive
e Monitor/video adapter board 17" 1024 x 768 true colour or larger
f 2 button mouse (PS2 mouse preferred)
g Standard 101-keyboard layout and IBM-compatible keyboard
h CD/RW for back-up purposes
i 2 Serial communication ports
j 1 Parallel port
k Microsoft Windows 2003 Server Service Pack 3
m USB port
Performance PC Specification:

l CPU shall be a quantity of two Xeon 2.2GHZ
m RAM shall be 1GB
n Hard Disk shall be a RAID 5 configuration using drives that are a minimum of 18 GB Ultra 160 10k RPM SCSI.
o CD/DVD-R drive
p Monitor/video adapter board 17" 1024 x 768 true colour or larger
q 2 button mouse (PS2 mouse preferred)
r Standard 101-keyboard layout and IBM-compatible keyboard
s Tape backup equalling the RAID capacity
t 2 Serial communication ports
u 1 Parallel port
v Microsoft Windows 2003 Server Service Pack 3
w USB port

4.3. COMMUNICATION PORTS AND LOOPS

4.3.1. The computer shall have two serial communication ports. If additional ports are required they shall be provided by installing additional compatible multi-port cards.

4.3.2. Windows XP, 2000 or NT system communication ports shall be expandable up to a maximum of 64 ports. For system applications requiring additional communications ports, expansion cards shall be used.

4.3.3. Each communication port shall support one local direct connect loop or multiple remote loops via modem. A local RS-485 multi-drop communication loop shall support up to 31 access control panels, 124 readers, 744 output relays and monitor up to 496 alarm points.

4.3.4. Remote configuration shall be supported. Up to 250 dial-up or networked remote locations may be defined. Each remote location shall support one RS-485 drop line supporting up to 31 access control panels, 124 readers, 744 output relays and monitor up to 496 alarm points.

4.4. VIDEO IMAGE/ID BADGING SYSTEM

4.4.1 An ID Badging suite shall be provided. Access control system database to be SQL compliant.

4.5. FRONT END SOFTWARE SPECIFICATIONS

4.5.1. The System software shall be C*Cure 800 core software.

4.5.2. Databases: The software shall provide edit, add, delete, search, sort, and print options for records in selected databases.

4.5.3. Printer Output: The software shall direct user-selected activity to the Windows supported printer.

4.5.4. Monitor Display: The software shall display all system activity on a colour monitor in real time, except for remote locations configured as dial-up. The software shall allow a WAV file to be played upon all alarm conditions. The software shall provide an acknowledge function for all incoming alarm messages that are defined for alarm acknowledgment.

4.5.5. Disk Storage: The software shall store user-selected activity on the hard disk. Report options shall recall selected history information from the hard disk. The user may request report information based on selected cardholders, specific areas and/or specific times. The software shall allow archiving by defined dates.

4.5.6. English Descriptions: The software shall support descriptive names for all database entries. The card database shall include name, number, PIN, access level, status, activation, and expiration date or limited usage and 40 user-defined fields.

4.6. FRONT END SOFTWARE REQUIREMENTS

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Deleted: The standard PC configuration used for stand-alone or mini-servers shall be Northern Computers WP2SFSM. For Client Workstations it shall be Northern Computers WP2C
Deleted: dual core 64 bit
Deleted: faster
Deleted: 3.5" floppy disk and
Deleted: shall be
Deleted: XP Professional or Windows 2000 Professional
Deleted: 2
Deleted: 3.5" floppy disk and
Deleted: Monitor shall be 15" 1280 x 1024 true colour
Deleted: XP Professional or Windows 2000 Professional
Deleted:
Deleted: 2
Deleted: as follows: Northern Computers NTEXPDI4 for 4 additional ports, NTEXPDI8 for 8 additional ports, NTEXPDI16 for 16 additional ports, NTEXPDI32 for 32 additional ports, and NTEXPDI64 for 64 additional ports
Deleted: Northern Computers WIN-PAK 2.0

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4.6.1. Password Protection: The software shall provide multi-level password protection, with user-defined operator name/password combinations. Name/password log-on shall restrict operators to selected areas of the program. The software shall allow the assignment of operator levels to define the system components that each operator has access to view, operate, change or delete.

4.6.2. Action Messages: The software shall allow recall of user created text messages upon any condition.

4.6.3. Graphics: The software shall allow recall of user created screen graphics, upon alarm/trouble/normal conditions. These graphics shall allow the user to go from a general area to a specific area in various layers or stages and shall allow the user to monitor and control system devices from floor plans.

4.6.4. Manual Panel Control: The software shall allow manual control of selected inputs, outputs and groups of outputs. Manual panel control shall include pulse, timed pulse, and energise/de-energise or return to time zone options for output points and shunt/unshunt or return to time zone options for input points. For entrances and readers manual control shall include but be limited to Lock, Un-Lock, Shunt, Un-Shunt, Pulse and Timed Pulse.

4.7. CCTV SYSTEM CONTROL

4.7.1. The software shall provide complete control of all CCTV System functions from the computer keyboard.

4.7.2. The software shall support a CCTV system with up to 99 monitors and 999 cameras per CCTV switcher.

4.7.3. The software shall support individual camera/monitor connections, pan and tilt camera control functions and focus, zoom, and iris control motorized lens control functions.

4.7.4. Supported CCTV microprocessor-based switchers shall include, but not be limited to: American Dynamics, Burle, Dedicated Micros, Geutebruck, Javelin, Vicon, Panasonic, and Pelco.

4.7.5. The software shall activate selected camera/monitor combinations upon input point, system alarm, or card activity.

4.7.6. Software for the CCTV system shall allow the highest level operators to change the operating parameters of the system. The software features shall include the following capabilities:

a Edit camera title information, consisting of camera number and alphanumeric identification.
b Any camera/monitor combination can be programmed to an alarm or card reader.

4.8. VIDEO IMAGING/ID BADGING

4.8.1 An ID Badging suite shall be provided. Access control system database to be SQL compliant.

4.9. ACCESS CONTROL FIELD HARDWARE DEVICES

4.9.1. The security management system shall be equipped with access control field hardware required to receive alarms and administer all access granted/denied decisions.

4.9.2. The control panel shall be the C*Cure 800 iStar Pro 8/16 controller.

4.9.3. The control panel power supply shall be the C*Cure 800 power supply unit.

4.9.4. Enclosure: The control panel enclosure shall have hinge cover with key lock. A control panel input point shall monitor an enclosure tamper switch.

4.9.5. Mechanical:
a Height: 14 inches (355mm)

Deleted: Northern N-1000-III for two card readers or N-1000-IV for four card readers

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b Width: 16 inches (406mm)
c Depth: 4 inches (101mm)

4.9.6. Power Requirements: 12VAC 50 VA or +12 VDC @ 2 Amps

4.9.7. The control panel shall incorporate microprocessor-based, digital technology, using high speed processing for maximum reliability.

4.9.8. The system shall use distributed intelligence architecture, with control panels operating independently of one another.

4.9.9. All database information shall be stored at the control panel level.

4.9.10. All decision-making shall be performed at the control panel, eliminating degraded mode operation.

4.9.11. Proprietary software programs and control logic information used to coordinate and drive system hardware shall be stored in Read Only Memory (PROM).

4.9.12. The control panel shall be PROM and programmable RAM field upgradeable.

4.9.13. The system shall be flexible and modular in design, allowing easy expansion.

4.9.14. The control panel shall have CE, UL 294, and ULC listings and approvals.

4.10. CONTROL PANEL CONFIGURATION

Refer to Clause W40 310.070 for full technical requirements for door control panels.

4.11. CONTROL PANEL REQUIREMENTS

Refer to Clause W40 310.070 for full technical requirements for door control panels.

4.12. CONTROL PANEL FEATURES

Refer to Clause W40 310.070 for full technical requirements for door control panels.

4.13. LINE DRIVERS AND MODEMS

4.13.1. The communications interface from system PC to control panels shall be via Cat 6 structured cabling c/w any converters required.

4.13.2. Deleted.

4.13.3. Deleted.

4.13.4. Printers, and peripheral security devices connected with RS-232 shall not be more than 50 feet away, without using the appropriate modems. Beyond this distance a short-haul or leased-line modem shall be used for transmission over a pair of voice grade quality (3002) telephone lines or dedicated cable or RS-485 multi-drop applications shall not run more than 4000 feet or connect more than 31 control panels.

4.13.5. Deleted.

4.14. PAGING

4.14.1. Paging system shall allow interfacing from the security system via phone line or direct connect to a relay output.

4.14.2. Paging system shall allow user programmable alphanumeric messages to be sent.

Deleted: RS-232C to 20mA and/or RS-232C protocol to RS-485. The converter shall be the Northern C-100-A1 converter, Northern N-485-PCI-2, or combinations thereof

Deleted: The C-100-A1 converter shall provide a 20mA interface to the N1000 and an RS-232C interface to a Personal Computer, and shall provide LED's to indicate data received and transmitted. Power Requirements: 12 VAC or +12 VDC linear

Deleted: The N-485-PCI-2 shall provide an RS-485 interface through the N-485-API-2 to the N1000 and an RS-232C interface to a Personal Computer. Power Requirements: +9VDC @ 300mA

Deleted: A panel in a remote communication 485 multi-drop configuration connected to a N-485-HUB-2 converter shall have the ability to interface to a standard, 9600 baud telephone line with Hayes (or Hayes compatible) auto-answer/auto-dial modems using the Northern M200-220

4.14.3. A single message shall be able to be sent to a group of pagers.

4.14.4. Paging system shall allow messages to be repeatedly sent to insure reception

4.14.5. Paging system shall have battery backup.

4.14.6. Provide ability to timestamp a page.

4.14.7. The pager interface shall communicate to a standard alphanumeric pager.

4.14.8. Deleted.

4.14.9 Provide interface to Disabled Persons Toilet Alarm system to allow staff paging function of alarm activation. Liaise with Disabled Persons Alarm vendor to determine requirements and provide all necessary equipment to enable paging function.

300.070 EQUIPMENT:
- Internal
  - Temperature 0 to 40°C.
- External
  - Temperature -20 to 50°C.
- Protect equipment to BS EN 60529,
  - IP 65 external readers

300.080 INTEGRATED SYSTEM:
Provide integrated system in accordance with BS 7807. Combine the following sub-systems
- Intruder alarm.
- Access control.
- Closed circuit television.
- Door entry system

310.000 PRODUCTS/MATERIALS

310.001 ELECTROMAGNETIC DOOR LOCKS:
Application Locking devices shall comprise electronic magnetic shear locks on high security areas
NOTE
ALL ELECTROMAGNETIC/ELECTRONIC DOOR LOCKS SHALL BE SUPPLIED AND INSTALLED BY IRONMONGERY WORK PACKAGE CONTRACTOR. THE SECURITY CONTRACTOR SHALL LIAISE WITH AND ADVISE THE IRONMONGERY CONTRACTOR AS TO INTERFACE REQUIREMENTS E.G. VOLTAGE ETC. IT SHALL BE THE RESPONSIBILITY OF THE SECURITY CONTRACTOR FOR THE INTERFACE BETWEEN THE ACCESS CONTROL SYSTEM AND THE ELECTROMAGNETIC/ELECTRONIC LOCK.

310.010 ENTRY PHONE ACCESS SYSTEM:
Provide
- Supply design entryphone system complete with all interconnecting wiring. Security/access systems contractor shall install all equipment and wiring.

- In conjunction with other security system.

Wall mounted unit. call points
- Vandal resistant call points
- Electric lock release from remote location, via interface with access control system

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310.020 CARDS:
- Type Programmable contact-less smart card technology system.
- Standard
  - BS EN ISO/IEC 7810.

Deleted: Mifare

310.050 TOKEN:
Provide tokens to match the reader.
- Quantity of cards in initial supply 1000No.
- Technology
  - Programmable contact-less smart card technology

Deleted: Mifare contact-less

310.060 TOKEN READERS/CODE INPUT DEVICE:
- Type Multi-format and multi-technology readers
- Application Located at 1400mm AFFL at locations generally illustrated on GA drawings, final location to suit architectural layouts

Deleted: Mifare Token Reader

Provide token reader/code input device to match token and access point.
- Valid Transaction
  - Token only.
- Technology
  - Proximity device.

Readers shall be capable of reading HID, Deister, CASI-RUSCO, iCLASS, MiFare and DesFIRE card technology
- Weigand & RS232 output compatible with access controllers

Deleted: Classic/Standard

Card characteristics
- Mounting
  - Surface.
  - Internal.
  - External. where indicated
  - Weatherproof for external readers
  - Tamper protected
  - Colour - to be agreed.
- Enclosure (keypad)
- Control facilities
- Computer controlled
- Functions.
  - Valid token.
  - Blocked token.
  - Time blocked token.
  - Group blocked token.
  - Adjustable entry times
  - Automatic error count
  - Response time valid token to unlock seconds 1
  - Re-lock if access point not used after seconds 1-20
  - Door status to be indicated on Windows programme
- Anti pass-back.
- Local indications
  - LED green
  - Accept token.
  - Reject token.
  - Token status
  - audible beeper
- Power supply
- Standby power supply
- Memory battery protected.
- Alarms.
  - To intruder alarm system

Deleted: Stage E Issue

- Local.
  - Audible beeper
- Remote at front end controller PC
- Tamper.
- Door status.
- Invalid access attempt.

310.070 CONTROLLER:
Provide access system controller to match token readers/code input devices.
- Hierarchy arrangement
  - Multiple access points
  - Central controller access control system database server
  - Interfaces with,
    - Access point controllers.
    - fire alarm system.

  Inputs
  - Valid transaction.
  - Invalid transaction.
  - Token identity.
  - Access point status.
    - Open/closed.
  - Time.
    - Locally generated at access controller, set from central server
  - Fire alarm Interface to each controller.
  - Locks fail safe "closed".
- Outputs to access points.
  - Transaction validation for token use
    - Access point status change on command from local controller
- Other outputs
  - Transaction details include
    - Time signal include
    - Alarms.
      - To intruder alarm system monitored contacts
      - To central controller PC to be supplied complete with software
    - Unauthorised database change
    - Invalid transaction include
    - Tamper.
    - Access point status include
    - Timed out transaction
    - Pass-back attempt.
    - Duress access.
    - Access point forced include
    - Transaction interval timed out include
    - Integrated security management system
- Reports
  - To printer.

  To VDU.
  - Integrated security management system
- Functions
  - Validation of tokens/codes include
  - Access point status change include
    - Open/close.
  - Access restrictions include
    - Time bands include
  - Assign names to tokens include

Deleted: Stage E Issue

  - Erase token/codes include
  - Record data to media
    - Magnetic
    - Back-up include
- Facilities

  Database protection included
    - Security password hierarchy.
  - Programmer CNC Controller
    - Fixed.
  - Main power supply.
  - Standby power supply.
    - BS 4737
    - BS EN 54-4

310.080 VEHICLE BARRIERS:
- Type Single boom traffic Control Barrier
- Manufacturer and reference • Broughton Controls Ltd
- Shaw Road
- Oldham
- Tel 0161 627 0060

Or approved equivalent
- Rising arm
  - Arm length (m) 5-6m - (final dimensions to be site measured prior to order
  - Arm colour and marking Red/white (manufacturers standard
  - Rigid.
  - with fixed barrier end support post
- Safety devices
  - Locking
  - Obstruction reverse
  - Power fail
    - Lowered.
  - Safety / autoclose induction loop vehicle detection system
- Control

  Power supply 230v single phase
  - Motor electromechanical continuously rated servo motor
  - Intercom unit
  - Vandal resistant intercom system comprising 1 master to 1 slave unit suitable for external use.

  Intercom to be linked to main security control room.
  - Power / Control Pillar
  - housing motor and controls.
  - with push button control - up/down/stop/continuous raise
  - Barrier housing mounted test/access/isolate keyswitch

  Barrier entry / exit controls as follows:
  Main car park:
  - Controlled Entry & Exit - via card reader linked to the building access control system. Induction loop within roadway on exit route.
  - Remote operation - via two way Entryphone linked to remote barrier control unit.

320.000 WORKMANSHIP

320.010 WORK ON SITE:
Ensure that all building works are completed and service connections are provided,
- by others.

Deleted: Stage E Issue

320.020 INSTALLATION:
Install, commission and set to work equipment in accordance with manufacturer's recommendations.

320.030 QUALITY CONTROL:
Handle, store and install equipment and components of the access control systems in accordance with the manufacturer's recommendations.
•Obtain all equipment and components from a single source.
Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Record all commissioning measurements and tests.

Deleted: Stage E Issue

BS APPENDIX

BS 7227:1990
Procedures for the application of ISO 7812 to allocate UK Issuer Identification Numbers (UK IINs) for use on identification cards

BS 7807:1995
Code of practice for design, installation and servicing of integrated systems incorporating fire detection and alarm systems and/or other security systems for buildings other than dwellings

BS EN 50133-1:1997
Alarm systems. Access control systems for use in security applications. Part 1 System requirements

BS EN 60529:1992
Specification for degrees of protection provided by enclosures (IP code)

Deleted: Stage E Issue

W41 SECURITY DETECTION AND ALARM

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide an alarm system monitoring all external doors, plant room doors and selected internal doors via automatic detection devices.

To provide panic alarm systems, lone worker alarm systems and trapped person alarm systems to specific areas in the building.

100.020 DESIGN PARAMETERS
BS 7671: 2001 - Requirements for Electrical Installations, including all amendments.
BS 4737 - Intruder Alarm Systems

100.030 SYSTEM DESCRIPTION

1. Intruder Detection and Alarm System

Complete the detail design, supply, install, commission and set to work an electronic intruder detection and alarm system covering all external doors and selected internal areas comprising control panel, detection devices, and interconnecting wiring.

The Intruder Detection and Alarm system shall be a fully integrated part of the Integrated Security Management System, as defined in section W40.

Control Panel

The main system control panel shall be located in the Security Control Room. The system shall have the facility to link to a remote alarm receiving centre via RedCare link.

A digital communicator, integral to the Main Control Panel shall provide point identification information in English text, e.g. PIR in Reception, etc.

Internal and external sounders shall be located as detailed on the layout drawings.

The system shall be sized to allow future installation of automatic detection to the building perimeter and areas accessible from ground level.

The system shall be capable of generating confirmed alarms.

Detection Devices

Detection devices shall comprise magnetic reed-type door monitor contacts fitted to all monitored doors and dual technology (combined passive infrared and ultrasonic) sensors to specified areas.

Combined remote interface/low voltage power supply units shall be distributed throughout the floor levels as required.

Interconnecting Wiring

The system shall be wired separately as a stand-alone system in LSF insulated cabling and shall interfaced to the ISMS as defined below and in section W40.

Deleted: interfaced with the building-wide ICT system

Deleted: Category 6 structured

The Electrical Contractor shall supply and install a concealed or flush conduit containing system outlet box and draw wires for use by the Specialist Contractor. The Electrical and Specialist Contractors shall

Deleted: Stage E Issue

liaise and agree on all necessary containment requirements.

The lateral distribution of all cables shall be via a 150mm wide cable basket located in the interstitial levels.

From the cable basket, 20mm diameter galvanised conduit shall be run concealed to access control points.

Additional Items

- detail design of system;
- site commissioning tests;
- on site training for Client's maintenance staff.

2. Panic Alarm System

Complete the detail design, supply, install, commission and set to work electronic panic alarm system to all areas identified in the drawings, comprising hard-wired personal attack switches, control panels, interface devices and interconnecting wiring.

Systems comprise desk mounted double action activation switches (two buttons pressed simultaneously to trigger alarm), stainless and impact resistant housings, normally closed relay rated at 24V d.c., 2A. System signals integrated security system.

3. Lone Worker Alarm Systems

Infrared alarm systems to quickly locate someone requiring assistance to all areas identified in the drawings, comprising personal transmitters (4No. per location), receivers, control panels, interface units and interconnecting wiring. Personal transmitters clipped to pocket/belt or neck chain, activated by removing from pocket/belt or by pulling from chain. Ceiling mounted receiver relays signal to control panel which relays signals to integrated security system to identify location of alarm. Self-monitoring system with anti-tamper, anti-masking, anti-false alarm and battery check features.

4. Trapped Person Alarms

System provided by specialist Cold Room vendor as part of cold room package. Security system trade package contractor to provide interface point at each cold room to allow Trapped Person Alarm to be connected to integrated security system. Security contractor to liaise with cold room system vendor to agree system requirements.

5. Door Locking System

Provide emergency door locking system to Main Reception desk to automatically lock main entrance bi-parting doors. Provide push button, power supply, etc. plus all interconnecting wiring to interface with door system controller (by others). Liaise with door vendor to agree system requirements. Final connection to door system controller by door trade package contractor.

100.040 CONTROL REQUIREMENTS
Provide integrated security management system as identified in section W40.

Provide facilities to monitor and control all intruder detection points. The intruder controller equipment shall provide a high level communication with the Integrated Security Management System (ISMS).

Arrange for the system to be able to be set in full or in part. The method of setting shall be via PIN numbers entered in to system, commanded via the ISMS system or via a configured timed function.

Arrange for the system to operate automatically in the event that a PIN Number is entered, either to ARM or DIS-ARM the system.

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In the event that an alarm is raised during an ARMED period send an 'Intruder Detected' signal to the manned station at the Security control room, remote manned centre and initiate the external flashing Xenon indicator and sounder.

An alarm will also be created indicating cable fault or device tamper. These types of alarms will be ARMED 24 hours a day.

Final intruder alarm system zones, part/full set configuration etc is to be confirmed.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.050 SYSTEM SCHEMATICS
(67) Series

100.060 SYSTEM DRAWINGS
(67) Series

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20.

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20.

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20.

274.000 ACCESSORIES FOR ELECTRICAL SERVICES

274.010 GENERAL:
Comply with work section general clauses reference Y74.1000 and those detailed below.
•Supply accessories for electrical services as section V20.

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51.

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20.

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20.

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
•Carry-out off-site painting and anti-corrosion treatment as work section V20.

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W41

300.000 GENERAL

300.010 SYSTEM REQUIREMENTS:
Select security detection components and equipment, suitable to meet system objectives requirements.

300.020 INTRUDER ALARM SPECIALIST:
Use a security detection specialist for design development, supply, installation and testing and commissioning of complete security installation.
Security detection specialist
- Engage a single Security Systems Specialist to develop design, supply, install, commission and set to work an integrated security system encompassing all systems within this specification.

300.030 RECOGNISED FIRM:
Engage a firm recognised by the National Approval Council for Security Systems to carry out the specified work on the security detection and alarm system to the appropriate NACOSS Code of Practice.
•Class of Recognition Security Systems
•Category of Recognition
  •Certificated.

300.050 STANDARDS:
•BS 4737-2.
•BS 4737-3
•BS EN 50131-1.
•BS EN 50131-6.
•BS EN 50132.
•BS EN 50136.
•PD 6608.

300.060 INTRUDER ALARM GRADING CLASSIFICATION:
Ensure the intruder alarm system complies with the requirements of BS EN 50131-1
•Security grade
  •Medium-to-high risk, grade 3
  •Component Environmental classification
    •Indoor - general, class II,
    •Outdoor - general, class IV,

300.070 INTRUDER ALARM TRANSMISSION SYSTEM PERFORMANCE:
Ensure the intruder alarm system transmission system performance complies with the requirements of BS EN 50131-1 Annex B

300.080 INTEGRATION WITH OTHER SYSTEMS:
Integrate other systems with intruder alarm systems to form a complete system complying with the requirements and the appropriate standards.
•Control of lighting - internal
•Control of lighting - external
•Acceptance of alarm from access control system
•CCTV system including digital recording
Entryphone system

300.090 ELECTROMAGNETIC COMPATIBILITY:
Ensure all equipment and systems are installed to provide electromagnetic compatibility within the

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system and with any other systems installed in the same location, in accordance with BS EN 50130-4.

300.140 INTEGRATED SYSTEM:
Provide integrated system in accordance with BS 7807. Combine with the following sub-systems
•Intruder alarm.
•Access control.
•Closed circuit television.

310.000 PRODUCTS/MATERIALS

310.010 VISIBLE AND AUDIBLE WARNING DEVICES:
•Type External and Internal Sounders
•Application Internal sounders to indicate alarm set and break in, external sounder to sound on alarm set and break in
•Standard
  •BS 4737-2.
  •BS 4737-4.3.
  •BS EN 50131-1.
•Lamp
  •Flashing.
  •Wall mounting.
  •Weatherproof. for external units
  •Colour of lens Red
•Sounders
  •Siren.
  •Internal.
  •External to BS EN 50131-1.
•Colour
  •white
•Finish
  •Weatherproof. for external units
  •Internal.
•Power supply
  •From control unit
  •Integral.
  •BS EN 50131-1.
•Accessories
  •Fit line monitor device.
  •Cut off timer; time (sec) to be agreed
  •Two tone modulation.

310.020 POWER SUPPLIES:
•Standard
  •BS EN 50131-1 and BS 4737-2.
  •BS 4737-4.1
•Provide
  •Mains supply with rechargeable battery standby.
  •Automatic dialling equipment power supply.
  •Digital communications power supply.
  •Direct line signalling equipment power supply.
  •12 V.

310.030 PASSIVE INFRA-RED MOVEMENT DETECTORS:
•Standard
  •BS 4737-3.7.
  •BS 4737-4.3.
•Power supply

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  •From control unit.
•Mounting
  •Wall.
  •Ceiling.

Coverage
  •Finger pattern.
  •Wide angle 120° plan.
  •360° balanced curtains.
  •to suit the application.
•Accessories
  •Automatic temperature compensation.
  •Alarm memorisation.

310.050 COMBINED INFRA-RED AND ULTRASONIC MOVEMENT DETECTORS:
•Standard
  •BS 4737-3.5 and BS EN 4737-3.7.
  •BS 4737-4.3.
  •BS EN 50131-1.
•Power supply
  •From control unit.
•Mounting
  •Wall.
  Ceiling.

System
  •Combined PIR and ultrasonic detection.
  •Verification of PIR alarm by ultrasonic detection.
•Coverage
  •Finger pattern.
  360° balanced curtains
  • to suit the application.

Accessories
  •LED indicators for PIR section tripped; ultrasonic section tripped; verified alarm condition exists.
  •Alarm memorisation.
  •Remote alarm annunciation.
  •LED indicators for PIR section tripped; ultrasonic section tripped; verified alarm condition exists

310.070 COMBINED INFRA-RED-MICROWAVE DOPPLER DETECTORS:
•Standard
  •BS 4737-3.4 and BS 4737-3.7.
  •BS 4737-4.3.
  •BS EN 50131-1.
  •MPT 1353.

310.140 SENSOR CABLE:
•Type to be selected by security system specialist contractor
•Standard
  •BS 4737-4.3.

310.150 CONTINUOUS WIRING:
•Type to be selected by security system specialist contractor
•Standard
  •BS 4737-3.1.
  •BS 4737-4.1.
•Circuit Configuration

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•Alternative wires short circuit alarm.
•Adjacent wires short circuit alarm.

310.170 PROTECTIVE SWITCHES:
•Type Magnetic reed door contacts
•Application External perimeter doors
•Standard
•BS 4737-3.3
•BS 4737-4.3.
•BS EN 50131-1.
•Switch type
•Magnetic contact.
•Mounting
•Overhead door.
•Flush mount.

310.190 DELIBERATELY OPERATED DEVICES:
•Type Personal Attack
•Application Main Reception
•Manufacturer and reference

Chubb

•Or approved equivalent
•Standard - BS 4737-3.14.
•Characteristics
•Latching.
•Quiet.
•Hand operated.
•below desk mounted

310.191 DELIBERATELY OPERATED DEVICES:
•Type Lone Worker Alarm
•Manufacturer and reference

Chubb

•Or approved equivalent
•Standard - BS 4737-3.14.
•Characteristics
•Latching.
•Quiet.
•Portable wire free.

310.290 ALARM MONITORING SYSTEM:
•Standards
•BS 4737-4.1.
•BS 4737-4.2.
•BS 7042
•Final setting
•Exit route detector
•Initial unsetting keypad
•Characteristics
•Simple audible alarm.
•No alarm on deliberately-operated device actuation.

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•Event time recording.
•Identification of actuated detector.
•System redundancy 36 hours battery pack
•Alarm transmissions.
•Duress unsetting facility
•Double knock alarm indication
•Coincident alarm initiation
•Circuit identification
•Programming On panel allow for remote maintenance via modem
•Alarm and fault indication on panel
•Event recording
•Power supply
•Integral
•Equipment
•Microprocessor.
•Input keyboard.

310.300 ALARM TRANSMISSION:
•Use
•Main.
•Standard
•BS7042
•Form of transmission
•RedCare telephone line.
•Characteristics
•Automatic dialling via auto-dialler

310.330 INTER CONNECTING WIRING:
•Type to be selected by security system specialist contractor
•Standard
•BS 4737-3.30.
•Flexible to BS 4737-2.
•Flexible to BS EN 50131-1.

320.000 WORKMANSHIP

320.010 INSTALLATION:
Install, commission and set to work equipment in accordance with manufacturer's recommendations and
•BS 4737-4.1.
•BS 4737-4.3.

320.020 WORK ON SITE:
Ensure that all building works are completed and service connections are proved,
•By others.

320.030 QUALITY CONTROL:
Handle, store and install equipment and components of the security detection and alarm systems in accordance with the manufacturer's recommendations. Obtain all equipment and components from a single source unless otherwise instructed.
Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Record all commissioning measurements and tests.

320.040 DOCUMENTATION:
Provide full documentation to comply with
•BS 4737-2.
•BS 4737-4.1

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•BS 4737-4.3.

320.050 MAINTENANCE:
Prepare maintenance agreement and
•Submit for user acceptance.
•Implement for defects liability period.
•Standard
  •BS 4737-4.2.
•Emergency maintenance response to time
  •24 hours
•Resetting after alarm
  •From remote control centre.

320.060 CABLE INSTALLATION:
Install cables as required. Protect cables from mechanical damage.
•Standard
  •BS 4737-4.1.
  •BS 4737-4.2.
  •BS 4737-4.3.
•Jointing - no joints permitted.
•Terminations
  •Crimped.
  •Clamped.
  •IDC.
•Support intermediate wiring in,
  •HDG steel conduit

320.080 INSTALLATION SUPERVISOR:
Nominate the individual to be completely responsible for the installation, commissioning and setting to work. Provide such details on this individual as required.

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BS APPENDIX

BS 4737-2:1986
Intruder alarm systems. Part 2 Specification for installed systems for deliberate operation

BS 7807:1995
Code of practice for design, installation and servicing of integrated systems incorporating fire detection and alarm systems and/or other security systems for buildings other than dwelling

BS EN 50130-4:1996
Alarm systems. Part 4 Electromagnetic compatibility. Product family standard: Immunity requirements for components of fire, intruder and social alarm systems

BS EN 50131-1:1997
Alarm systems. Intrusion systems. Part 1 General requirements

W50 FIRE DETECTION AND ALARM

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide an automatic analogue addressable fire detection and alarm system throughout the buildings and to automatically signal a remote manned centre in the event of a fire.

100.020 DESIGN PARAMETERS
§ BS 5839-1: 2002 - Fire Detection & Alarm Systems for Buildings

100.030 SYSTEM DESCRIPTION
Complete the detail design, supply, install, commission and set to work a fire detection and alarm system to Category L2 of BS 5839 comprising main control and indication panels, full function repeater panels, automatic and manual detection devices and interconnecting wiring.

The fire alarm system shall have a fully open protocol and be such that any device can be changed or maintained and any devices can be added in future without the attendance of the manufacturer or installing contractor when the warranty is complete.

Main Control and Indication Panel/Repeater Panels

The main control and indication equipment panels (c.i.e.) shall be the central processing unit of the system, receiving and analysing signals from detection devices and interface equipment and from each repeater panel, providing audible and visual information to the user, initiating automatic alarm response sequences and providing the means by which the user interacts with the system.

The c.i.e. shall be recessed and modular in construction allowing for future extension of the system and for allowing networking to other control panels which may be installed in the future.

The c.i.e. shall be easily configured to meet the exact detection zone and output mapping requirements of the building.

The c.i.e. shall be microprocessor based and operate under a multitasking software programme. Operating programs and configuration data must be contained in easily up-datable non-volatile memory.

The c.i.e. shall be a real time clock to enable events to be referenced against time and date. This clock shall be accurate to within 1 minute per year under normal operating conditions.

It shall be possible for an engineer to perform configuration updates on site by plugging into the c.i.e. a portable personal computer.

The c.i.e. shall meet the requirements of BS 5839 and shall be approved, together with associated ancillary equipment, by the Loss Prevention Council (LPC) to LPC 1014.

The c.i.e. shall comprise separate processors, cross-monitoring each others correct operation, for the major functions of the systems. In particular different processors must be used for the main control function, the detection input and alarm output functions and the display and control function.

In the case of plug-in addressable detectors, the address code system shall utilise soft and safe addressing techniques to prevent unauthorised and potentially dangerous reconfiguration of the system.

The c.i.e. shall be complete with integral LCD alphanumeric display and printer.

The c.i.e. shall be complete with integral battery back up.

Detection Devices

All detection devices shall be analogue addressable and shall comprise:

- multi sensor detectors (smoke and heat combined);
- smoke detectors;
- heat detectors;
- combined detector/sounder/xenon beacon;
- beam detectors;
- manual call points.

Indication devices shall be analogue addressable and shall comprise:

- sounders combined with detector base;
- stand alone sounders;
- xenon beacons;
- vibrating pager-type alarms.

Audible indication shall be by voice alert integrated within and controlled by analogue addressable detection and alarm system. Each indication device shall be fitted with a microchip capable of storing 5No. different voice messages.

The final position of all devices shall be coordinated with all other services to ensure that all devices are accessible and clear of obstructions following installation of all services.

Interface Devices

All interface devices shall be analogue addressable loop-powered devices and shall be provided to interface to:

- lifts
- mechanical control panels
- lighting management system
- Security system including door access installation
- "hold open" doors
- gas isolation system.

Liaise with all relevant trade package contractors to agree final location and electrical requirements of all interface units. Final connection to equipment by Fire Detection and Alarm System trade package contractor.

As part of the main indicator and control panel, provide section for key switches and associated indication for manual operation of specific interfaces. Provide space within the panel facia for mechanical system interface key switches and controls (by Mechanical Contractor) and for atrium smoke clearance system interface key switches and controls (by smoke vent system contractor). Liaise with all relevant contractors and specialist vendors to coordinate requirements. Final connection of mechanical system interfaces and smoke vent system interfaces by respective contractor.

Interconnecting Wiring

All interconnecting wiring shall be LSF insulated standard fire resisting cable.

Deleted: mineral insulated copper clad cable.

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Additional Items

- detail design of system;
- site commissioning tests;
- on site training for Client's maintenance staff.

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Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.040 CONTROL REQUIREMENTS
As detailed in Cause & Effect diagrams.

100.050 SYSTEM SCHEMATICS
(68) Series Drawings

100.060 SYSTEM DRAWINGS
(68) Series Drawings

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20.

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20.

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51.

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20.

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20.

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

291.000 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

291.010 GENERAL
Comply with work section general clauses reference Y91.1000 and those detailed below.
•Carry-out off-site painting and anti-corrosion treatment as work section V20.

Deleted: Stage E Issue

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W50.

300.000 GENERAL

300.010 TYPE OF SYSTEM:
- Type Full Analogue Addressable Fire alarm and detection system
- Standard
  - BS 5839-1.
    - Category L - Protection of life.
      - L2: systems installed only in defined parts of the protected building; a type L2 system should normally include the coverage required of a type L3 system.
      - Areas to be protected escape routes, rooms leading off escape routes, plant rooms.

300.020 CONNECTION TO LOCAL AUTHORITY FIRE BRIGADE:
- Private line
  - Via local collectors at main control panel.
- PSTN
  - Auto dialler on a RedCare line shared with the intruder alarm

300.030 ZONES:
- Standard - BS 5839-1.
- Zones
  - Number to be confirmed
  - Size maximum 2000sq/m
- Show the location of zones by:-
  - specially prepared plan of building, permanently mounted adjacent to the indicator panel.
- Zone testing
  - Provide a means of testing wiring of each zone of system.

300.040 CONTROL SYSTEM:
- Standard
  - BS 5839-6 Annex B.
  - BS EN 54-2 and BS EN 54-4.
- Analogue addressable.

300.060 MONITORING:
Provide all end of line and other circuit elements to ensure the system is fully monitored to comply with BS 5839.

300.080 REMOVAL OF TRIGGER DEVICE:
Provide precautions against removal of trigger devices.
- Use trigger devices that are removed only by a special tool.
- Use trigger devices with bases that provide circuit continuity with trigger device removed.

Ensure that, where alarm sounders use same wiring as trigger device, removal of trigger device does not affect operation of alarm sounder.

300.100 REMOTE CENTRE:
Make provision to send signal to remote centre.
- Signals
  - Alarm.
  - Pre-alarm.
  - Fault.
  - Zone isolated.

300.110 FIRE ALARM SPECIALIST:
Engage a specialist to develop the design, supply, install, commission and set to work the fire alarm system.

C0605 The New LMB Building Project W50
Electrical Specification FIRE DETECTION AND ALARM
Revised Stage E Scheme Including Agreed VE

Deleted: Stage E Issue

300.130 INFORMATION TO BE SUPPLIED AT HANDOVER
At handover provide copies of the following:
- copies of certificates signed by the relevant designers, installers and commissioning engineers
- completion notice from Building Control
- completion certificates for all fire related installations and systems

These must be set out as per the forms in BS 5839-1, 2002.

On Practical Completion, the following shall be supplied:
- copies of drawings of Fire Detection and Alarm and Emergency Lighting systems as installed including decibel levels achieved in all areas.
- copies of drawings showing suppression systems, positive pressure systems, dampers and all other fire related mechanical services installations as installed
- a simple guide to all fire related systems, written to allow non-technical staff to carry out basic operation and routine testing of all fire related equipment without needing to bring in technical assistance.

The following software and configuration items are to be supplied at handover:
- the control equipment manufacturer's system programming software. This should allow the user to set up the system initially so that it operates as specified and carry out all required changes to the configuration thereafter. The software must provide at least the ability to program text messages; add, subtract or modify the type of addressable modules; change the sounder and output operation and allow the adjustment of sensitivity of sensors.
- site specific configuration. This is the software that contains all of the programmed configuration specific to the site that is the subject of the installation.
- full written instructions on the use of the software
- details of a suitable portable computer on which the software can be run
- the necessary leads for uploading/downloading the control unit where special plugs or leads are required.
- all password needed to access all levels of the configuration software and all levels of the control unit menu structure
- the software detailed in items i) and ii) should be provided on CD ROM (2No. copies of each CD-ROM required).

310.000 PRODUCTS/MATERIALS

310.010 MANUAL CALL POINTS:
- Manufacturer and reference

Gent
Apollo
Chubb

  - Or approved equivalent
- Standard
  - BS EN 50130-4.
  - BS EN 54-11.
- Indication of operation LED
- Protection against accidental operation hinged clear polycarbonate cover
- Mounting
  - Surface.
  - Weather resistant IP65 for external areas
  - Hinged cover. clear Perspex - to prevent inadvertent operation
- Switch contact
  - Break.
- Environmental Category IP31
  - Degree of Protection to BS EN 60529 IP65 for external areas
- Operation

Deleted: Stage E Issue

- MCP activation response within
  - 3 seconds.
- Field programmable to trigger alert or evacuate alarms.
- Test key
- Addressable.
- Monitored.
- Manual operation
  - Break glass.
    - Anti-fragmentation film.
  - Thumb pressure.
- Fit engraved label to all fire alarm devices with address, number and zone to correspond with panel text.

310.020 AUTOMATIC DETECTORS
Provide automatic fire detectors from the same manufacturers and with common facilities.
- Standard - BS EN 50130-4.
- Plug in bases.
- Common base for all detector types.
- Addressable detector base.
- Mechanical device to accept only
  - Optical smoke detectors.
  - Heat detectors.
  - Multi-sensor detectors (optical smoke and heat detector combined).
- Detectors locking.
- Address code setting
  - Software.
  - Separate addressable plug for each detector.
- Visible activation indicator.
- Visible remote indication for detectors concealed.
- Label detector and bases with address number.
- Colour of devices white
- Fit engraved label to all fire alarm devices with address, number and zone to correspond with panel text.

310.030 HEAT DETECTORS:
- Manufacturer and reference Gent
Apollo
Chubb

  - Or approved equivalent
- Point type
  - Standard
    - BS 5446-2.
    - BS EN 54-5.
- Heat-sensitive element
  - Rate-of-rise of temperature and fixed temperature element.
- Types
  - Analogue addressable.
- Temperature setting
  - 60°C.
- Fit engraved label to all fire alarm devices with address, number and zone to correspond with panel text.

310.040 SMOKE DETECTORS:
- Type Optical analogue addressable
- Manufacturer and reference Gent
Apollo

Deleted: Stage E Issue

Chubb

  - Or approved equivalent
- Detector type
  - Optical.
  - Point type.
    - Standard
      - BS 5446-1.
      - BS EN 54-7.
  - Analogue addressable.
  - Sensitivity
    - Sensitivity set by CIE software.
  - Environmental conditions IP31
- Accessories
  - Line monitor device.
  - Anti-insect screens.
  - Anti-thunder fly fin structure.
- Fit engraved label to all fire alarm devices with address, number and zone to correspond with panel text.

310.040D SMOKE DETECTORS:
- Type Optical beam detector
- Manufacturer and reference Apollo Fire XP95 Range
- Detector type
  - Optical.
  - Optical beam type
    - Standard
      - BS 5839-5.
      - BS EN 54-12.
    - Optical obscuration manufacturers standard
    - Thermal turbulence manufacturers standard
    - Stabilisation time manufacturers standard
    - Spectral range manufacturers standard
    - Temperature range manufacturers standard
    - Compensated for contamination of optical parts manufacturers standard
      - End compensation alarm manufacturers standard
    - Optical path length manufacturers standard
    - Maximum angular misalignment manufacturers standard
    - Dependence on CIE manufacturers standard
    - Power supply
      - Loop powered
  - Analogue addressable.
  - Environmental conditions IP31
- Fit engraved label to all fire alarm devices with address, number and zone to correspond with panel text.

310.040F SMOKE DETECTORS:
- Type Multisensor analogue addressable
- Manufacturer and reference Morley or Notifier.
Detector type
- Switchable between heat and smoke sensing elements

Ionisation.
  - Point type.
    - Standard
      - BS 5446-1.

Deleted: Stage E Issue

- BS EN 54-7.
- Analogue addressable.
- Sensitivity
  - Sensitivity set by CIE software.
- Environmental conditions IP31

- Accessories
  - Line monitor device.
  - Anti-insect screens.
  - Anti-thunder fly fin structure.
- Fit engraved label to all fire alarm devices with address, number and zone to correspond with panel text.

310.070 SOUNDERS:

- Manufacturer and reference Gent
Apollo
Chubb

  - Or approved equivalent
- Standard - BS EN 54-3
- Standard - BS 5839-8 Annex
- Sounder types
  - Electronic sounder.
  - Addressable.
  - Voice sounder c/w microchip capable of storing 5No. pre-programmed voice messages.
- Sounder characteristics
  - Sound power output (dBA) 100
  - Forced phasing between Alert and Fire signals
- Colour
  - Fire red.
- Finish
  Protection to BS EN 60529
  - IP31 for internal areas
  - IP65 for external areas
  - Weather proof. where mounted externally
  - Internal.
  - Sounder driver
    - Monitored
    - Addressable
    - Activation indicator.
  - Sounder booster
    - Input
      - CIE sounder output.
      - Monitored
      - Addressable
  - Sounder power supply
    - Addressable.
    - loop powered

310.080 FIRE ALARM CONTROL AND INDICATING EQUIPMENT:

- Manufacturer and reference
Morley
Notifier

  - Or approved equivalent
- Standard
  - BS 5839-1.
  - BS 5839-6 Annex B.

Deleted: Stage E Issue

- BS EN 54-2 and BS EN 54-4.
- BS EN 50130-4.
- Functional requirements
  Standard functions.
  - battery state indicator
  - battery reverse polarity protection.
  Open protocol
  - Networkable

  Mounting
  - Surface.
- Assembly Construction
  - Material of Enclosure steel
  - Display components
    - Behind hinged front panel.
- Degree of Protection to BS EN 60529
  - IP 43.
- Accessibility
  - By special tool
- Enclosure Finish manufacturers standard
- Colour manufacturers standard
- Power supply
  - Integral.
- Indication of origin of alarms
  Zone indication
  - Integral with CIE
  - Graded series of displays
  - Alphanumeric display
    - 2x40 character LCD
  - Backup display
  - Repeat display at repeater panel at main entrance, refer 310.090.
  - Printer included.
    - Panel mounted.
    - 40 columns.
- General
  - Microprocessor based
  - Modular software
    - Deadlock prevention
  - Execution monitoring
    - 1 hour cycle.
  - Execution failure safe state
  - One man test and commissioning
  - Monitoring circuit
  - Configuration data.
    - Non-volatile memory.
    - Alterable memory.
      - Programmable at
        - Level 2
      - Manual action at Level 3 before data change
      - Automatic check
        - 1 hour
    - EEPROM.
    - Read/write memory programming protection
    - Battery backed.
      - ROM.
      - RAM.

Deleted: Stage E Issue

- Real time clock
- Configuration updates performed on site.
- Configuration data copied on to floppy disc
- Document control system for configuration data
- System fault protection
  - No more than 512 detectors affected by first fault
- Maximum addressable points controlled by a single processor.
  - 99 per loop
- Key switch, positions
  - Normal, key free Level 1.
  - Normal, key trapped Level 1.
  - Enable Level 2.
  - Test display.
  - Scroll.
  - Silence.
  - Sound alarm.
  - Sound alert.
  - Reset.
- Remote inputs to CIE
  - Evacuate.
  - Silence Alarm.
  - Reset.
  - Alert.
  - Class change.
  - Programmable

- System Configuration
  - Capable of operating
    - Analogue addressable detectors.
  - Division of addressable loops into zones 20
  - One fault not to disable more than 32 detectors.
  - Capacity of addressable loop
    - Zones 20
    - Minimum 99 devices.
  - Maximum number of fully loaded addressable two wire loops 4
  - Fault protection by line isolators.
    - At zone boundaries.
    - At each addressable device.
    - to meet the requirements of BS5839
  - Line isolator operation time.
    - Within 2 seconds of fault.
  - Allocation of addresses independent of physical arrangement of loops.
  - Distributed CIE
- Interfacing
  - Other CIE/systems repeater panels.
  - Electronic paging systems initiate vibrating signal and text message to pagers via radio signal. Provide 20No. pagers.
  - Repeater panel
    - With system essential controls located as shown in the drawings.
- Basic System Functions
  - Monitor status
    - All devices on addressable loops.
    - Short circuit and Open circuit faults.
    - Incorrect addressing.
    - Unauthorised device removal or exchange.
    - Pre alarm condition.
    - Detector contamination.
    - Internal connections.

Deleted: Stage E Issue

  - Interfaces.
  - Chargers.
  - Battery.
  - Remote signalling.
- Audible indication
- Visual Indicator Lamps
  - Power on - Green.
  - Quiescent condition
  - Fire Alarm - Red.
  - Fault Warning - Yellow.
  - Disabled/Isolated - Yellow.
  - Fire zones - Red per zone.
  - Test condition - Yellow.
  - Output to fire alarm routing equipment - Red.
  - Output to fire protection equipment - Red.
  - Output to fault warning routing equipment - Yellow.
  - Flashing
  - Steady
- Push Button or Switch Controls
  - Sound Alarms/Evacuate.
  - Silence Alarm
    - Audible signal if not reset.
  - Silence Control Sounder.
  - Test Alarms.
  - Reset fire.
    - Level 1.
    - Combined with control sounder silence at Level 2.
  - Lamp Test.
  - Cancel Fault Buzzer.
  - Keypad.
  - QWERTY keyboard and function keys
  - Keyswitch override for devices not to be isolated during system test.
- Access, levels
  - Level 1 - No restriction.
  - Level 2 - Operator
    - By code
  - Level 3 - Servicing
    - By code
  - Level 4 - Engineering
    - by code
- Zone status indicators
  - Alarm.
  - Fault.
  - Isolated.

- Alarm Monitoring Functions
  - Interrogate addressable devices
    - Order of scanning
    - Every 2 seconds maximum.
  - Analysis of sensor output against fire algorithms to differentiate between
    - Fire conditions.
    - Pre-fire conditions.
    - Multiple fire conditions
    - Coincidence detection
    - Transient contamination
    - Permanent contamination
    - Sensor condition.
    - Non-fire events

Deleted: Stage E Issue

- Indication of alarm for any detectors not to exceed 10 seconds, with output not more than 2 seconds later.
- Response to mcp activation
  - 3 seconds.
- Time zoning
- Alarm sectoring

- Alarm Output Functions
  - Two monitored sounder circuits. Output (A)
  - Logic outputs
  - Audible indication of alarm
    - Silenced at Level 1.
    - Silenced at Level 2.
  - Alarm reset
  - Alarm output silence
  - Output to fire protection equipment
  - Disable warning at Level 3
  - Sound outputs
    - Alert pulsed tone.
    - Evacuate continuous tone.
    - Class change
    - Special event
    - Time delay sequences for alarm response.
      - Activation of manual call point activates evacuation signal immediately.
        Activation of automatic detector initiates alert condition, instigating 2 minutes delay to allow alert to be investigated.
        Evacuation signal activated if alert not cleared within time period.

  - Delay sounder output
    - Delay override
  - Delay transmission to central station for,
    - 2 minutes.
    - Inhibit delay if building unoccupied.
    - No delay on activation of manual call point.
- Supervision and Fault Reporting
  - Faults to be reported
    - Short circuit and Open circuit
      - Loops.
      - Sounder cables.
      - Conventional detector circuits.
      - MCP circuits.
      - Ancillary devices circuits.
      - Repeat or Secondary indicators.
    - Unconfigured device.
    - Addressable device failure.
    - Device not responding.
    - Double address.
    - Incorrectly configured device.
    - Detector condition.
    - Detector removed.
    - Repeater or Remote printer failure.
    - Repeat or Secondary indicators fault.
    - Earth fault
    - Main Power fault.
    - Standby Power fault.
    - PSU fault.
    - Charger fault.
    - Battery fault.

Deleted: Stage E Issue

  - Battery critical.
  - Mains failure.
  - Auxiliary PSU failure.
  - Total loss of power
  - Fuse failure.
  - Relay Output fault.
  - System fault
  - Signalling fault.
  - Scanning or interrogation failure.
  - Processor failure.
  - Memory check error.
  - Memory configuration data loss.
  - Processor failure
    - Re-initialise, record and reset.
  - Transmission in path fault
- Fault sounder
- Fault indicator
  - Silence fault warning
    - Level 1.
  - Reset
    - Manual code
  - Fault output
    - On de-energising
- Zone fault indicator
- Test message to define and locate fault.
- Monitor status of auxiliary units
- Fault response time
  - Less than 100 sec.
- Processor fault count
- Auxiliary fault output
- Delay generation of event
  - Normal de-bounced contacts 6 seconds.

- System Management System, available at Levels as required by BS EN 54-2.
  - Management Facilities
    - Isolate and re-connect.
      - Addressable point.
      - Detector zone.
      - Sounder zone.
      - Remote centre signalling.
  - Walk-test of zones to verify detectors and sounders.
  - Interrogate sensor
    - Cleanliness.
    - Condition.
  - Display on alphanumeric display via menu system.
    - Alarm status
      - Alarm log
        - First zone alarm top field
        - Most recent zone alarm
        - Total number of alarms
        - Alarm scrolling
        - Alarm display reversion
    - Output to fire alarm routing equipment
    - Suppression of non-alarm displays
      - Action to display non-alarm information
      - Non-alarm reversion time
    - System events
      - Event log.

Deleted: Stage E Issue

- Event log capacity.
- Analysis of sensor data
- Interrogation of sensor cleanliness
- Loop map connections.
- Enabled and disabled sensors.
- Fire plan configuration.
- Address locations.
- Initialisation log
- Fault status
  - Fault log.
  - Fault indication suppression override
  - Disablement
- Point isolated status.
- Zone isolated status
- Point address status
  - Address displayed/printed
    - As numerals
    - As alphanumeric code
- Non-fire event status
  - Non-fire log.
- Zone alarm status.
- Zone fault status.
- Clear display function for non-fire events.
- Cycle or scroll display
- Print, via menu system
- Alarm status
  - Alarm log.
- System events
  - Event log.
  - Event log capacity
- Current fault and warning logs
- Analysis of sensor data
- Interrogation of sensor cleanliness
- Loop map connections.
- Enabled and disabled sensors.
- Fire plan configuration.
- Address locations.
- Initialisation log
- Fault status
  - Fault log.
- Point isolated status.
- Zone isolated status
- Point address status
  - Address displayed/printed
    - As numerals
    - As alphanumeric code
- Non-fire event status
  - Non-fire log
- Weekly system audible and visible warning test (BS 5839-1).
- Disable/re-enable at level 2
- Zone
- Fire detection equipment output
- Fault warning routing equipment.
- Sounder.
- Fire alarm routing equipment.
- Addressable points
- Isolated devices reset after pre-set time

Deleted: Stage E Issue

- Co-incidence detection setting zone by zone
- Real time clock adjustment
- Event counter
  - Automatic display
- Test facilities
- Memory check
  - Automatic
    - Cycle 7 days or less
- Site configuration updating
  - Loop map connections
  - Addressable device label change.
  - Address allocation.
- Division of addressable loops into zones
- CIE programmable
  - Executable code and mandatory data at Level 4.
  - On site.
  - With integral keyboard.
  - By separate computer
  - Software documentation
- Communications with remote centre
  - Signals
    - Alarm.
    - Fault.
    - Zone indications.
- Communications link
  - RS 232
  - RS 485

310.090 REPEATER PANEL

- Manufacturer

Morley or
Notifier

- Standard
  - BS EN 54-2 and BS EN 54-4.
  - BS EN 50130-4.
- Functional Requirements,
  - Addressable
  - Repeat indication within 5 seconds of CIE indications.
  - Visual display
    - CIE Indication
    - CIE Display
    - Clock
    - Alarm
    - Faults
    - Zone alarms
    - Zone faults
    - Transmission to fire alarm routing equipment.
    - Transmission to fire protection equipment
    - Disablement
      - Sounder.
      - Fire alarm routing equipment.
  - Controls
    - Sound Alarm.
    - Silence audible indication
    - Disable/re-enable sounders
    - Disable/re-enable signals to fire alarm routing equipment.

Deleted: Stage E Issue

•Silence Alarm.
•Reset fire.
•Mounting,
•Flush.
•Assembly Construction
•To match CIE.
•Degree of Protection to BS EN 60529 IP43
•Enclosure Finish,
•stainless steel
•Power Supply,
•From addressable loop.

310.100 MIMIC PANEL
•Standard
•BS EN 54-2.
•BS EN 50130-4.
•Assembly Construction,
•Material of Enclosure
•Steel.
•Hinged lid with reinforced glass and steel frame.
•Mounting.
•Flush.
•Degree of Protection to BS EN 60529
•IP 43.
•Functional Requirements,
•Addressable
•Visual display
•CIE Indication
•CIE Display
•Clock
•Alarm.
•Faults.
•Controls
•Sound Alarm.
•Silence Alarm.
•Reset fire.
•Site plan
•Hardware
•Engraved stainless steel.
•LED zone indication
•Software
•Site reprogrammable.
•Power Supply,
•From addressable loop.
•Enclosure Finish
•Brushed stainless steel
•Mimic construction
•Illuminate
•Sensor in fire.
•Zone in fire.
•LED in each area & zone.

310.110 ANCILLARY SERVICES:
Make provision to open or close circuits of ancillary services by means of relay or similar device.
•Standard
•BS EN 54-2.
•BS EN 50130-4.

Deleted: Stage E Issue

•Services
•Actuation of fixed fire-extinguishing systems.
•Closing of windows, smoke and fire doors.
•Controlling ventilating systems.
The fire alarm system shall interface to the following systems:
- All mechanical plant
- Integrated security management system to facilitate activation of local CCTV cameras
- Access Control System
- Atrium smoke vents to initiate opening of vents.
- Lifts to initiate grounding of lifts.
- Comms room conventional fire alarm system and gas extinguishing system.
- Gas solenoid valves
- Building lighting control system
- Radio pagers issued to fire marshals within the building.
- Release of electromagnetic hold open doors

•Relay type
•Addressable
•Output
•Voltfree contacts, rated manufacturers standard
•Monitored.
•Power from addressable loop.
•Activation indicator
•Input
•Monitored
•Addressable
•Keyswitch for sensor disable
•Fireman's switch
•From CIE.
•From detectors for hold open doors
•Activation indicator
•Output
•Monitored.
•BMS.
•Door holder.
•Plant
•Non-fire
•Contacts

310.120 POWER SUPPLIES:
•Application Back up supplies to fire panels
•Manufacturer and reference Morley or Notifier
•Standard
•BS 5839-1.
•BS EN 54-4.
•BS EN 50130-4.
•Power supply enclosure integral
•Degree of protection to BS EN 60524
•IP30.
•Integral with CIE.
•Access to controls
•Level 3 if integral.
•Tool.
•Connection to CIE
•Two transmission paths.
•Normal power supply
•Public supply system.

Deleted: Stage E Issue

•Primary battery 24A/Hr
•Charger
•Battery monitoring
•Power supply fault signalling to CIE
•Common fault signal
•Loss of main power
•Loss of standby power source
•Low battery voltage
•Charger fault
•manufacturers standard
•Fault indication on pse
•Standby battery recharge time
•To 80% 24 hours.
•Battery accommodation integral

310.130 REMOTE INDICATOR MODULE
•Type Ceiling mounted LED
•Application Remote indication of concealed detectors
•Manufacturer Gent
Apollo
Chubb

•Or approved equivalent
•Standard
•BS EN 54-2.
•BS EN 50130-4.
•Driven by its associated detector.
•Monitored for open and short circuits.

310.140 LINE ISOLATOR MODULE
•Standard
•BS EN 54-2.
•BS EN 50130-4.
•Derive power from addressable loop.
•Visible LED indicator that module has tripped.

310.150 VISIBLE ALARMS:
•Type Flashing Xenon beacon, either integral to each automatic detector or stand-alone units.
•Manufacturer and reference Gent
Apollo
Chubb.

•Or approved equivalent
•Standard
•BS EN 54-2.
•BS EN 50130-4.
•Flashing. between 0.5Hz and 2Hz.
•Xenon.
•Power supply
•loop powered

310.160 ZONE MONITORING UNIT:
•Manufacturer and reference Gent
Apollo
Chubb.

•Or approved equivalent
•Standard

Deleted: Stage E Issue

•BS EN 54-2.
•Characteristics
•Addressable.
•Monitored.
•Provide reset to detectors.
•Reports faults and alarms to CIE.
•Power supply
•loop powered

310.170 AUTOMATIC RELEASE MECHANISM:
•Type Electromagnetic Door Holders
•Application Door Retainers held open during working hours, holders to de-energise on signal from fire alarm and door access system
•Install central release mechanism that allows all doors to be closed from central location.
All door release mechanisms to release outwith normal working hours by means of an automatic clock which can be altered as necessary by the User.

•Standard
•BS 5839-3.
•BS EN 50130-4.
•Type and Characteristics
•Door holder
•Shutter release.
•Damper release.
•Automatic operation
•Operation by CIE signal
•Operation by
•Local smoke detector.
•remote interface module
•Nominal holding force
•Power supply
•d.c.
•24V.
•Mounting
•Wall.
•Floor.
•to suit door locations

310.180 FIRE ALARM SYSTEM ANCILLARIES:
Type RADIO PAGERS
•

320.000 WORKMANSHIP

320.010 QUALITY CONTROL:
Handle, store and install equipment and components of the fire detection and alarm system in accordance with BS 5839 and the manufacturer's recommendations.
•Obtain all equipment and components from a single source.
Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Record all commissioning tests and provide the certification required by BS 5839-1.
•Provide manufacturer's certificates of equipment design to an approved quality management system and CIE component selection.

320.020 SMOKE DETECTOR INDICATORS:
Fit smoke detector indicators external to doors, where zone is divided into rooms. Fit smoke detector indicators within rooms or adjacent areas where smoke detectors are concealed within risers and voids.

Deleted: Stage E Issue

320.030 MANUAL CALL POINTS:
•Where manual call points are sited in zones.
•Wire into detector circuit for fire zone.
•Wire manual call points sited on staircase landings
Where manual call points are located internal to staircases these shall be wired on the same zone as detectors within the staircase.
• Where manual call points are located external to staircases these shall be wired on the same zone as local floor level detectors.

320.040 RECORD DRAWINGS AND OPERATING INSTRUCTIONS:
Provide instructions on use of installation to person responsible for use of premises. Supply the user with a logbook and certificate of installation and commissioning, in accordance with BS 5839-1, Appendix B and D.
Provide record drawings to user for maintenance and record purposes.
Show position of various items of equipment, junction boxes, etc. and sizes and routes of cables and wires. Include wiring diagrams of junction boxes and distribution cases.
•Provide circuit diagrams of fire alarm system and its components.

320.050 CABLE INSTALLATION:
Plan and install all fire detection and alarm system cables in accordance with BS 5839-1 and the cable manufacturer's recommendations.
•Run cables point to point without tees or spurs.
•Design loop load to not exceed 80% of cable capacity.
•Mark terminals +/-

C0605 The New LMB Building Project W50
Electrical Specification FIRE DETECTION AND ALARM
Revised Stage E Scheme Including Agreed VE

Deleted: Stage E Issue

BS APPENDIX

BS 5839-1:2002
Fire detection and alarm systems for buildings. Part 1 Code of practice for system design, installation, commissioning and maintenance

BS 5839-3:1988
Fire detection and alarm systems for buildings. Part 3 Specification for automatic release mechanisms for certain fire protection equipment

BS 5839-5:1988
Fire detection and alarm systems for buildings. Part 5 Specification for optical beam smoke detectors

BS 5839-6:1995
Fire detection and alarm systems for buildings. Part 6 Code of practice for the design and installation of fire detection and alarm systems in dwellings

BS 5839-8:1998
Fire detection and alarm systems for buildings. Part 8 Code of practice for the design, installation and servicing of voice alarm systems

BS 5839-9:2003
Fire detection and alarm systems for buildings. Part 9 Code of practice for the design, installation, commissioning and maintenance of emergency voice communication systems

BS EN 50130-4:1996
Alarm systems. Part 4 Electromagnetic compatibility. Product family standard: Immunity requirements for components of fire, intruder and social alarm systems

BS EN 54-2:1998
Fire detection and fire alarm systems. Part 2 Control and indicating equipment

BS EN 54-3:2001
Fire detection and fire alarm systems. Part 3 Fire alarm devices. Sounders

BS EN 60524:1993
Direct-current resistive volt ratio boxes

BS EN 60529:1992
Specification for degrees of protection provided by enclosures (IP code)

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W51 EARTHING AND BONDING

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To provide protection to people, plant and equipment in the event of an electrical fault.

To provide protection from electromagnetic and electro-static sources of energy.

100.020 DESIGN PARAMETERS
BS 7671: 2001 - Requirements for Electrical Installations, including all amendments
BS 7430: 1998 - Code of Practice for Earthing

100.030 SYSTEM DESCRIPTION
Supply install and test earthing and bonding system comprising earth bars and copper conductors.

The earthing system shall be TN-C-S. The electrical system shall utilise EEBAD system of earthing.

Earthing and bonding shall be effected by utilising earthed steel containment and the outer sheath of steel wire armoured cables and dedicated earthing and bonding conductors.

Earth leakage protection shall be by automatic release of thermal magnetic devices allowing 0.4 seconds for hand held equipment and 5 seconds for fixed equipment

Earth Bars

Install suitably sized copper earth bars in the HV switchroom, HV transformer compounds, LV switchrooms and in electrical rooms in interstitial levels. Install additional clean earth bars in interstitial electrical rooms, in each comms room and as detailed in the drawings. Each earth bar shall have 25% spare capacity.

Earthing & Bonding Conductors

Install suitably sized main equipotential bonds to the:

- incoming water service
- incoming gas service
- structural steel
- lightning protection system.

Install supplementary bonds to all extraneous conductive parts such as water pipework, ductwork, sinks, basins, etc.

Install connection between lightning protection system and main earth bar.

Earth Farm

Refer to section V11 for HV earthing requirements.

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Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance

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with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.050 SYSTEM SCHEMATICS
(61) series

100.060 SYSTEM DRAWINGS
(61) series

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.

280.020 CONDUCTORS:
Type
- Copper conductor, thermosetting insulation, low smoke and fume sheath

•Application
- Main equipotential bonds
- Supplementary bonds
- Circuit protective conductors

•Manufacturer BASEC approved
•Conductors for lightning protection system
•Conductors for earthing systems to BS 7430.
Reference Y80.2010C
•Conductor joints
•Lightning protection - reference Y80.2020A
•Earthing systems - reference Y80.2020B
•Tape fixing devices
•Reference Y80.2030A

280.030 EARTH ELECTRODES:
•Drawing/schedule (69) series drawings
•Earth electrodes for lightning protection systems.
•Rod - reference Y80.2040A
•Building or structural element - reference Y80.2040C
•Earth electrodes for system earthing.
•Rod - reference Y80.2040B
•Building or structural element - reference Y80.2040D
•Earth electrode clamps
•Reference Y80.2060A
•Earth electrode inspection facilities
•Reference Y80.2070A
•Earth electrode tank penetration seal
•Reference Y80.2080A

280.040 EQUIPOTENTIAL BONDS:
•Main equipotential bonds
•Reference Y80.2090A
•Supplementary equipotential bonds
•Reference Y80.2100A

280.050 EARTHING:
Type
- EEBAD

•Circuit protective conductors

Reference Y80.2110A
•Earthing clamps - reference Y80.2120
•Earth busbars
•Reference Y80.2130A

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•Test links - reference Y80.2140
•Lugs/tags - reference Y80.2150
•Protective cable terminations - reference Y80.2160
•Protective conductor warning notices/labels
Reference Y80.2170
•Main earth conductor - reference Y80.2180
•Earth bar label - reference Y80.2190

280.060 WORKMANSHIP:
•Clean earth distribution - reference Y80.3010
•Dissimilar metals - reference Y80.3020
•Stranded conductor joints - reference Y80.3040
•Protective cable terminations
•Reference Y80.3050A

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20

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PART 3 SPECIFICATION CLAUSES SPECIFIC TO W51

300.000 GENERAL

300.010 STANDARDS:
Carry out electrical system earthing work in accordance with BS 7671 (IEE wiring regulations), BS 7430, Electricity, Safety, Quality and Continuity Supply Regulations and Local Electricity Supply Authority Requirements.
•Comply with the requirements of BS EN 50310.

300.050 SOIL TESTS:
Carry out soil tests in accordance with BS 1377 to establish soil electrical resistivity and
•Redox potential (V).
•Moisture content (%).
•Dissolved salts
  •Chloride.
•pH.
•Organic acids.

300.060 RISE IN POTENTIAL IN TELECOMMUNICATIONS
Ensure the potential rise in telecommunications circuits due to power system earth faults is limited, as BS 6701, to
•430V.

300.070 EXCHANGE OF INFORMATION:
Consult with the electricity supply company regarding the earthing arrangements of the installation. Construct the earthing system to the requirements of electricity supply company. Ensure any part of the earth fault current path provided by the electricity supply company or others is suitable for the operation of the earth fault protection to be installed. Obtain the agreement and permission of undertakings providing services which are to be bonded to the earthing system.

300.080 EARTH FAULT RELAYS:
Provide earth faults relays on electrical systems of 75kW connected load and over

310.000 PRODUCTS/MATERIALS

310.010 CLEAN EARTH DISTRIBUTION:
Install clean earth distribution in double insulated cables from earth electrodes to equipment points. Mount all busbars with insulators and separately from other earthing systems.

310.020 MAIN EARTH TERMINAL:
Provide earth bar at incoming electrical service position, for each switchboard.
•Bond earth terminals and metallic structure of switch and control gear and plant.
•Connect each earth terminal to all other earth terminals by a ring conductor sized as BS 7430 and BS 7671.
•Location
  •HV switchroom
  LV switchrooms

Deleted: HV transformer compounds

Deleted: interstitial electrical rooms
comms rooms

•Mounting
  •Mount earth bar on insulated supports located at 300mm centres for 25mm bar and 450mm centres for 50mm bar, giving 30mm clearance at rear of bar.
•Drill clearance holes, one for each cable plus 30% spare holes (two minimum) at 50mm minimum centres through bar for connection of cable lugs. Ensure clearance holes are minimum necessary size to maintain adequate lug/bar contact.

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310.030 MAIN EARTH TERMINAL CONNECTIONS:
Connect main earth conductors and main equipotential bonding conductors to main earth terminals. Terminate circuit protective conductors on switchboard earthing bar.
Terminate conductors with
•compression type lugs suitable for bolting direct to bar.
•Extend protective conductor from incoming main cable gland direct to main earth terminal.
•Extend separate protective conductor from main earth terminal to main switch/switch panel served by incoming main cable.
•When main cable is provided by electrical supply Company, extend separate protective conductor from Main Cable armouring gland or direct earth terminals or PME earth installed by supply Company to main earth terminal.
•Bond all main equipment and plant to an earth terminal, connected to the bonding ring conductor.

310.040 SUBSTATION EARTH BAR:
•Location
  •Substation.
•Mounting
  •Mount earth bar on insulated supports located at 300mm centres for 25mm bar and 450mm centres for 50mm bar, giving 50mm clearance at rear of bar.
•Insulators
  Mount busbar on
  •stand-off porcelain insulators securely fixed to wall.
  •Terminations
    Connect each conductor and tape separately and allow spare holes (minimum two) for future connections.

310.050 SUBSTATION MAIN EARTH BUSBAR TERMINATIONS:
Provide terminations on busbar for each Substation main earth conductor and
•HV Switchgear frame earth (bare copper tape).
•LV Switchgear frame earth (bare copper tape).
•Transformer frame earths (bare copper tape).
•Transformer neutral earths (insulated copper cable).
•LV Switchboard neutral busbars (insulated copper cable).
•Earthing conductor to minimum 2 groups of electrodes.
•Future cable/tape terminations
  •30% of above terminations subject to four minimum.

310.060 NEUTRAL/EARTH CONNECTION:
Provide earth leakage protection system and position neutral/earth connection

310.070 CLEAN EARTH BAR:
•Location
  •interstitial areas
  comms rooms

Deleted: electrical rooms

•Mounting
  •Mount earth bar on insulated supports located at 300mm centres for 25mm bar and 450mm centres for 50mm bar, giving 50mm clearance at rear of bar.
•Insulators
  Mount busbar on
  •stand-off porcelain insulators securely fixed to wall.
  •Terminations
    Connect each conductor and tape separately and allow spare holes (minimum two) for future connections.

310.080 TRANSFORMER OR GENERATOR EARTH ELECTRODE SYSTEMS:
Provide separate electrode systems, each not exceeding 20 ohms resistance, with separate main

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earthing conductors for each transformer or generator, and an additional spare electrode system for test purposes. Bond all electrode systems together using a ring conductor. Connect electrode systems to ring conductor via links or disconnecting joints for test purposes.

310.090 INSULATED ISLAND GLANDS:
On cables to switchboards provide insulated island glands to facilitate testing.

310.100 MICS CABLE TERMINATIONS:
Provide manufacturer's seals incorporating protective conductors at each termination, where glands are used or not, and connect conductors to conduit box, adaptable box or equipment box earth terminals.

310.110 FRAME EARTH LEAKAGE:
Where frame earth leakage devices are used for phase to earth protection, connect two earthing conductors as BS 7430, one to the framework of the switchgear and main earth bar via current transformer or other devices, the other to cable sheaths and earthing devices, insulated where necessary.

310.130 CEILING SUPPORTS:
•Application Suspended metal frame ceilings
Bond main supports to non-current metallic parts of Electrical Installation.
•Conductor
•Use LSF insulated copper cable, sized 6mm
•Holes
•Use holes in main supports for terminal screws.
•Terminals
•Connect bonding conductors to supports through holes with tinned copper cable lugs or tags secured to support with brass screws, washers, nuts and locking device.
•Connection
Connect bonding conductors to supplementary bonding conductors in cable trunking:-
•using crimp type connectors.

310.150 TELECOMMUNICATIONS FUNCTIONAL EARTH:
Provide functional earth in accordance with BS 6701 and BS 7430.

320.000 WORKMANSHIP

320.010 INSTALLATION OF EARTHING SYSTEM:
Carry out installation of earthing system in accordance with BS 7671 (IEE Regulations) and BS 7430.

320.020 WORK ON SITE:
Ensure that all building works are completed and service connections are provided,
•By others.

320.030 QUALITY CONTROL:
Handle, store and install all equipment and components of the lightning protection system in accordance with the manufacturer's recommendations and
•BS 7430.
•BS 7671.
Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Test and commission the system in accordance with BS 7430 and BS 7671 and as specified.
Record all test measurements.

320.040 MAIN AND SUPPLEMENTARY EQUIPOTENTIAL BONDING:
Bond in accordance with BS 7430 and BS 7671 to main earth terminal all extraneous conductive parts of the installation.
•Ensure the following services are bonded.
•Main water pipes.

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•Main gas pipes.
•Fuel oil pipes.
•Air ductlines.
•Heating pipework.
•Chilled water pipework.
•Exposed metallic parts of building structure.
•Thermal insulation metallic cladding.
•Metallic cable sheaths of all cables except British Telecom.
•Lightning protection systems.
Bond with supplementary equipotential bonds to protective conductor system, all simultaneous accessible conductive.
•Ensure the following areas are bonded to BS 7671, Section 601.
•bathrooms and shower rooms.
•boiler houses.
•calorifier rooms.
•all other plantrooms.
•wet and damp process areas.
•kitchens and laundries.
•Bond to non-current carrying parts of Electrical Installation in associated spaces to BS 7671 and BS 7430.
•Use clamps to BS 951 for bonding of pipes.

320.050 MEDIUM VOLTAGE CABLE SHEATHS AND ARMOUR:
Bond the sheaths and armour of medium voltage cables solidly to earth,
•3 core cable - At both ends.
•Single core tails
•At both ends of tail.
•Single core cables
•Solid.

320.060 LOW VOLTAGE SHEATHS AND ARMOUR:
Bond the sheaths and armour of low voltage cables solidly to earth,
•3 core cables, at both ends.
•Single core cables
•At both ends.

320.070 METALLIC FENCING:
Bond to earth any metallic fencing enclosing earth electrical system in accordance with BS 7430.

320.080 IDENTIFICATION:
Use numbered and/or lettered plastic cable sleeves to indicate circuit numbers and phases of corresponding phase conductors.
Ensure conductors are connected to earth bar in same sequence as phase and neutral conductors.
Identify at substation, switchboard and building earth bars each protective, bonding and earthing conductor. Provide labels on bars adjacent to each conductor.

320.090 GENERATORS:
Provide separate earth electrode system, completely independent of supply earth system where incoming supply is not derived from Consumer's own transformers.
Connect star point of generator to earth electrode system as generator manufacturer's recommendations and to BS 7430.
Bond generator star point and metal framework to Local Electricity Supply Company earthing point.
•Size of earthing and bonding leads to be confirmed

320.110 MEDIUM VOLTAGE SYSTEM EARTHING:
Install MV system earthing to BS 7430. Connect all exposed conductive parts of the system to earth via protective conductors. Provide earth fault relay to detect currents of 10% - 15% of full load current. Provide earth loop impedance path by earthing and bonding to achieve operation of the earth fault

relay at this current. Ensure extraneous conductive parts of the system are in direct contact with all simultaneous accessible conductive parts, if necessary by bonding or connection to the common steelwork structure. Connect the neutral of the MV system to one point only. Use the generator or supply transformer star point. Earth neutral,

•Directly

Use the resistor or reactor to limit fault current to not more than 1.5 times the full load current of the largest unit in the system. Ensure if direct earthing is used the earth fault current is of the order necessary to operate the protective devices and does not produce unacceptable electromagnetic stresses. For delta connected sources use an earthing transformer between the phases and earth. For multiple power sources use switchgear to ensure single point earthing under all operating conditions.

320.160 EARTHING OF ELECTRICALLY SUPPLIED STREET FURNITURE:

Install earthing to street furniture in accordance with BS 7430 and BS 7671.

•TN-C-S systems. Use a combined neutral and earth (CNE) cable to supply street furniture. Use separate conductors for phase, neutral and protection on the load side of the protective device. Bond exposed conductive parts of the street furniture using a 10mm^2, or the size of the neutral if smaller, cable. Do not bond small items not likely to come into contact with exposed or extraneous conductive parts or earth. On circuits feeding more than one item of street furniture, provide an earth electrode of 20ohm or less resistance at the last or pen-ultimate item of furniture on the circuit. Where an electrode resistance of 20ohm cannot be achieved, provide earth electrodes at each item of furniture.

320.170 EARTHING OF ELECTRICAL SYSTEMS IN HAZARDOUS AREAS:

Install earthing of electrical systems in hazardous areas to BS 7430 and BS EN 60079. Use the recommendations in HS(G)41 at petrol filling stations.

•Use the recommendations in HS(G)41 in hazardous areas.

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BS APPENDIX

BS 1377-1:1990
Methods of test for soils for civil engineering purposes. Part 1 General requirements and sample preparation

BS 1377-3:1990
Methods of test for soils for civil engineering purposes. Part 3 Chemical and electro-chemical tests

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

BS 7430:1998
Code of practice for earthing

BS 7671:2001
Requirements for electrical installations. IEE Wiring Regulations. Sixteenth edition

BS 951:1999
Electrical earthing. Clamps for earthing and bonding. Specification

BS EN 50310:2000
Application of equipotential bonding and earthing in buildings with information technology equipment

BS EN 60079-10:2003
Electrical apparatus for explosive gas atmospheres. Part 10 Classification of hazardous areas

BS EN 60079-14:2003
Electrical apparatus for explosive gas atmospheres. Part 14 Electrical installations in hazardous areas (other than mines)

BS EN 60079-17:2003
Electrical apparatus for explosive gas atmospheres. Part 17 Inspection and maintenance of electrical installations in hazardous areas (other than mines)

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W52 LIGHTNING PROTECTION

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES
To protect the buildings against lightning strikes.

100.020 DESIGN PARAMETERS
BS 6651: 1999, including all amendments

100.030 SYSTEM DESCRIPTION
Employ a specialist to design, supply, install, and test lightning protection system comprising air termination networks at roof levels, bonding of all metal elements in or on the structure, down conductors and earth pit connection points.

Air Termination Network

Flat tape system.

Down Conductors

Metallic elements of structure.

Earth Pit

Prefabricated earth pit c/w test connection to copper earth rod.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with “Putty Pads”. Install Putty Pads in strict accordance with manufacturer’s instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.060 SYSTEM DRAWINGS
(69) series

C0605 The New LMB Building Project W52
Electrical Specification LIGHTNING PROTECTION
Revised Stage E Scheme Including Agreed VE

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PART 2 SELECTIONS SCHEDULES FOR REFERENCE SPECIFICATIONS

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.

280.020 CONDUCTORS:
•Conductors for lightning protection system

Horizontal air terminations - reference Y80.2010A
  •Covering colour to suit cladding system
  •Self supporting air terminations - reference Y80.2010B
•Conductors for earthing systems to BS 7430.
  Reference Y80.2010C
•Conductor joints
  •Lightning protection - reference Y80.2020A
  •Earthing systems - reference Y80.2020B
•Tape fixing devices
  •Reference Y80.2030A

280.030 EARTH ELECTRODES:
•Earth electrodes for lightning protection systems.

Rod - reference Y80.2040A
  •Building or structural element - reference Y80.2040C
•Earth electrodes for system earthing.
  •Rod - reference Y80.2040B
  •Building or structural element - reference Y80.2040D
•Earth electrode clamps
  •Reference Y80.2060A
•Earth electrode inspection facilities
  •Reference Y80.2070A
•Earth electrode tank penetration seal
  •Reference Y80.2080A

280.040 EQUIPOTENTIAL BONDS:
•Main equipotential bonds

Reference Y80.2090A
•Supplementary equipotential bonds
  •Reference Y80.2100A

280.050 EARTHING:
•Circuit protective conductors
  •Reference Y80.2110A
•Earthing clamps - reference Y80.2120
•Earth busbars
  •Reference Y80.2130A
•Test links - reference Y80.2140
•Lugs/tags - reference Y80.2150
•Protective cable terminations - reference Y80.2160

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•Protective conductor warning notices/labels
Reference Y80.2170
•Main earth conductor - reference Y80.2180
•Earth bar label - reference Y80.2190

280.060 WORKMANSHIP:
•Dissimilar metals - reference Y80.3020
•Tape joints
•Copper - reference Y80.3030A
•Aluminium - reference Y80.3030B
•Stranded conductor joints - reference Y80.3040
•Protective cable terminations
•Reference Y80.3050A
•Earth electrodes
•Reference Y80.3060A

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
Comply with work section general clauses reference Y90.1000 and those detailed below.
•Carry out fixing to building fabric as specified in work section V20.

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PART 3 SPECIFICATION CLAUSES SPECIFIC TO W52

300.000 GENERAL

300.010 STANDARDS:
•Provide lightning protection system in accordance with BS 6651.
•Provide lightning protection connection components complying with BS EN 50164-1 and BS EN 50164-2.

300.020 USE OF BUILDING ELEMENTS:
Ensure that building and structural elements used as items in or bonded to the lightning protection system are designed and erected in accordance with BS 6651 as well as their appropriate constructional specification or code of practice. Ensure that all connections to building and structural elements are waterproof and corrosion protected to a degree appropriate to their exposure.

300.030 LIGHTNING PROTECTION SPECIALIST:
Engage a lightning protection specialist to carry out the following elements of the lightning protection system.
•Design.
•Installation.
•Testing.
•Commissioning.

300.040 APPROVALS:
Obtain the approval of all authorities concerned for the installation of the lightning protection system. Comply with the regulations of all concerned authorities for the installation and connection of public utility services to a common earth termination network, comply with agreements made with bodies concerned with other services connected to a common earth termination network.
•Public utility services
•Water Cambridge Water
•Gas TBC
•Telecommunication BT, SuperJANET and TBC.

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300.050 REGULATIONS AND AGREEMENTS:
Comply with the regulations of all concerned authorities for the installation and connection of public utility services to a common earth termination network, comply with agreements made with bodies concerned with other services connected to a common earth termination network.

300.060 BONDING OF SERVICES:
Bond or isolate all metallic services in or on the structures in accordance with BS 6651 and as indicated in the Schedules and Drawings.

300.070 PROTECTION OF ELECTRONIC EQUIPMENT:
Protect electronic equipment in buildings in accordance with BS 6651 Appendix C.
•Equipment transient design level (Volts)
•Transient Control level (Volts)
Protect telecommunication lines in accordance with BS EN 61663.

310.000 PRODUCTS/MATERIALS

310.010 TEST JOINTS:
•Conductor
•Form
•Strip.
•Material
•Copper PVC covered
•Link disconnecting

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- Base
- Copper Link.
- Stud.
  - Size
  - Material

310.020 BUILDING ELEMENTS:
Use building elements as down conductors main terminations in accordance with BS 6651, with non-ferrous bonding points built as Figure 7 for reinforcing bars.
- Ensure reinforcing bars are in good electrical contact by
  - Welded

310.030 LIGHTNING PROTECTION SYSTEM BONDS:
- Manufacturer and reference Furse Nottingham
- Rigid.
- Re-bar
- Provide purpose made bonding clamp
  - Metal work clamp
  - Tower earth clamp
  - Re-bar earth point
    - Re-bar clamp
- Bond material
  - Form
    - Strand.
  - Material
    - Copper
      - BS 6360.
- Connectors to down conductor or air terminal
  - Test and Junction copper
  - Rod to tape copper
  - Rod to strand copper
  - Bolted copper

320.000 WORKMANSHIP

320.010 INSTALLATION:
Install the lightning protection system and its element in accordance with the manufacturer's recommendations and BS 6651 and BS 7430.

320.020 WORK ON SITE:
Ensure that all building works are completed and service connections are provided,
- By others.

320.030 QUALITY CONTROL:
Handle, store and install all equipment and components of the lightning protection system in accordance with the manufacturer's recommendations and
- BS 6651.
- BS 7430.

Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective.
Test and commission the system in accordance with BS 6651 and as specified.
Record all test measurements.

320.040 BONDING:
Bond or isolate building structural elements and metallic services as BS 6651, including,
- Steel structural frame.
- Reinforcement bars in concrete.
- Metallic roof coverings.

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- Services
  - Television and radio aerials and supports.
  - Metal flues and flue lining.
  - Window cleaning gear.
  - Dry risers.
  - Water services.
  - Air ductlines.
  - Gas services.
- Flag-masts.
- Roof level plant rooms.
- Water tanks.

320.050 LABELLING:
Provide and fix system labels as required by
- BS 6651.

320.060 INSTALLATION RECORDS:
Prepare system records, including the following items:
- To BS 6651.
- As installed drawings.
- Nature of soil
  - Earth resistivity measurement.
  - Earth electrode resistance.
  - Weather conditions to be noted
- Details of earth electrodes
  - Type as installed
  - Location as installed
  - Reference electrode as installed

Hand over the system records:
- Incorporate in the electrical services operation and maintenance manual as collated by the Electrical Contractor

320.070 MAINTENANCE:
Carry out maintenance as required by BS 6651 for the defects liability period and provide proposal for continuing maintenance to
- Building owner.

BS APPENDIX

BS 6651:1999
Code of practice for protection of structures against lightning

BS 7430:1998
Code of practice for earthing

BS EN 50164-1:2000
Lightning protection components (LPC). Part 1 Requirements for connection components

BS EN 50164-2:2002
Lightning protection components (LPC). Part 2 Requirements for conductors and earth electrodes

BS EN 61663-1:2000
Lightning protection. Telecommunication lines. Part 1 Fibre optic installations

BS EN 61663-2:2001
Lightning protection. Telecommunication lines. Part 2 Lines using metallic conductors

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W70 STRUCTURED CABLING SYSTEM

PART 1 SYSTEM OBJECTIVES

100.010 PERFORMANCE OBJECTIVES:
•Engage a specialist to carry out all works described within this work section.
•Provide a structured cabling system compliant with all clauses contained within this work section.
•Provide and incorporate prices for a complete working structured cabling system as described herein. If there are any areas of doubt, or, if any other equipment or ancillary works are required to provide a complete working system it is the responsibility of the contractor to identify the works, equipment and components required and to allow for such items within the prices provided.
•All active equipment and termination and connection to same shall be provided by the Client. Contractors to make due allowance for all necessary attendances.

100.020 DESIGN PARAMETERS:
•Design/install the structured cabling system in compliance with the following system supplier:
Brandrex,
- Krone,
- AMP Netconnect
- Hellermann Tyton
- Molex

100.030 SYSTEM DESCRIPTION:
•Supply, install and test a structured cabling system.
•Type
•Category 6
•Fibre
•The entire structured cabling system as specified is to be from a single manufacturer.

Wiring for each service or system shall be c/w a unique sheath colour for ease of identification, e.g. red for fire, etc. The colour of each system's cabling shall be agreed with the CA prior to implementation. The Electrical Contractor shall ensure that all sub-contractors recognise and implement the agreed colour coding system.

Acoustic Penetrations

Install all electrical services in strict accordance with the acoustic requirements set out by Sandy Brown Associates (SBA). Refer to SBA details for standard acoustic penetration details. Install all recessed electrical services back-boxes lined with "Putty Pads". Install Putty Pads in strict accordance with manufacturer's instructions. Blank off all unused cable glands. Install accessory boxes such that flanges are in contact with the wall leaves behind around their entire extent. Seal all gaps with non-hardening sealant.

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100.050 SYSTEM SCHEMATICS:
(62) series, (67) series

100.060 SYSTEM DRAWINGS:
(62) series, (67) series

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PART 2 SELECTION SCHEDULES FOR REFERENCE SPECIFICATIONS

260.000 CONDUIT AND TRUNKING

260.010 GENERAL:
Comply with work section general clauses reference Y60.1000 and those detailed below.
•Supply conduit and cable trunking as specified in section V20.

261.000 HV/LV CABLES AND WIRING

261.010 GENERAL:
Comply with work section general clauses reference Y61.1000 and those detailed below.
•Supply HV/LV cables and wiring as work section V20.

263.000 SUPPORT COMPONENTS - CABLES

263.010 GENERAL:
Comply with work section general clauses reference Y63.1000 and those detailed below.
•Supply support components as specified in section V20.

280.000 EARTHING AND BONDING COMPONENTS

280.010 GENERAL:
Comply with work section general clauses reference Y80.1000 and those detailed below.
•Supply earthing and bonding components as specified in section W51.

281.000 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

281.010 GENERAL:
Comply with work section general clauses reference Y81.1000 and those detailed below.
•Carry out testing and commissioning of electrical services as section V20.

282.000 IDENTIFICATION - ELECTRICAL

282.010 GENERAL:
Comply with work section general clauses reference Y82.1000 and those detailed below.
•Supply identification - electrical as specified in section V20.

290.000 FIXING TO BUILDING FABRIC

290.010 GENERAL:
•Carry out fixing to building fabric as specified in work section V20.

C0605 The New LMB Building Project W70
Electrical Specification STRUCTURED CABLING SYSTEM
Revised Stage E Scheme Including Agreed VE

Deleted: Stage E Issue

PART 3 SPECIFICATION CLAUSES SPECIFIC TO W70

300.005 STANDARDS:
•Provide structured cabling systems in compliance with the following standards:
  •European Committee for Electrotechnical Standardisation (CENELEC) - European
  •Telecommunications Industry Association (TIA/EIA) - American
  •International Organisation for Standardisation (ISO) - International
•This specification is based on the European Standards.
•Identify any instances where their solution is only compliant with the above.

300.010 AMENDMENTS AND REVISIONS:
In complying with any standard, equally comply with any published amendments and revisions issued up to and including start on site (and subsequently where the contractor can reasonably be assumed to be able to comply).

300.020 STANDARDS CONTRADICTIONS:
Confirm that this document to have been checked to identify any areas in which they feel it contradicts any of the following standards.

300.030 EUROPEAN STANDARDS:
Carry out work in accordance with the following European standards and all standards that are referenced within.
  •BS EN 50173-1 - Information Technology - Generic Cabling Systems.
  •BS EN 50174-1 - Information Technology - Cabling Installation. Specification and quality assurance.
  •BS EN 50174-2 - Information Technology - Cabling Installation. Installation planning and practices inside buildings.

300.040 BRITISH STANDARDS:
Carry out work in accordance with the following British standards and all standards that are referenced within.
  •BS 7671 - Requirements for Electrical Installations - IEE Wiring Regulations Sixteenth Edition.

300.050 INDUSTRY PRACTICE:
Carry out work in accordance with the following industry practices.
  •Ensure that the structured cabling system is fully compliant with the fibre optic industry association (FIA) code of practice for the installation of fibre cables.

300.060 MANUFACTURER'S GUIDELINES:
Carry out work in accordance with the manufacturer's guidelines and recommendations for their proposed solution.

310.000 TECHNICAL SPECIFICATION
Except if and where marginally varied by the detail later in the specification, the schedule reference below indicates which items are part of the SCS contract and which items are excluded from their contract, and therefore provided by others as noted.
•all required items associated with the SCS system shall be included with the exception of all active equipment and final terminations and connections thereto, which shall be provided by others.

310.010 ROOM TERMINOLOGY:
The following room terminology will be utilised throughout this work section:
  •Floor Equipment Room.
    Accommodation for:
      •Termination point of horizontal cabling subsystem (Floor distributor)
      •Active distribution equipment.
  •Building Equipment Room.
    Accommodation for:

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- Termination point for campus backbone cabling subsystem (Campus distributor)
- Termination point of building backbone cabling subsystem (Building distributor)
- Termination point of horizontal cabling subsystem
- Active core equipment.
- Active distribution equipment.

- Server Room.

Accommodation for:

- Server equipment.
- Storage area network equipment.
- Backup equipment

310.020 TERMINOLOGY:
The following terminology will be utilised throughout this section

- User Outlet (UO), End point of horizontal cable located in the work area.
- Floor Distributor (FD). Horizontal cabling subsystem termination point.
- Building Distributor (BD). Building backbone subsystem termination point.
- Campus Distributor (CD). Campus backbone subsystem termination point.
- Main Distributor Frame (MDF). Consolidation point for FD/BD and/or CD.
- Test Jack Frame (TJF). Telephone system / PTO / copper backbone termination point.
- Data Patch Panel (DPP). Active data equipment termination point.
- Voice Patch Panel (VPP). Active voice equipment termination point.

320.000 HORIZONTAL CABLING SUBSYSTEM
Horizontal cabling to link all user outlets to the Floor Distributor in a star topology, with each cable terminated, presenting an RJ45 outlet at the UO end. At the FD end the cable will be terminated onto either an RJ45 patch panel, 110 or Krone type interface.
User Outlets (RJ45 outlets) are universal outlets and serve both voice and data needs (i.e. telephones, fax, PCs, terminals, printers, etc.)

320.010 HORIZONTAL CABLE:
Horizontal cable to consist of not more than 4 pairs and be within its own sheath, and not sharing sheaths with any other cable. Cable to be of the same type and manufacturer throughout the entire system.
Cable type

- Unshielded Twisted Pair (UTP), 100ohm
- Fibre to specific outlets.

Sheath composition

- LSFOH

Each cable connection to be connected into the back of an RJ45 outlet, plug or socket. Ensure connection does not form a mated RJ45 pair. Cable to be terminated onto the back of a user outlet at the work area end and interface at the Floor Distributor end.
Each cable and each sheath to be continuous throughout its route length with no cable splicing or other type of connection.
Ensure every cable is installed so that it can be cut and re-terminated. This should be allowed singly or in cable groups depending on the terminations considered (typically in patch frames, groups would need to be re-terminated).
Some RJ45s are only suitable for stranded cables and some are only suitable for solid cables. Ensure that the appropriate RJ45s are used in each situation.
Ensure cables are not bent to a radius less than that specified by the cable manufacturer, either during installation or as installed, and that any part of the overall installation provided is such as to mean that any cable would in the future need to contravene these bending principles.
Notify the relevant parties if works installed by others may mean that it would be difficult or impossible to meet the bending radii requirements.

320.020 USER OUTLETS:

- Type
  - Floor box user outlets
  - Surface user outlets
  - Ceiling user outlets

C0605 The New LMB Building Project W70
Electrical Specification STRUCTURED CABLING SYSTEM
Revised Stage E Scheme Including Agreed VE

Deleted: Stage E Issue

- Flush wall mounted user outlets.

- The location and quantity of user outlets are detailed in the (62) series drawings.

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All face-plate outlets to be modular snap fit, such that one can be removed from a face-plate without affecting the others. Note, this applies to face-plates not patch panels.
Some user outlets are only suitable for stranded cables and some are only suitable for solid cables. Ensure that the appropriate RJ45 user outlets are used in each situation.

320.040 PRESENTATION:
Present the horizontal cable on patch panels within cabinets or frames as defined later in this work section.

- Patch panel type
  - 1U - 24 port patch panel
  - 2U - 48 port patch panel

320.050 PATCH PANEL LAYOUT:
Separate the patch panels by 1U cable tidies such that each cable tidy is followed by not more than 48 outlets, followed by a 1U cable tidy and so on, i.e. one cable tidy per 48 outlets plus one additional cable tidy.

320.060 SCHEMATIC DRAWINGS:

- Provide a schematic drawing showing the proposed layout of each of the floor distributors.

330.000 BUILDING BACKBONE CABLING SUBSYSTEM

- Type
  - Fibre

330.010 FIBRE BACKBONE CABLING:
Provide fibre backbone cabling from the Building Distributor to each Floor Distributor as follows:

- Topology
  - Star
- Type
  - Multimode 50/125 multi mode OM3
- Cores
  - 24
    - For diverse topologies the core quantity detailed above is per route, i.e. a diverse star topology with 12 cores would be provided as two diverse routes each with 12 cores.
- Building Distributor end termination
  - ST
- Floor Distributor end termination
  - ST

330.015 PRESENTATION:
Terminate and present the fibre backbone cable on patch panels within cabinets or frames as defined later in this work section.

- Patch panel type
  - 1U - 8 port patch panel

330.020 PATCH PANEL LAYOUT:
Patching area to start and end with a 1U cable tidy, with each patch panel separated by 1U cable tidies. Hence the total amount of cable will be the total amount of patch panels plus one additional cable tidy.

330.040 PATCH PANEL LAYOUT:
Separate the patch panels by 1U cable tidies such that each cable tidy is followed by not more than 48 outlets, followed by a 1U cable tidy and so on, i.e. one cable tidy per 48 outlets plus one additional cable tidy.

350.000 PATCH CORDS AND FLY LEADS
Utilise patch cords to patch the required services to the required outlets within both the Floor and

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Building Distributors.
Fly leads are utilised to provide the final connection from the user outlet to the end device.
- Type
  - Copper
  - Fibre

350.010 COPPER PATCH CORDS AND FLY LEADS:
Copper patch cords and fly leads to be composed of stranded not solid conductors and be provided with factory fitted RJ45 plugs.
- Colours
  - TBC with Client prior to ordering.
- Types, lengths and colours of patch cords TBC with Client prior to ordering.

350.020 FIBRE PATCH CORDS:
- Types, lengths and colours of patch cords TBC with Client prior to ordering.
- All connectors to be factory fitted.

350.030 PATCH CORD INSTALLATION:
Install the following patch cord type to ensure the correct device is patched to the correct service.
  - Copper
  - Fibre

The responsibility for production of the patching schedule is
  - SCS contractor

350.040 FLY LEAD INSTALLATION:
Install all fly leads to ensure the correct device is connected to the correct user outlet. The responsibility for production of the patching schedule is
  - SCS contractor

360.000 CABINETS AND FRAMES

360.010 CABINETS:
- Manufacturer and reference
- Cooper B-Line
- Rittal TS

Or approved equivalent

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• Krone
• APW
• Cannon

Provide cabinets to house the Building and Floor Distributors and the following equipment as provided by others
  - Active data equipment
- Type
  - Free standing
  - Provided with integral 100mm plinth
- Sizes and quantities of cabinets are detailed in the (62) series drawings.

Cabinets to be of steel construction throughout:
- Access
  - Front door
    - Safety glass
    - Hinged opening with lift-off capability
    - Lock and key.
  - Rear door
    - Mesh
    - Steel
    - Hinged opening with lift-off capability
    - Lock and key.
  - Side panels
    - Lift-off
    - keys and lock

Deleted: Stage E Issue

  - Cable entry
    - Top
- Ancillaries
  - Castors
  - Levelling feet
  - Fan tray
  - Power distribution strips
    - Switched
    - 10 way

Cabinets that are immediately adjacent to each other may be supplied and installed with no side panels, bayed together.
Provide vertical cable containment, installed vertically in the middle of each side.
Provide vertical patch cord guides to manage patching, installed vertically at left and right of the front and similarly at the rear for cabinets with front and rear patching.

370.000 INSTALLATION
Ensure all manufacturer guidelines, main contractor site rules and any specialist client requirements detailed within the complete tender documentation are followed.
Carry out all installation works in accordance with the site health and safety file, with the contractor ensuring their areas of responsibility operate in a clean and tidy environment. Ensure all outlets are protected from dust ingress.

370.010 BRING INTO SERVICE SUPPORT:
Make available engineers over at least the two days either side of each bring into service (BIS) date, as well as on the BIS date(s) itself, to provide whatever support is required.

370.020 PROJECT MANAGEMENT:
Appoint a qualified and experienced structured cabling system project manager to plan, direct and oversee their works and workers, and to liaise with and provide timely information to all relevant parties.
Meet the main contractor's programme as separately notified.

370.030 TRAINING:
Train the users how to use the system, showing all elements of patching and user outlet relocation and addition.
Provide training for up to four users, with training being scheduled with reasonable notice at the request of client name or their agents. The users may be trained together or separately, before or within one month after hand over, at the discretion of client name or their agents.

370.040 TESTING:
Describe how it is intended to prove the provenance of the components which will be installed. Provenance in this sense means how the parts were provided by the manufacturer, how they were obtained by the contractor, how they were held by the contractor, etc, ensuring overall that they are what they purport to be.
Carry out full testing as specified in the standards for all elements of the structured cabling system, and obtain appropriate passes for each element such as to ensure total structured cabling system compliance with the standards.
- Tests to include but not be limited to:
  - Attenuation.
  - NEXT (near end cross talk).
  - DC resistance/unbalance.
  - Mutual capacitance and capacitance to ground.
  - Impedance.
  - Distance in metres from the relevant patch panel to each outlet.
  - Testing in accordance with the manufacturer and TIA/EIA, ISO and EN standards.
- Tests carried out on the cat3 or CW1308 cabling to include but not be limited to:
  - Full continuity tests on every conductor.
  - Polarity tests on every pair.
- Tests carried out on the fibre optic cabling to include but not be limited to optical time domain

Deleted: Stage E Issue

reflectometer (OTDR) tests.
•Where test results are produced by electronic means submit the electronic versions in
•CD
•If special software is required to view the results, free issue the necessary disks containing the software, together with the required user licence(s)

370.050 TESTING EQUIPMENT:
List and describe the proposed testing equipment, which will be used on site and/or in their factory.
All equipment used for testing to be certified with a valid calibration certificate, a copy of which is to be provided to the client or their agents at their premises with reasonable notice.
Provide sample test result sheets for each of the tests to be carried out.

370.060 INSPECTION CHECKS:
During the installation period the client or their agents will make various physical inspections of the installation, including but not limited to: standard of workmanship, standards adherence, labelling.
The client or their agents will carry out witness checks of about 10% of the structured cabling system and the testing. Ensure reasonable notice is given before commencement of any tests.
Before hand over and after full testing by the contractor, the client or their agents will carry out random sample tests to confirm the quality of the installation. Tests will include electronic tests and inspection for such as labelling shortcomings.
Make available all personnel and equipment required to enable the client or their agents to carry out any of the above checks, both on site and in their factory.

370.070 AS INSTALLED INFORMATION:
Provide an operations manual that explains how to use the structured cabling system and describes what can and what cannot be connected to it.
Provide the as installed information as defined below and in accordance with the main contract requirements. Provide this information as part of the systems operations manual.
- •Drawings
  - •Outlet positions
- •Schedules
  - •Cables and outlets
  - •Test results
- •Component descriptions
- •Handover certificate
- •Warranty certificate

370.080 LABELLING:
Provide appropriate labelling for all elements of the scheme. This will include
- •Horizontal Cabling Subsystem
  - •Horizontal cable
  - •User outlet
  - •Patch panel, both the panel and the outlet
- •Building Backbone Cabling Subsystem
  - •Backbone cable
  - •Patch panel, both the panel and the outlet
- •Campus Backbone Cabling Subsystem
  - •Backbone cable
  - •Patch panel, both the panel and the outlet
- •Fly leads
- •Cabinets and frames

Cables to be labelled at all points where they enter or exit from concealment.
All labelling to be machine produced. Ensure that hand written labels are not used.
Patch panel labelling to consist of two rows of characters. Top row to be common to the complete length of the patch panel and be descriptive of the outlet type, i.e. 1st Floor User Outlets. The bottom row to identify each individual outlet.

370.090 LABELLING SCHEME:
The labelling scheme shall be agreed with the CA prior to ordering, however it is likely to follow a

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similar pattern to the example identified below.

370.092 HORIZONTAL CABLING SYSTEM:
Uniquely identify each user outlet using the following notation:
N - N - A - A - NN
N 1 digit number indicating building, 1 for building one, 2 for building two, etc,
N 1 digit number indicating floor level, 0 for ground, 1 for first, 2 for second, etc
A 1 letter indicating patch frame or cabinet
A 1 letter indicating patch panel
NN 2 digit number from 1 to 48
Uniquely identify each horizontal cable at both ends using consecutive numbers.
Uniquely identify each fly lead at both ends to match the user outlet.

370.094 BUILDING BACKBONE CABLING SUBSYSTEM:
Uniquely identify each backbone cable at both ends containing an identifier / description for both the source and destination of the cable. Each pair or outlet within each backbone cable to also be uniquely identified at both ends as a two or three-digit number running sequentially.

380.000 WARRANTY
Provide a warranty for the complete structured cabling system.
Type
- •Installer warranty.
- •Major Structured Cabling Manufacturer warranty.

Duration of the warranty to be from the handover date of the completed system for a minimum of:
- •25 years

Appropriate extensions to the structured cabling system to equally be covered by the warranty.
Appropriate extensions to be those which meet the manufacturer's design guides, installed by the contractor (or by any other contractor registered with and authorised by the end manufacturer as a certified installer) using certified components and procedures as prescribed by the manufacturer.
Arrange for the structured cabling manufacturer to visit site during the installation and at practical completion and confirm to the client, or their agents, manufacturer compliance.
The warranty shall not be voided by normal use of the system, including moves and changes carried out by the client or their agents.
The warranty shall provide for the client or their agents to contact the contractor in the first instance, who shall attend the site within one working day to carry out appropriate tests and who will then progress the claim through the manufacturer. Action on the claim shall have been agreed and initiated within 10 working days of notification of the claim. The action shall be completed without unreasonable delay.
A contract shall exist between the client and the manufacturer such that if the contractor is no longer in existence (or in the event of non-performance by the contractor) then the manufacturer shall fulfil all the obligations of the contractor.
State the name, address and claim contact details (department name, persons name and phone no) of the manufacturer. This may be used to verify that the warranty is fully compliant with the above requirements.

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Y10 PIPELINES

Y10.1000 GENERAL
•Supply pipes and fittings as specified in work section
•Supply pipes and fittings as schedule reference Y10-Pipework
•Location
1010 PRE-FABRICATED PIPEWORK:
Supply pre-fabricated pipework in accordance with relevant materials and workmanship clauses.
1020 FITTINGS:
For changes in direction use centreline radius/nominal bore of not less than 1.5 unless otherwise directed. For reductions and enlargements use easy transition type with inclined angle not exceeding 30 degrees.
1030 FABRICATED FITTINGS:
Use only with approval, if manufacturer's standard fittings are not available.
1040 PIPE JOINTS:
Obtain approval from Local Water Authority or Water Research Centre for materials used in water supplies.

Y10.2010A HEAVY BLACK STEEL PIPES TO BS EN 10255:
Material - Steel
Standard - BS 10255
Dimensions - Heavy. Random single lengths, 4m to 7m.
Ends - Screwed to BS 21 and BS EN 10226-1, taper thread or plain.
Finish - Varnished.

Y10.2020A STEEL FITTINGS - SCREWED BENDS AND SPRINGS TO BS EN 10255:
Material - Steel grade, seamless.
Standard - BS EN 10255.
Size range - 6mm to 150mm.
Dimensions - BS EN 10255, medium weight.
Ends - Screwed to BS 21 and BS EN 10226-1.
Finish - Galvanised.

Y10.2060A HEAVY WEIGHT CARBON STEEL FITTINGS, BUTT WELDED TO BS 1965-1:
Material
Carbon steel, grade 430, electric resistance welded.
Standard - BS 1965-1.
Size range - 25mm to 400mm.
Dimensions - BS 1965-1 Heavy
Ends - Bevelled.
Finish - Varnished.

Y10.2080B BLACK STEEL FITTINGS, GROOVED FOR MECHANICAL JOINTS:
Material - Steel fittings to BS 1965-1.
Standard - Manufacturer's.
Size range - 20mm to 600mm.
Ends - Grooved for mechanical joints.
Finish - Black.

Y10.2215A CARBON STEEL COMPRESSION COUPLINGS TO BS EN ISO 8434:
Material - Steel tubes to BS EN 10305-1 and BS EN 10305-4.
Standard - BS EN ISO 8434-1.
Dimensions, compression fittings BS EN ISO 8434-1
Ends - Plain.
Finish - Manufacturer's standard.

Y10.3010A CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - WELDED FLANGE:
Material - BS EN 1092-1.
Flange type - Weld neck flange or hubbed slip-on flange for welding.

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Flange facings - Raised face - type B.
Bolting - In accordance with BS EN 1092-1.

Y10.3010B CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - THREADED FLANGE:
Material to BS EN 1092-1.
Facings - Raised face type B.
Bolting - in accordance with BS EN 1092-1.
Threaded flanges - BS 21 and BS EN 10226-1 parallel thread.

Y10.3020A JOINTING RINGS - NON-METALLIC FLAT GASKETS:
Non-metallic flat gaskets for flanges to BS EN 1092-1, BS EN 1092-2, BS EN 1092-3 or BS EN 1092-4.
Standard - BS EN 1514-1
Gasket type - Full face for type B.

Y10.3020B JOINTING RINGS - METALLIC GASKETS:
Corrugated, flat or grooved metallic and filled metallic gaskets for flanges to BS EN 1092-1, BS EN 1092-2, BS EN 1092-3 or BS EN 1092-4.
Standard - BS EN 1514-4
Gasket type - Corrugated metal.
Gasket design - Self centring for type B.

Y10.3030A SCREWED JOINTS TO BS 21 AND BS EN 10226-1:
Use PTFE tape to BS 7786 or use hemp and jointing compound to BS 6956-5, or BS EN 751-2.

Y10.3030B SCREWED JOINTS TO BS 21 AND BS EN 10226-1 WITH PTFE TAPE:
Use PTFE tape to BS 7786.

Y10.3030C SCREWED JOINTS TO BS 21 AND BS EN 10226-1 WITH CHEMICAL CLEANING:
Use hemp and jointing compound to BS 6956-5 or BS EN 751-2, prior to chemical treatment and use PTFE tape to BS 7786 after chemical treatment.

Y10.3040A RAILROAD UNION CONNECTIONS:
Seating - Spherical seating bronze to iron, railroad pattern.

Y10.3040B NAVY UNION CONNECTIONS:
Seating - Spherical seating bronze to bronze, navy pattern.

Y10.3050A WELDED JOINTS, WELDING RODS FOR STEEL PIPES:
Gas welding, BS 1453 type A2 or A3; electric arc welding BS 2633; or electric arc welding BS 2971.

Y10.3125 JOINTING EQUIPMENT FOR PRESS FITTING SYSTEM:
Provide the manufacturer's recommended pressfitting tool for use with press fitting system.

Y10.3140A MECHANICAL JOINTS, GROOVED STEEL PIPES:
Material - Malleable cast iron to BS EN 1562; ductile cast iron to BS EN 1564; or carbon steel to BS EN 10025-1, BS EN 10025-2.
Joint - Standard, flexible or rigid; or reducing joint.
Size range - 20mm to 600mm.
Gaskets - Grade 'E' EPDM.
Finish - Painted to manufacturer's standard.

Y10.3150A MECHANICAL JOINTS, PLAIN END STEEL PIPES:
Material - Malleable cast iron to BS EN 1562; or ductile cast iron to BS EN 1564.
Size range - 40mm to 400mm.
Gaskets - Grade 'E' EPDM.
Finish - Manufacturer's standard.

Y10.3170A FLEXIBLE COUPLINGS, SLEEVE TYPE:
Joint - Bolted, sleeve type, with wedge type elastomeric gaskets.

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Type - Non-end load capable.
Dimensions - Manufacturer's standard.
Material - Ductile cast iron to BS EN 1564, or to BS EN 1563.
Finish - Manufacturer's standard.
Gaskets - In accordance with BS EN 681-1, BS EN 681-2 or BS EN 682.

Y10.3180A FLEXIBLE FLANGE ADAPTERS, SLEEVE TYPE:
Joint - Bolted, sleeve type, with wedge type elastomeric gaskets, flanged on end.
Type - Non-end load capable.
Dimensions - Manufacturer's standard.
Material - Ductile cast iron to BS EN 1564.
Flange - To connect to BS EN 1092-2, PN10 flange.
Finish - Manufacturer's standard.
Gaskets - In accordance with BS EN 681-1, BS EN 681-2 or BS EN 682.

Y10.3200A PIPE RINGS AND CLIPS, STEEL PIPEWORK:
Use suitable pipe, hangers, slider and roller type supports, taking into account the pipe load, material and pipe/insulation surface temperature.

Y10.4010 APPEARANCE:
Arrange all exposed pipe runs to present neat appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting.
Ensure all vertical pipes are plumb or follow building line.

Y10.4020 SPACING:
Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.
The following are recommended as minimum clearances in spacing of pipe runs:-

Between	and	Clearance (mm)
Pipeline -	wall finish	25
insulated or	ceiling finish or soffit	50
uninsulated	floor finish	150
insulated pipeline	adjacent service runs	25
uninsulated pipeline	adjacent service runs	50
adjacent pipelines	both uninsulated	150
	one uninsulated	75
	both insulated	25

Y10.4030 GRADIENTS:
Install pipework with gradients to allow drainage and/or air release, and to the slopes where indicated.

Y10.4040B AUTOMATIC AIR VENTS:
Provide a means of venting the pipe system at all high points.
Provide an automatic air vent valve with a copper outlet pipe from the valve to a tundish in an adjacent drain line or to another suitable location.

Y10.4050 DRAIN REQUIREMENTS:
Grade pipework to allow system to be drained. Provide a means of draining the system at all low points.

Y10.4060 EXPANSION AND CONTRACTION:
Arrange supports and fixings to accommodate pipe movement caused by the thermal changes, generally allow the flexure at changes in direction. Allow for movement at branch connections.

Y10.4070A PIPE FITTINGS, BENDS/SWEPT TEES:
Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and venting, concentric on vertical pipes, with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe sizes; above this ratio use reducing fittings. Use square tees at venting and draining

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points. Square elbows are not acceptable. Use bends and swept tees where practical.

Y10.4070B PIPE FITTINGS, ELBOWS/SQUARE TEES:
Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and venting, concentric on vertical pipes, with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe sizes; above this ratio use reducing fittings. Use square tees at venting and draining points. Square elbows are not acceptable. Use elbows and square tees.

Y10.4080 FABRICATED JUNCTIONS:
Form by inserting a branch section of a pulled bend into the main pipe. Develop the profiles of both the branch section and the hole in the main pipe, to ensure minimum protrusion into the main pipe. Weld or braze into position.

Y10.4090 FABRICATED FITTINGS - FERROUS:
Supply pipe material and end connections to the specification of the associated straight pipe runs.
Pattern - Bends, springs, offsets and branches.
Technique - Pipe bore 50mm or less - machine cold bend.
Pipe bore greater than 50mm - machine hot bend.
Ensure that fabricated branch bends of welding saddles are to the fitting proportions in BS 1965-1.

Y10.4100 FABRICATED FITTINGS - NON-FERROUS:
Provide pipe material and end connections to the specification of the associated straight pipe runs.
Pattern - Bends, springs, offsets and branches.
Technique - Machine bend and ensure that machine guides and formers are smooth and clean, free from any scores, or other damage. Deformed bends will not be accepted.
Fabricate branch from a section of pulled bend, profiled to match the contour of the main to avoid overlap and protrusion into the main. Cut and swage the main to form a raised cup to accept the spigot end of the branch. Limit angle of the branch to 60°. Join by bronze welding on site. Apply reinforcement by plates, collars or shoes.

Y10.4110 PIPES THROUGH WALLS AND FLOORS:
Enclose pipes passing through building elements, (walls, floors, partitions, etc.) concentrically within purpose made sleeves. Fit masking plates where visible pipes pass through building elements, including false ceilings of occupied rooms.

Y10.4120A PIPE SLEEVES:
Where pipe insulation is not carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe to allow clearance. Do not use sleeves as pipe supports.
Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish.

Y10.4120B PIPE SLEEVES WITH INSULATION CARRIED THROUGH:
Where pipe insulation is carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe and insulation to allow clearance. Do not use sleeves as pipe supports.
Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish.

Y10.4125 PIPE SLEEVES THROUGH FIRE BARRIERS:
Pack annular space between pipe and sleeve or insulation and sleeve with non-flammable and fire resistant material to form a fire/smoke stop of required rating. Apply 12mm deep cold mastic seal at both ends within sleeve.

Y10.4130 CONNECTIONS TO EQUIPMENT:
Make final connections to equipment in accordance with manufacturer's instructions and as indicated.

Y10.4140 DISTRIBUTION HEADERS:
Terminate ends with a cap, a blank flange, a grooved blank end or as indicated.

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Y10.4150A TEMPORARY PLUGS, CAPS AND FLANGES:
Seal all open ends as installation proceeds by plugs, caps or blank flanges, to prevent ingress of foreign matter.
Use plugs of metal, plastic or wood to suit pipework material.
In the event of such precautions not being taken, strip out pipework adjacent to open ends to demonstrate that fouling of bores has not occurred.

Y10.4160 FLANGED JOINTS GENERAL:
Use number and diameters of bolts to standard. Fit bolts of length to give not less than one thread, or more than 3mm protrusion beyond nut when joint is pulled up.
Fit washers under each nut.

Y10.4170 DISSIMILAR METALS:
Take appropriate means to prevent galvanic action where dissimilar metals are connected together.

Y10.4180 PIPE RINGS AND CLIPS:
Select type according to the application and material compatibility, give particular attention where pipes are subject to axial movement due to expansion or contraction.

Y10.4190 ANCHORS:
Location
•As drawing numbers
Construct to resist axial stress transmitted by flexure of horizontal and vertical pipe runs or loading on vertical pipes assuming that unbalanced forces exist at all anchor points, even when these are situated in intermediate positions between two expansion loops or bellows. Use similar or compatible materials to the attached pipe.
Provide and fix all associated backing plates, nuts, washers and bolts for attachment to or building into building structure; ensure structure is suitable for transmitted stress. Set out and line up anchors accurately in position. Inspect final grouting into building structure.

Y10.4200 SLIDE GUIDES:
Location
•As drawing numbers
Direct movement of expansion and contraction from pipe anchor points towards loops, bellows or flexible inserts. Ensure that thrust is linear relative to the axis of pipe.
Apply a friction reducing material between metal faces subjected to movement.

Y10.4205 PIPE SUPPORTS:
Arrange supports and accessories for equipment, appliances or ancillary fitments in pipe runs, so that no undue strain is imposed upon pipes.
Ensure that materials used for supports are compatible with pipeline materials.

Y10.4220 SUPPORT SPACING:
Space supports as tables.

PIPE BORE (mm)	MAXIMUM SUPPORT SPACING (M)					
Nominal	STEEL PIPE		COPPER PIPE		IRON PIPE	
	horizontal	vertical	horizontal	vertical	horizontal	vertical
up to 15	1.8	2.4	1.2	1.8	-	-
20	2.4	3.0	1.4	2.1	-	-
25	2.4	3.0	1.8	2.4	-	-
32	2.7	3.0	2.4	3.0	-	-
40	3.0	3.6	2.4	3.0	-	-
50	3.0	3.6	2.7	3.0	1.8	1.8
65	3.7	4.6	3.0	3.6	-	-
80	3.7	4.6	3.0	3.6	2.7	2.7
100	3.7	4.6	3.0	3.6	2.7	2.7
125	3.7	5.4	3.0	3.6	-	-
150	4.5	5.4	3.6	4.2	3.7	3.7
200	5.6	6.0	-	-	3.7	3.7
250	5.0	6.0	-	-	4.5	5.4

Deleted: Stage E Issue

300	6.1	10.0	-	-	8.0	10.0
350	10.0	12.0	-	-	-	-
400	10.5	12.6	-	-	-	-
450	11.0	13.2	-	-	-	-
500	12.0	14.4	-	-	-	-
600	14.0	16.8	-	-	-	-

PIPE BORE (mm)	MAXIMUM SUPPORT SPACING (M)					
Nominal	UPVC PIPE		POLYETHYLENE PIPE		GLASS PIPE	
	Class O, B, C	Class D, E, 6, 7	Type 32	Type 50		
	horizontal	horizontal	horizontal	horizontal	horizontal	vertical
up to 10	-	0.6	0.3	0.45	-	-
15	-	0.6	0.4	0.6	-	-
20	-	0.65	0.4	0.6	-	-
25	-	0.75	0.4	0.6	-	-
32	-	0.8	0.45	0.7	-	-
40	-	0.9	0.45	0.7	0.9	1.7
50	1.1	1.2	0.55	0.85	1.2	1.7
65	1.2	1.4	0.55	0.85	-	-
80	1.4	1.5	0.6	0.9	1.2	1.7
100	1.5	1.7	0.7	1.1	1.2	1.7
125	1.7	1.9	-	-	-	-
150	1.8	2.1	-	1.3	1.2	1.7
175	2.0	2.3	-	-	-	-
200	2.1	2.5	-	-	-	-
225	2.3	2.7	-	-	-	-
250	2.4	2.9	-	-	-	-
300	2.6	3.1	-	-	-	-
350	2.9	3.4	-	-	-	-
400	3.1	3.7	-	-	-	-
450	3.4	3.7	-	-	-	-
above 450	3.7	3.7	-	-	-	-

Maximum horizontal support spacing for grooved steel pipe 6 metres.
Vertical support spacing
Check total self-weight and pressure loading against manufacturer's recommendations when using mechanical joints or end load capable flexible couplings. Ensure adequate pipe support when using non-end load capable flexible couplings.
Space vertical support intervals for plastics pipe at not greater than twice horizontal intervals tabulated.
Where multiple pipe runs of differing bores are supported from a common point, use support spacing of pipe requiring closest spacing.
Spacings give for PVC-U pipe to BS 3505 are for 20^0C. Support continuously for temperatures 60^0C and above.

Y10.4230A ISOLATION AND REGULATION:
Provide valves, cocks and stop taps for isolation and/or regulation where indicated, and on:-
mains to isolate major sections of distribution;
the base of all risers and drops except in cases where one item of apparatus only is served which has its own local valve or stop tap;
points of pipe connection of all items of apparatus and equipment except where the item could conveniently be isolated or regulated by valves provided for other adjacent items;
draw-off fittings except where ranges of fittings are served by a common float, the isolator then being fitted with the float.

Y10.4240 MAINTENANCE AND RENEWAL:
Arrange pipework, valves, drains, air vents, demountable joints, supports, etc., for convenient routine maintenance and renewals. Provide all runs with a regularly spaced pattern of demountable joints in the form of unions, flanges, etc., and also at items of equipment to facilitate disconnection.
Locate valves, drains, flanges etc. in groups.

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Y10.4250 CLEANING:
Remove cement and clean off all pipework and brackets.

Y10.4260 NON-FERROUS COMPONENTS:
Thoroughly clean and degrease.

Y10.5010A WELDING GENERAL, CLASS 1:
Use skilled craftsman in possession of a current Certificate of Competence appropriate to type and class of work, issued by an approved authority. Mark each weld to identify operative. Submit specimen welds, representative of joints and conditions of site welding, for each craftsman, test non-destructively, approximately 10% of butt weld joints and 5% of all other joints.
Weld pipeline joints to BS 1821 and BS 2633 as appropriate. Carry out non-destructive testing on 10% or as indicated.

Y10.5020 WELDED JOINTS, STEEL PIPES:
Preparation, Making and Sealing.
Oxy-acetylene welding, conforming to BS 1821 or BS 2640 appropriate to system temperature and pressure.
Arc welding, conforming to BS 2633 or BS 2971 appropriate to system temperature and pressure.
Use arc welding process on piping greater than 100mm.

Y10.5030 PAINTING WELDED JOINTS, STEEL PIPES:
Unless pipework is being prepared for galvanizing after manufacture, wire brush and paint all welds with red oxide paint when welds are complete.

Y10.5040 FLANGED JOINTS, STEEL PIPES:
Welded Flanges
Weld neck and bore of 'slip on' flange.
Butt weld neck of welding neck flange.
Screwed Flanges
Apply jointing materials. Screw on flange and expand tube into flange with roller expander where necessary.
Preparation
Ensure that flange mating faces are parallel; flange peripheries are flush with each other; and bolt holes are correctly aligned.
Making and Sealing
Insert jointing between flange mating faces. Pull up joint equally all round.

Y10.5050 SCREWED JOINTS, STEEL PIPES:
Preparation
Ensure that plain ends are cut square. Reamer out bore at plain ends.
Screw plain ends, taper thread.
Making and Sealing
Coat male pipe threads with jointing compound and hemp, or PTFE tape on small sizes.
Immediately after applying coating, connect with female end of socket or fitting, and tighten ensuring that coating does not intrude into pipe. Leave joint clean.

Y10.5060 MECHANICAL JOINTS, GROOVED STEEL AND STAINLESS STEEL PIPES:
Preparation
Ensure that cut ends are square, free of bumps, dents and score marks and are within manufacturer's tolerances. Form groove in accordance with manufacturer's recommendations.
Assemble joint in accordance with manufacturer's instructions.
Making and Sealing
Ensure gasket is suitable for service. Thoroughly lubricate gasket, externally and internally, using manufacturer's recommended lubricant. Stretch gasket over pipe end and bring pipe ends together. Slide gasket into central position over both pipe ends. Position joint half housings over gasket and insert bolts and nuts and electrical continuity clip if required. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.
Earth continuity
Use manufacturer's earth continuity clips to ensure compliance with IET regulations.

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Y10.5070A ANCHORS, STEEL PIPES, U-BOLTS:
Provide anchors constructed using mild steel over-straps or heavy U-bolts. Secure to channel section, adequately attached to or grouted into building structure; weld longitudinal edges of strap to pipe.

Y10.5070B ANCHORS, STEEL PIPES, SLIP-ON FLANGES:
Provide anchors constructed by passing two slip-on flanges over pipe to anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure, and finally weld flanges to pipe.

Y10.5080 PRESS FITTING JOINTS:
Make press fitting joints in accordance with manufacturer's recommendations. Ensure all fittings are electrically continuous when the jointing process is complete.

Y10.5090 STEEL PIPEWORK PAINTING:
Remove scale, rust or temporary protective coating by chipping, wire brushing or use of approved solvents and paint with one coat of red oxide primer, as work proceeds.

Y10.8010 SOLVENT WELDED JOINTS, PVC PIPES:
Use solvent welded joints generally, ring seal joints at expansion joints and elsewhere as necessary.
Preparation - Ensure that plain ends are cut square. Reamer out bore at plain ends. Clean plain ends with solvent cleaner.
Making and Sealing - In accordance with fitting manufacturer's instructions.

Y10.8020 FUSION JOINTS, POLYETHYLENE PIPES:
Preparation - Square cut plain ends. Form pipe ends for socket type joints.
Making and Sealing - In accordance with fitting manufacturer's instructions.

Y10.8030 MECHANICAL FITTINGS FOR POLYETHYLENE PIPE:
Preparation - Ensure that cut ends are square. Check wall thickness/pressure rating of fitting.
Making and sealing - Ensure correct gasket type is used for service (e.g. water or gas). Assemble fitting in accordance with manufacturer's instructions.

Y10.8040 ANCHORS - PVC PIPES:
Clamp pipework to mild steel channel section attached to or grouted into building structure, using PVC coated over-straps, or clamps and with a polypropylene strip between pipe and mild steel section.

Y10.8050 JOINTING POLYBUTYLENE PIPES AND FITTINGS:
Carry out installation of polybutylene pipes and fittings in accordance with manufacturer's instructions.

Y10.8060 COMPRESSION FITTINGS ON MULTI-LAYER PIPES:
Carry out installation of compression fittings on multi-layer pipe in accordance with manufacturer's recommendations.

Y20 PUMPS

Y20.1000 GENERAL
1010 PUMPS:
Provide pumps manufactured and tested in accordance with appropriate British Standard, in particular BS EN 809, BS EN 60335-2-41 and BS EN 60335-2-51 where applicable.
1020 PUMP SELECTION:
Select pump at or near most efficient part of performance curve for duty required.
1030 SAFETY GUARDS:
Fit safety guards around revolving parts on close coupled and belt drive pumps.
1040 PUMP TESTING:
Ensure pumps comply with BS EN ISO 5198 and BS EN ISO 9906 as appropriate.

Y30 AIR DUCTLINES AND ANCILLARIES

Y30.1000 GENERAL
1010 DUCTWORK INSTALLATION STANDARDS:
Carry out construction and installation of ductwork in accordance with DW 144, DW 154, DW 171, DW 191 and BS 5588 as appropriate.
1020 DUCTWORK DIMENSIONS:
Sizes of ductwork are internal dimensions. Where applicable make allowance for any internal lining.

Y41 FANS

Y41.1000 GENERAL
1010 DESIGN DUTIES:
Air Volume
Ensure scheduled volume is provided when operating against resistance of system corrected for changes between specified and selected component resistances.
System Resistance
Adjust scheduled resistance to compensate for actual resistance of selected components.
Operating Point
Select operating point on pressure/volume curve to provide stable and efficient operation.
Guaranteed Performance
Provide fan performance figures in accordance with BS 848-1 and BS 848-9.
1020 PROTECTION:
Protect casings, impellers and shafts against corrosion.
Protect bearings against dirt and moisture.

Y45 SILENCERS/ACOUSTIC TREATMENT

Y45.1000 GENERAL
1010 PERFORMANCE:
Ensure that specified performance is met where protection is applied to infill to protect from moisture and grease.
1020 TESTING:
Provide certified insertion loss data in accordance with BS EN ISO 7235. Provide generated sound power levels with insertion loss data.
Where equipment is manufactured in modules ensure performance ratings apply to complete unit.
1030 PROTECTION:
Protect silencers where they are installed in positions exposed to external weather conditions.
Block ends of silencers prior to delivery to site to prevent damage.
1040 DIRECTION OF FLOW:
Clearly mark direction of air flow on silencers.

Y45.3010 GENERAL:
Install acoustic treatment equipment in positions indicated, in accordance with manufacturer's instructions.

Y45.3020 ACOUSTIC ENCLOSURES:
Ensure that erection is carried out by enclosure manufacturer.

Y45.3030 ACCESS TO ACOUSTIC ENCLOSURES:
Provide door type openings in enclosures as required for access to items enclosed. Provide openings for inlet and discharge ductwork and for connections as indicated. Provide angle flange connections for mating to ductwork and equipment.

Y45.3040 SUPPORTS:
Supply steel section supporting frames or brackets where silencers are fixed to the walls of air chambers.

Y45.3050 ACOUSTIC LININGS:
Where personnel access is provided, protect acoustic linings to prevent damage.

Y45.3060 SOUND PRESSURE LEVEL READINGS:
Measure sound pressure levels at the positions indicated using equipment in accordance with BS EN 61672-1 and BS EN 61672-2.

Y45.3070 MEASURE SOUND INSULATION OF BUILDING ELEMENTS IN ACCORDANCE
Measure sound insulation of building elements in accordance with BS EN ISO 140-4, BS EN ISO 140-7 and BS EN ISO 140-14 as appropriate.

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Y51 TESTING AND COMMISSIONING OF MECHANICAL SERVICES

Y51.1000 GENERAL

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Y60 CONDUIT AND TRUNKING

Y60.1000 GENERAL
1010 STANDARDS:
Provide conduit and cable trunking in accordance with the relevant British Standards and in particular the requirements of BS 7671 Requirements for Electrical Installations (The IEE Wiring Regulations).

Y60.2010B CONDUIT SYSTEMS METAL RIGID CLASS 4:
•Fittings
•2020A RIGID CONDUIT SYSTEM - METALLIC CONDUIT:
Use couplers to match conduit grade and finish.
Use solid couplers to join lengths of conduit.
Conduit fittings and adaptable boxes
Material - Malleable iron adaptable boxes.
Do not use factory made bends, inspection bends or inspection couplers unless shown on drawings or schedules.
Ensure fittings are same class and finish as associated conduit system.
Supply covers for circular or adaptable boxes in the same material and finish as boxes.
Use steel dome or cheese headed screws to secure covers for Class 2 finish.
Use brass dome or cheese headed screws to secure covers for Class 4 finish.
Limit number of entry holes within loop-in boxes to four.
Adaptable box, minimum size - 100mm x 100mm x 50mm.
Connections
Use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes. Use solid couplers.
Conduit fixing saddles - Spacer bar.
Plugs - Hexagonal malleable iron.
Locknuts - Hexagonal steel.
•2020B RIGID CONDUIT SYSTEM - METALLIC CONDUIT AS DRAWINGS/SCHEDULES:
Use couplers to match conduit grade and finish.
Use solid couplers to join lengths of conduit unless inspection couplers are shown on the drawings or schedules.
Conduit fittings and adaptable boxes
Material - Malleable iron adaptable boxes.
Do not use factory made bends, inspection bends or inspection couplers unless shown on drawings or schedules.
Ensure fittings are same class and finish as associated conduit system.
Supply covers for circular or adaptable boxes in the same material and finish as boxes.
Use steel dome or cheese headed screws to secure covers for Class 2 finish.
Use brass dome or cheese headed screws to secure covers for Class 4 finish.
Limit number of entry holes within loop-in boxes to four.
Adaptable box, minimum size - 100 mm x 100 mm x 50 mm.
Connections
Use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes. Use solid couplers.
Conduit fixing saddles - Spacer bar.
Plugs - Hexagonal malleable iron.
Locknuts - Hexagonal steel.
Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
Material - Metal, steel.
Method of connection - Threadable.
Suitability for bending - Rigid, BS EN 61386-21.
Electrical characteristics - with electrical continuity.
Resistance against corrosive or polluting substances
Conduits with same protection outside and inside
High protection - Hot dip zinc coating. BS EN 61386-1 Table 10 Class 4.

Y60.2010C CONDUIT SYSTEMS - METAL RIGID STAINLESS STEEL:
•2020C RIGID CONDUIT SYSTEM - STAINLESS STEEL CONDUIT:

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Use couplers to match conduit grade and finish.
Use solid couplers to join lengths of conduit.
Conduit fittings and adaptable boxes
Material - Stainless steel.
Ensure fittings are same class and finish as associated conduit system.
Supply covers for circular or adaptable boxes in the same material and finish as boxes.
Limit number of entry holes within loop-in boxes to four.
Adaptable box, minimum size - 100 mm x 100 mm x 50 mm.
Connections
Use couplers and externally screwed bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes. Use solid couplers.
Conduit fixing saddles - spacer bar, stainless steel.
Plugs - Hexagonal stainless steel.
Locknuts - Hexagonal stainless steel.

•2020# RIGID CONDUIT SYSTEM - METALLIC CONDUIT:
•Use couplers to match conduit grade and finish.
•Use solid couplers to join lengths of conduit unless inspection couplers are shown on the drawings or schedules.
•Conduit fittings and adaptable boxes
•Material
•Malleable iron conduit fittings.
•Malleable iron adaptable boxes.
•Steel adaptable boxes.
•Do not use factory made bends, inspection bends or inspection couplers unless shown on drawings or schedules.
•Ensure fittings are same class and finish as associated conduit system.
•Supply covers for circular or adaptable boxes in the same material and finish as boxes.
•Use steel dome or cheese headed screws to secure covers for Class 2 finish.
•Use brass dome or cheese headed screws to secure covers for Class 4 finish.
•Limit number of entry holes within loop-in boxes to four.
•Adaptable box, minimum size
•100 mm x 100 mm x 50 mm.
•Connections
Use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes.
•Use solid couplers.
•Use flanged couplers with washers.
•Conduit fixing saddles
•Spacer bar.
•Plain.
•Hospital.
•Plugs
•Hexagonal malleable iron.
•Slotted brass plugs.
•Locknuts
•Hexagonal steel.
•Hexagonal malleable iron.
•Circular steel milled edge.
•Circular steel crenellated.

Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
Material - Metal, stainless steel.
Method of connection - Threadable.
Suitability for bending - Rigid, BS EN 61386-21.
Electrical characteristics - with electrical continuity.
Resistance to ingress of water (rating to BS EN 60529)
Conduits giving protection against water jets (IPX5).
Resistance against corrosive or polluting substances
Conduits with same protection outside and inside

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High protection - Stainless steel. BS EN 61386-1 Table 10 Class 4.

Y60.2010D CONDUIT SYSTEMS - STEEL FLEXIBLE, LSF SHEATHED:
•2040A PLIABLE OR FLEXIBLE CONDUIT SYSTEMS - METALLIC:
Type of Packing - Unpacked.
Type of sheath - Low smoke and fume material.
Fittings material - Brass adaptors.
Connections
Use brass male adaptors to connect flexible conduit to motors and any other equipment having a threaded entry.
Use male adaptors, solid couplers, flanged couplers with washer and externally screwed brass bushes to connect flexible conduit to trunking and equipment not having a threaded entry.
Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
Material - Metal, steel.
Method of connection - Non-threadable.
Suitability for bending - Flexible, BS EN 61386-23.
Resistance to flame propagation
Non-flame propagating conduit.
Resistance against corrosive or polluting substances
Conduits with same protection outside and inside
Medium protection
Conduits with greater protection outside than inside -Medium/high
Stove enamel inside, LSF sheathed outside. BS EN 61386-1 Table 10 Class 2.

Y60.2010E CONDUIT SYSTEMS - NON-METALLIC RIGID:
•2030A RIGID CONDUIT SYSTEM - INSULATING CONDUIT:
Connections
Do not use slip joints. Use expansion couplings as required. Solvent solution.
Conduit fittings and adaptable boxes
Do not use factory made bends, inspection bends or inspection couplers.
Use boxes and connections to suit size of conduit and method of jointing.
Use heavy gauge, high impact rigid PVC conduit fittings.
Provide all boxes for supporting luminaires or other heavy devices with metal brackets or insert clips to provide a support independent of the box.
Provide boxes for flexible conduit, accessories and luminaire connection with a brass earthing terminal and/or steel circular earthing ring.
Conduit fixing saddles - Spacer bar or hospital.
Plugs - Spout entry plug.
Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
Material - Insulating, PVC or equivalent material.
Method of connection - Non-threadable.
Suitability for bending - Rigid, BS EN 61386-21.
Electrical characteristics
Without electrical insulating characteristics.

Y60.2010F CONDUIT SYSTEMS - NON METALLIC FLEXIBLE:
•2050A PLIABLE OR FLEXIBLE CONDUIT SYSTEMS - NON-METALLIC:
Method of connection - Threadable conduit.
Connections
Use plastic adaptors and bushes.
Use male adaptors to connect flexible conduit to motors and other equipment having a threaded entry.
Use female adaptors and externally screwed bushes to connect flexible conduit to trunking and equipment not having a threaded entry.
Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.
Material - Insulating, PVC.
Method of connection - Threadable or non-threadable.
Suitability for bending - Flexible, BS EN 61386-23.
Electrical characteristics
Without electrical insulating characteristics.

Y60.2020A RIGID CONDUIT SYSTEM - METALLIC CONDUIT:
Use couplers to match conduit grade and finish.
Use solid couplers to join lengths of conduit.
Conduit fittings and adaptable boxes
Material - Malleable iron adaptable boxes.
Do not use factory made bends, inspection bends or inspection couplers unless shown on drawings or schedules.
Ensure fittings are same class and finish as associated conduit system.
Supply covers for circular or adaptable boxes in the same material and finish as boxes.
Use steel dome or cheese headed screws to secure covers for Class 2 finish.
Use brass dome or cheese headed screws to secure covers for Class 4 finish.
Limit number of entry holes within loop-in boxes to four.
Adaptable box, minimum size - 100mm x 100mm x 50mm.
Connections
Use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes. Use solid couplers.
Conduit fixing saddles - Spacer bar.
Plugs - Hexagonal malleable iron.
Locknuts - Hexagonal steel.

Y60.2020C RIGID CONDUIT SYSTEM - STAINLESS STEEL CONDUIT:
Use couplers to match conduit grade and finish.
Use solid couplers to join lengths of conduit.
Conduit fittings and adaptable boxes
Material - Stainless steel.
Ensure fittings are same class and finish as associated conduit system.
Supply covers for circular or adaptable boxes in the same material and finish as boxes.
Limit number of entry holes within loop-in boxes to four.
Adaptable box, minimum size - 100 mm x 100 mm x 50 mm.
Connections
Use couplers and externally screwed bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes. Use solid couplers.
Conduit fixing saddles - spacer bar, stainless steel.
Plugs - Hexagonal stainless steel.
Locknuts - Hexagonal stainless steel.

Y60.2030A RIGID CONDUIT SYSTEM - INSULATING CONDUIT:
Connections
Do not use slip joints. Use expansion couplings as required. Solvent solution.
Conduit fittings and adaptable boxes
Do not use factory made bends, inspection bends or inspection couplers.
Use boxes and connections to suit size of conduit and method of jointing.
Use heavy gauge, high impact rigid PVC conduit fittings.
Provide all boxes for supporting luminaires or other heavy devices with metal brackets or insert clips to provide a support independent of the box.
Provide boxes for flexible conduit, accessories and luminaire connection with a brass earthing terminal and/or steel circular earthing ring.
Conduit fixing saddles - Spacer bar or hospital.
Plugs - Spout entry plug.

Y60.2040A PLIABLE OR FLEXIBLE CONDUIT SYSTEMS - METALLIC:
Type of Packing - Unpacked.
Type of sheath - Low smoke and fume material.
Fittings material - Brass adaptors.
Connections
Use brass male adaptors to connect flexible conduit to motors and any other equipment having a threaded entry.
Use male adaptors, solid couplers, flanged couplers with washer and externally screwed brass bushes to connect flexible conduit to trunking and equipment not having a threaded entry.

Y60.2050A PLIABLE OR FLEXIBLE CONDUIT SYSTEMS - NON-METALLIC:
Method of connection - Threadable conduit.
Connections
Use plastic adaptors and bushes.
Use male adaptors to connect flexible conduit to motors and other equipment having a threaded entry.
Use female adaptors and externally screwed bushes to connect flexible conduit to trunking and equipment not having a threaded entry.

Y60.2080A CABLE TRUNKING AND FITTINGS:
Comply with BS 4678. Use trunking of each type from one manufacturer.

Y60.2090A METAL TRUNKING - FACTORY PAINTED FINISH:
Material
Steel trunking to BS 4678-1. Supply partitions and covers same material as trunking.
Gauge of metal - Table 1 BS 4678.
Style
Use trunking manufactured with inward return edge flanges and fitted with flange couplers which ensure that when the cover is removed a minimum of 80% of the nominal trunking or compartment width is available for access.
Protection to BS 4678-1
Electroplated zinc having a minimum thickness of zinc coating of 0.0012mm inside and outside with additional coating of stoved or air drying paint, applied at least to the external surface.
Finish - Manufacturer's standard, all surfaces.
Colour
Manufacturer's standard or to BS 4800 Shade as approved.
Fixings
Use purpose made brackets to fix to structural steel or suspension rods.
Provide external fixing lugs where specified protection for the installation is IP44 or greater.
Fittings
Use bends, tees and angles of similar gauge, type and finish as trunking body and supplied by same manufacturer.
Partitions and Covers
Ensure partitions are electrically continuous with the body of the trunking or provide a connector for a circuit protective conductor.
Ensure gap between partitions and lids maintains segregation of circuits.
Material - Same material as trunking.
Joints
Use purpose made jointing pieces fixed with screws into captive nuts. Ensure screws do not protrude through the nuts.
Ensure rigidity of trunking is maintained across joint.
Ensure external dimensions of trunking are maintained and not reduced by more than 4% across joints between trunking lengths and/or fittings.
Use purpose made fittings of the same manufacture where trunking connects to switchgear and distribution boards.
Provide flanges for connection of flush floor trunking to vertical trunking to maintain the cross sectional area of compartments with 50 mm minimum radius.
Maintain electrical continuity at each joint by a copperlink, (tinned copper for galvanized trunking), fixed on outside of trunking, secured by screws, nuts and shakeproof washers. Screws must not project through the nut. Make provision for continuity to be achieved without need to remove paint from ferrous metal where trunking has a painted finish.
Screws, Nuts, Washers
Do not use self tapping screws. Use cheese or round head screws except where provision is made for the use of counter-sunk heads.
Material
Use steel zinc coated
•BS 3382 Parts 1 and 2.
Cable supports
Provide horizontal trunking with removable cable retainers or bridges to retain cables in situ.

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Provide vertical trunking with pin racks to support cables at 3000 mm maximum spacing.
Use insulated pins or insulation sleeved pins on pin racks.

Y60.2090B METAL SURFACE TRUNKING - ZINC FINISH:
Material
Steel trunking to BS 4678-1. Supply partitions and covers same material as trunking.
Gauge of metal - Table 1 BS 4678.
Trunking type
Standard cable trunking with compartments.
Style
Use trunking manufactured with inward return edge flanges and fitted with flange couplers which ensure that when the cover is removed a minimum of 80% of the nominal trunking or compartment width is available for access.
Protection to BS 4678-1
Electroplated zinc having a minimum thickness of zinc coating of 0.0012mm inside and outside.
Hot dip zinc coated steel to BS EN 10326, BS EN 10327 or BS EN 10143.
Finish - Manufacturer's standard, all surfaces.
Colour - Self Colour or Manufacturer's standard.
Fixings
Use purpose made brackets to fix to structural steel or suspension rods.
Provide external fixing lugs where specified protection for the installation is IP44 or greater.
Fittings
Use bends, tees and angles of similar gauge, type and finish as trunking body and supplied by same manufacturer.
Partitions and Covers
Ensure partitions are electrically continuous with the body of the trunking or provide a connector for a circuit protective conductor.
Ensure gap between partitions and lids maintains segregation of circuits.
Provide individual mounting plates for each accessory mounted on trunking covers.
Material - Same material as trunking.
Joints
Use purpose made jointing pieces fixed with screws into captive nuts. Ensure screws do not protrude through the nuts.
Ensure rigidity of trunking is maintained across joint.
Ensure external dimensions of trunking are maintained and not reduced by more than 4% across joints between trunking lengths and/or fittings.
Use purpose made fittings of the same manufacture where trunking connects to switchgear and distribution boards.
Provide flanges for connection of flush floor trunking to vertical trunking to maintain the cross sectional area of compartments with 50 mm minimum radius.
Maintain electrical continuity at each joint by a copperlink, (tinned copper for galvanized trunking), fixed on outside of trunking, secured by screws, nuts and shakeproof washers. Screws must not project through the nut. Make provision for continuity to be achieved without need to remove paint from ferrous metal where trunking has a painted finish.
Screws, Nuts, Washers
Do not use self tapping screws. Use cheese or round head screws except where provision is made for the use of counter-sunk heads.
Material
Use steel zinc coated
•BS 3382 Parts 1 and 2.
Cable supports
Provide horizontal trunking with removable cable retainers or bridges to retain cables in situ.
Provide vertical trunking with pin racks to support cables at 3000 mm maximum spacing.
Use insulated pins or insulation sleeved pins on pin racks.

Y60.2090D FLUSH FLOOR TRUNKING:
Trunking bodies
Supply trunking bodies complete with flanged connections for service outlet boxes.
Screwed levelling device.
Secure covers to trunking body using countersunk brass screws with slots, crosshead or hexagon

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key heads or steel cam locking devices for use with a removable tool.
Provide cork gasket or equivalent between cover and flange for sound deadening.
Trunking lids
Provide for trunking body recessed lids to suit applied floor finish.
Ensure securing devices on recessed covers are accessible without removing applied floor finish.

Y60.2090F ALUMINIUM DADO TRUNKING:
Material extruded aluminium - BS EN 50085.
Wall/dado trunking - three compartment.
Installation - surface.
Style - extrusion as manufacturer's standard.
Colour - manufacturer's standard or BS 4800 shade to be approved.

Y60.2100A UNDERFLOOR STEEL TRUNKING:
Trunking material
Sheet steel trunking to BS 4678-2.
Gauge of Metal - Table 1 BS 4678.
Degree of Protection - Class 3.
Connection to vertical trunking
Provide flanges for connection of vertical trunking and temporary blanking plates.
Maintain cross sectional area of compartments with 50 mm minimum radius for connections to vertical trunking.
Trunking bodies
Supply trunking bodies complete with flanged connections for service outlet boxes.
Use screwed levelling devices.

Y60.2110A SERVICE OUTLET BOXES:
•Recess lids
Provide service outlet boxes and junction boxes constructed from sheet steel with same finish as trunking.
Maintain continuity and segregation of compartments through boxes and fit flyovers where necessary.
Provide service outlet boxes with separate and segregated access to outlets associated with each wiring compartment. Fit cable guard or grommet to each section.
Incorporate spigots on boxes for connection to trunking.
Make frames adjustable on each corner, recess lids.
Manufacture frame and lids for service outlet boxes and junction boxes of cast metal, and suitable to accept type of floor covering.
Outlet plates
Provide outlet plates for each low voltage compartment equipped with socket outlets.
Provide outlet plates for each extra low voltage compartment equipped with items.
Provide outlet plates for each telephone compartment that ensure the telephone compartment and its outlet plate conform to the requirements of BT and of the telephone system installer, equipped with telephone outlets.
Provide blank outlet plates for any unused compartments.

Y60.2120A POWER POLES:
Provide service poles complete with associated conduit or trunking fittings. Maintain continuity and segregation of circuits throughout. Provide outlet boxes with separate access to wiring compartments.
Material - Extruded Aluminium.
Finish - Manufacturer's standard.
Fixings - Free standing or complete with fixing brackets at top.

Y60.2130A PVC SERVICE TRUNKING – GENERAL PURPOSE
Trunking to BS4678-4
Mechanical properties, trunking for medium mechanical stress.
Temperature tolerances – BS 4678-4, Table 1.
Electrical characteristics
Without electrical insulating characteristics.
Resistance against ingress of solid objects
Protected against solid objects greater than 1.0mm (IP4X).

Deleted: Stage E Issue

Resistance to ingress of water
Protected against dripping water (IPX2)
Resistance against corrosive or polluting substances
Medium protection.
Fittings
Use fittings from same manufacturer as trunking Use 'snap-on-covers. Use trunking fittings and Accessories suitable for jointing by solvent welding.
Use proprietary cable retaining clips at 500 mm maximum intervals on trunking that exceeds 1.8 m in length. Where junctions occur ensure first clip is not more than 300 mm from junctions.

Y60.2150A SEPARATE OR MULTI-COMPARTMENT TRUNKING:
Use separate trunking or multi-compartment trunking for segregation of services. Ensure steel partitions have a provision for connecting a circuit protective conductor.
Provide separation of wiring for circuits as required by BS 7671.

Y60.2170 SUPPORTS AND FIXINGS:
Provide proprietary suspension systems comprising channel sections with return lips and compatible fixing accessories made of material to BS EN 10162, BS EN 10210 and/or slotted angles to BS 4345.
Ensure support components for Class 4 conduit have the same finishing method as the conduit carried out after manufacture. Ensure components in direct contact with conduit match profile of conduit.
Ensure all steel components such as studding, bolts and steel screws, bolts, nuts and washers are either cadmium plated and passivated or zinc electroplated to BS 3382 after manufacture. Do not use metal fixing components likely to deteriorate and/or cause damage through electrolytic action.

Y60.3010A GENERAL:
Ensure entire system is electrically and/or mechanically continuous, to BS 7671.
Fire barriers
Comply with the requirements of BS 7671 wherever the conduit or trunking passes through the perimeter of a fire compartment (wall, floor or ceiling).
Appearance
Arrange conduit, trunking and ducting to present neat appearance, parallel with other service runs and lines of building construction, except where in screed or in-situ concrete. Ensure plumb vertical runs.
Cable installation
Install cable in conduit, trunking or equipment enclosures only when completely erected throughout its length.
Do not use framework of partitions or similar unless indicated.
Building expansion and settlement
Make provision in conduit and trunking at expansion and settlement joints to allow for movement of building structure. Provide circular through or adaptable boxes no more than 300 mm either side of expansion or settlement joints for conduit crossing.
Join boxes with flexible steel conduit type C or conduits arranged to form a telescopic joint and cover overall with PVC sleeve to provide minimum degree of protection of IP44 or purpose made telescopic joint protected by a PVC sleeve to at least IP44.
Quality
Cut conduit clean and square with axis. Remove any burrs prior to erection.
Site form 90° in conduit wherever practical or use circular or adaptable boxes.
Construct bends and sets cold with a bending machine. Do not apply heat when forming sets or bends.
Use bending tools complying with British Standards appropriate to conduit material.
Ensure no indentation or reduction in cross sectional area occurs during installation.
Use correct tools to assemble conduit. Ensure no toolmarks or damage to components occurs.

Y60.3020 LAYOUT:
Ensure the maximum circuit lengths and groupings of cables indicated are not exceeded.
Conduit sizing
Where dimensions are not indicated select trunking and conduit sizes in accordance with Appendix A of Guidance Note I Selection and Erection published by the IEE (now IET).

Y60.3030 SPACING:

Deleted: Stage E Issue

Install conduit, trunking and equipment clear of other services. Measure distance from external surface of any thermal insulation. Notify instances where minimum clearance cannot be achieved and bond items concerned. Minimum general spacings between conduits, trunking, equipment and
insulated steam services - 300 mm.
other services excluding steam - 150 mm.
above central heating radiators - 1000 mm.
ensure separation is in accordance with Appendix K of Guidance Note I Selection and Erection published by the IEE (now IET).

Y60.3040 CONDENSATION PREVENTION:
Install conduit and trunking systems to ensure internal condensation does not affect operation of associated circuits. Provide drainage points in accordance with BS 7671.
Where conduit passes through external wall between two areas of different ambient temperatures or in other locations likely to cause condensation, install a conduit or adaptable box. After wiring fill box with inert, permanently plastic compound with high insulation value.

Y60.3050A PROTECTION AND REPAIR OF STEEL COMPONENTS:
Paint joints of conduit and minor damages to finish of conduit and trunking immediately after erection or after damage occurs.
Use paint compatible with finish as follows
Galvanized finish, use two coats zinc rich paint.
Black enamelled finish, use two coats of good quality, air drying, black enamel paint.
Remove grease, oil, dirt and rust before applying protective paint.
Notify serious damage and repair or replace as instructed.

Y60.3060 EQUIPMENT CONNECTIONS:
Where surface mounted equipment is installed in conjunction with concealed conduit work, terminate concealed conduit at flush mounted conduit or adaptable box. Drill back of equipment, bush for back entry and mount equipment to conceal back box.
Connect to fixed equipment via conduit box located adjacent to termination point, using either solid or flexible conduit as indicated for final connection to equipment terminations.
Use conduit box as cable change point to facilitate changed wiring locally to adjacent equipment.
Connect trunking to equipment by specially fabricated connectors or by couplers and externally screwed brass bushes.

Y60.3070 CLEANING BEFORE WIRING:
Clean inside of conduits and trunking with swabs immediately before wiring.
Inspect all components and remove any foreign matter, fit temporary plugs to open ends of conduit and trunking to prevent ingress of water and solid material.

Y60.3080A WIRING:
Comply with BS 7671 when wiring installations.
Segregate circuits as indicated.
Ensure draw wires are left within empty conduits for use of specialist installers. Use draw wires comprising nylon tapes with fitted eyelets.
For concealed conduit ensure system is installed to enable re-wiring to be carried out from boxes for fittings or accessories only. Draw-in boxes will only be permitted with prior permission in writing.
Do not use tallow or any other substances to facilitate drawing-in of cables.

Y60.3090 BUILDERSWORK:
Ensure conduit is not concealed until work has been inspected and approved.
Obtain permission before horizontally chasing walls.
Ensure that conduit and fittings buried in concrete or behind plaster are protected against corrosion or electrolytic action prior to rendering.
Ensure conduit concealed in wall chases is covered by plaster and/or rendering to minimum depth of 12 mm.

Y60.4010 DRAW-IN BOXES:
Provide draw-in boxes in conduit at maximum intervals of 10 metres or after bends and/or sets totalling 180 degrees.

Deleted: Stage E Issue

Y60.4020 INSTALLATION OF CAST IN OR BURIED CONDUIT:
Ensure cast-in conduits are firmly secured to reinforcing steelwork and that accessory and/or conduit boxes are secured so they do not move during subsequent building operations.
Ensure there is no blockage immediately shuttering is removed.
Check there is no mechanical damage to conduit in floor screed prior to screeding. Fix securely before screed is poured. Provide temporary protection to conduits until screeds are laid.
Ensure minimum amount of cross-overs occur dependent upon screed depth. Do not install draw boxes in floors.
Do not install conduits
in screeds in areas indicated.
within site blinding.
in main structural slabs unless prior permission in writing is obtained.

Y60.4030 CONDUIT BOXES:
Ensure that wherever conduit boxes are cast in the face of the box is flush with the face of the concrete or plaster. Fit circular conduit boxes with extension rings to ensure a flush face with plaster or concrete or where terminal blocks are to be accommodated.
Ensure fixing holes are countersunk where material thickness allows or use round head screws to prevent damage to cables and remove burrs before cables are drawn in.
Use a minimum of two screw fixing for standard circular conduit boxes and four screws for large conduit boxes and adaptable boxes up to 150 mm x 100 mm.
Use back outlet boxes where surface conduits pass through walls, to outside accessories or lighting points.
Secure switch boxes and socket boxes using countersunk steel screws where provision is made for them or if not use round head screws. Use plug inserts and finally grout in position prior to plastering or screeding.

Y60.4040 FIXING CONDUIT:
Support conduit in accordance with Appendix I of Guidance Note I Selection and Erection published by the IEE (now IET).
Ensure conduit is not under mechanical stress. Fix conduit boxes independently of conduit. Make allowance for any additional mechanical loading supported by conduit boxes.
Where protection is specified as IP44 or greater ensure fixings of conduit boxes are suitable to maintain degree of protection.
Use following methods of fixing conduit:-

LOCATION	TYPE OF FIXING
Floor screeds.	Saddles or crampets.
Buried in plaster or render.	Crampets or saddles.
Above false ceilings.	Saddles.
Surface.	Saddles.

Y60.4050 FLEXIBLE AND PLIABLE CONDUIT:
Use flexible conduit for final connections to motors, other equipment subject to vibration or adjustment and to thermostats, motorised valves and similar items mounted in pipelines or ducts.
Use sufficient length between equipment and circular through box at end of conduit run (minimum 450 mm) to allow necessary full range of withdrawal, adjustment or movement.
Use solid type adapters to terminate flexible conduit.
Use PVC covered flexible conduit where installed externally, exposed to weather or in any position where ingress of moisture or condensation may occur.

Y60.4060 SCREWED STEEL CONDUIT:
Use materials clean and free from defects, rust, scale and oil. Obtain prior permission in writing for use of materials subject to remedial work before erection. Repair any damage caused by threading, bending or erection by painting with zinc rich paint before any rust occurs.
Ensure length of thread on conduit matches that in conduit couplers, fittings or equipment with no thread exposed after erection except at running couplers.
Ensure conduits butt inside couplers.
Use lubricant when cutting threads.
Use minimum number of running couplings

Deleted: Stage E Issue

For running couplings in Class 2 conduit, use coupler and locknut. Paint exposed thread with zinc rich paint.
For running couplings in Class 4 conduit, use three piece conduit unions.

Y60.4070A NON-METALLIC CONDUIT:
Comply with manufacturer's instructions for bending, setting and jointing of conduit. Use plastic conduit only where indicated.
Do not install conduit when ambient working temperature is or will be below -5°C or above 60°C.
Use solvents recommended by manufacturer of conduit when using solvent welded joints and ensure spigots enter full depth of sockets. Hold joints rigid and in position until weld sets. Remove excess solvent before surface damage occurs.
Use slip joints as necessary, but not exceeding 6 metres on straight lengths to allow for expansion and contraction over temperature variation as indicated.
Use semi-mastic adhesive where expansion joints are formed.
Where fitments do not have shaped or smooth conduit entries connect with male bushes and external couplings.
Ensure special care is taken to prevent mechanical damage or warping to conduit where mechanical loads are imposed on conduit system, e.g. lighting fittings.

Y60.4080 UNDERGROUND INSTALLATION:
Where buried below ground, use Class 4 conduit. Do not use any buried conduit boxes unless prior permission in writing has been obtained. Wrap conduit with PVC self-adhesive tape, half lapped. Extend taping 150 mm beyond point where conduit leaves ground. Install circular through conduit boxes at the end of the tape. Fill conduit boxes after cable installation with inert, permanently plastic compound with high insulation value, and wrap in PVC self adhesive tape.

Y60.5010 MANUFACTURE OF TRUNKING:
Take measurements on site before producing drawings for manufacture of trunking.

Y60.5020 ACCESS:
Arrange trunking to allow access to wiring. Locate covers on top or sides of trunking if practicable. Arrange access so covers are on a continuous face and cables can be laid in throughout the length of the trunking. Notify where either condition cannot be achieved.

Y60.5030A FIXING TRUNKING:
Ensure trunking is independently fixed and supported from building fabric. Obtain approval for proposed fixings/supports.
Support trunking in accordance with the manufacturer's requirements and/or Guidance Note 1 Selection and Erection published by the IEE now (IET).
Use two fixings minimum per standard length.

Y60.5040A STEEL TRUNKING:
Install steel trunking in accordance with the manufacturer's requirements and those of BS 7671.
Use trunking to avoid multiple parallel conduit runs, subject to approval.
Cut trunking clean and square with axis, prepare ends and remove burrs and sharp edges. Ensure inside of trunking is free from anything liable to damage cables either during installation or after covers are fitted.
When trunking is held in a vice, ensure surfaces remain undamaged and components are not warped.
Avoid tool marking or damage to trunking system components.
Do not site fabricate trunking tees, bends, flanges and other accessories. Use only factory made accessories.
Form circular holes over 6 mm diameter in trunking body using correctly sized punch sets. Use twist drill for holes up to 6 mm maximum diameter.
Use only factory formed openings for accessories.
Line unprotected apertures in trunking with PVC or nylon edging strip.
Fit ends of runs with removable blanking plates.
Ensure connections are not made to covers unless indicated or approval obtained.
Provide fixed section of cover projecting 25 mm either side of fabric where trunking passes through wall, floors or ceiling.
Fit cable retaining straps at 500 mm intervals except where cover is on top.

Y60.5050 UNDERFLOOR AND FLUSH FLOOR TRUNKING INSTALLATION:
Lay underfloor and flush floor trunking straight and level. Adjust height of services outlets, junction boxes and flush floor trunking to suit top of screed level. Ensure that spaces below trunking are free from voids and correctly packed. Prevent ingress of screed by masking where necessary.
Ensure trunking levelling and alignment is carried out in co-operation with person(s) responsible for confirming location and finish of floor levels.
Immediately following installation of trunking fit temporary covers to service outlets, junction boxes and flush floor trunking. Fit temporary blanking plates over open connections to vertical trunking.
Retain temporary covers until permanent covers are installed.
Ensure underfloor trunking systems are fully rewireable to final circuit outlets.
Connect conduits only at inspection or other easy access points.

Y60.5060 TRUNKING OF INSULATING MATERIAL:
Comply with manufacturer's instructions. Do not install trunking where ambient temperature is below -5°C or working temperature is above 60°C.
Use solvents recommended by trunking manufacturer when making solvent welded joints. Remove excess solvent before surface damage occurs. Hold joints rigid and in position until welds set.
Use manufacturer's standard radiused bends, connector tees, off-sets, end plates and component parts of trunking system assembly.
Ensure no type of trunking other than that specified is installed without approval.
Trunking may be substituted for conduit at certain positions subject to approval.

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Y61 HV/LV CABLES AND WIRING

Y61.1000 GENERAL
1010 CABLE MANUFACTURE:
Use new cables, delivered to site with seals intact, manufactured not more than one year prior to delivery, labelled with manufacturer's name, size, description, BS number, classification, length, grade and date of manufacture.
1020 CABLE CERTIFICATION MARKING:
Mark all types of cables with CENELEC cable certification marking or if included in British Approvals Service for Cables (BASEC) in accordance with BASEC regulations.

Y61.2005 LSOH SHEATHING:
Supply cables with Low Smoke Zero Halogen (LSOH) sheathing, tested in accordance with BS EN 50267 and BS EN 60332.

Y61.2010B STANDARD LSF FLEXIBLE WIRES - SINGLE COPPER CORE:
Standard - BS 7211, Tables 3(b) and 4(b).

Y61.2010C STANDARD HEAT RESISTING (110 DEGREES CENTIGRADE OR MORE) FLEXIBLE WIRES - SINGLE COPPER CORE:
Standard - BS 6004, Table 11(b); BS 6007, Tables 5, 8, and 10.

Y61.2010E STANDARD HOFR FLEXIBLE CORDS - MULTI COPPER CORES:
Standard - BS 6500, Table 16.

Y61.2020A STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, THERMOSETTING INSULATION, SHEATHED:
Standard - BS 5467, Tables 4, 6, 8, and 10.
Mechanical protection - Unarmoured.

Y61.2020B STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, THERMOSETTING INSULATION, SHEATHED AND ARMOURED:
Standard - BS 5467, Tables 4, 6, 8, and 12.
Mechanical protection - Armour.

Y61.2020E STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, LSF SHEATHED AND ARMOURED:
Standard - BS 6724, Tables 4, 6, 8, and 10.
Mechanical protection - Armour.

Y61.2020G STANDARD CABLES FOR CONDUIT AND TRUNKING, COPPER CONDUCTORS, LSF INSULATED:
Standard - BS 7211, Tables 3(a) and 4(a).
Mechanical protection - Conduit and trunking.

Y61.2020J STANDARD FLAT CABLES, 2-CORE OR 3-CORE, COPPER CONDUCTORS WITH OR WITHOUT CPC, LSF INSULATED SHEATHED:
Standard - BS 7211, Table 7.

Y61.2020K STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS LSF INSULATION, SHEATHED:
Standard - BS 7211, Tables 5 and 6.
Mechanical protection - Unarmoured.

Y61.2020M STANDARD CABLES WITH DEFINITE FIRE PERFORMANCE:
Standard - BS 7629-1 type as shown on drgs/schedules.
Fire performance BS 5839-1 Standard.
Sheath colour - red.
Mechanical protection, as shown on drgs/schedules.

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Y61.2030C STANDARD 11 KV, COPPER CONDUCTORS, ARMOURED AND SHEATHED CABLES:
Standard - BS 6622, Tables 4 and 5.
Mechanical protection - Armour.

Y61.2040D HEAVY DUTY MINERAL INSULATED CABLES, LSF OUTER COVERING:
Standard - 750V heavy duty to BS EN 60702-1, section 15.
Outer covering
Halogen free material to BS EN 60702-1, section 8.3.

Y61.2040E HEAVY DUTY MINERAL INSULATED CABLES, LSF OUTER COVERING:
Standard - 750V heavy duty to BS EN 60702-1, section 15.
Outer covering
Halogen free material to BS EN 60702-1, section 15.
Fire performance BS 5839-1 enhanced.
Sheath colour - Red.

Y61.2050A PAIRED, UNSCREENED AND UNARMOURED CONTROL CABLES:
Standard - BS 5308-1, Tables 2, 4 and 8.
Mechanical protection - Unarmoured, Type 1.

Y61.2050B PAIRED, UNSCREENED AND ARMOURED CONTROL CABLES:
Standard - BS 5308-1, Tables 2, 4 and 8.
Mechanical protection - Armour, Type 2.

Y61.2050C PAIRED, SCREENED AND UNARMOURED CONTROL CABLES:
Standard - BS 5308-1, Tables 3, 5 and 9.
Mechanical protection - Unarmoured, Type 1.

Y61.2050D PAIRED, SCREENED AND ARMOURED CONTROL CABLES:
Standard - BS 5308-1, Tables 3, 5 and 9.
Mechanical protection - Armour, Type 2.

Y61.2050E MULTI-CORE UNARMOURED AUXILIARY CABLES:
Standard - BS 5308-2, Tables 2, 3 and 6; BS 6346, Table 19.
Mechanical protection - Unarmoured, BS 5308 Type 1.

Y61.2050F MULTI-CORE ARMOURED AUXILIARY CABLES:
Standard - BS 5308-2, Tables 2, 3 and 6; BS 5467, Table 18; BS 6346, Table 19.
Mechanical protection - Armour, BS 5308 Type 2.

Y61.2050G MULTI-CORE UNARMOURED LSF, SHEATHED AUXILIARY CABLES:
Standard - BS 7211, Table 6
Mechanical protection - Unarmoured.

Y61.2050H MULTI-CORE ARMOURED LSF, SHEATHED AUXILIARY CABLES:
Standard - BS 6724, Table 18.
Mechanical protection - Armour.

Y61.2050I CONTROL AND AUXILIARY CABLES WITH DEFINITE FIRE PERFORMANCE:
•Drawing/schedule reference
Standard - BS 7629; type as shown on drgs/schedules.
Fire performance approval - LCPB.
Sheath colour - red.
Mechanical protection, as shown on drgs/schedules.

Y61.2050K FIRE ALARM CABLE:
Standard - BS 7629-1.
Mechanical protection - Unarmoured.
Fire performance - BS 5839-1 Standard.

C0605 The New LMB Building Project Y61
Electrical Specification HV/LV CABLES AND WIRING
Revised Stage E Scheme Including Agreed VE

Deleted: Stage E Issue

Y61.2070A STANDARD FILLED COMMUNICATIONS CABLES FOR OUTDOOR AND UNDERGROUND:
Standard - BS 3573, Tables 7, 8, 9, 10 and 11.

Y61.2070B STANDARD COMMUNICATIONS CABLES FOR INDOOR USE:
Standard - BT CW 1308; BT CW 1370; BT CW 1700; and BT CW 1750.

Y61.2080A STANDARD COAXIAL CABLES, FOR BROADCAST RECEIVING:
Standard - BS EN 50117.

Y61.2090A OPTICAL FIBRE CABLES:
Standard - BS EN 60794-3.

Y61.2100A INFORMATION TECHNOLOGY CABLES - STRUCTURED WIRING:
Provide IT cables in accordance with the IT system suppliers specification.
Type of system - Structured cabling - EIA/TIA 568-B.
Specification - EIA/TIA 568-B.
Termination reference - EIA/TIA 568-B.
Cable construction - Multi pair; unshielded (UTP).

Y61.3010A CABLES GLANDS - UNARMOURED CABLES, INDOORS:
Cable type
Flexible; wiring and power; control and auxiliary; and communications.
Standard - BS EN 50262 non-metallic, cable retention, IP54; A1P.
Environment - Indoor.

Y61.3010B CABLES GLANDS - UNARMOURED CABLES, OUTDOORS:
Cable type
Flexible; wiring and power; control and auxiliary; and communications.
Standard - BS EN 50262 non-metallic, cable retention, IP54; A2P.
Environment - Outdoor.

Y61.3010C CABLES GLANDS - ARMOURED CABLES, DRY INDOORS:
Cable type
Wiring and power; and control and auxiliary.
Standard - BS EN 50262 metallic, cable retention Class A, protective connection to earth, IP54.
Environment - Dry indoors.

Y61.3010D CABLE GLANDS - ARMOURED CABLES, INDOORS:
Cable type
Wiring and power; and control and auxiliary.
Standard - BS EN 50262 metallic, cable retention Class A, protective connection to earth, IP54.
Environment - Indoor.

Y61.3010E CABLE GLANDS - ARMOURED CABLES, OUTDOORS:
Cable type
Wiring and power; and control and auxiliary.
Standard - BS EN 50262 metallic, cable retention Class A, protective connection to earth, IP54 with shroud.
Environment - Outdoor.

Y61.3020A CABLE SEALS AND GLANDS - HEAVY DUTY MINERAL INSULATED CABLES - PROTECTED FOR 'D' 'I' 'N' HAZARDOUS AREAS:
Use seals and glands for mineral insulated cables in accordance with BS EN 60702-2, recommended or supplied by cable manufacturer.
Gland Type
Cable grip type, externally threaded for threaded entry. Certified for hazardous areas to BS EN 60079-14, `d', `i' or `n'.
Gland Shroud

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Thermoplastic or LSF material to match sheath.
Seal type
Plain or earth tail and self-threading pot.
Pot closure - Plastic stub cap.
Pot sealant - Compound, 105°C
Conductor insulation sleeving - Plain PVC.
Seal maximum temperature rating - 105°C.
Other seal characteristics
Certified to BS EN 60079-14 for hazardous areas.

Y61.3020B CABLE SEALS - HEAVY AND LIGHT DUTY MINERAL INSULATED CABLES - PROTECTED 'E' FOR HAZARDOUS AREAS:
Use seals for mineral insulated cables in accordance with BS EN 60702-2, recommended or supplied by cable manufacturer.
Seal type
Plain; or earth tail and self-threading pot; or polymeric one piece.
Pot closure - Plastic disc.
Pot sealant - Epoxy putty.
Conductor insulation sleeving - Headed PTFE.
Seal maximum temperature rating - 100°C or 85°C.
Other seal characteristics
Certified to BS EN 60079-14 for hazardous areas, `e'.

Y61.3020C CABLE SEALS AND GLANDS - HEAVY OR LIGHT DUTY MINERAL INSULATED CABLES - TEMPERATURES UP TO 105 DEGREES CENTIGRADE:
Use seals and glands for mineral insulated cables in accordance with BS EN 60702-2, recommended or supplied by cable manufacturer.
Gland Type
Cable grip type, externally threaded with lock washer and nut.
Gland Shroud
Thermoplastic or LSF material to match sheath.
Seal type - Plain or earth tail and self-threading pot.
Pot closure - Plastic stub cap.
Pot sealant - Compound, 105°C
Conductor insulation sleeving - Plain PVC.
Seal maximum temperature rating - 105°C.

Y61.3020D CABLE SEALS AND GLANDS - LIGHT DUTY MINERAL INSULATED CABLES - TEMPERATURES UP TO 105 DEGREES CENTIGRADE:
Use seals and glands for mineral insulated cables in accordance with BS EN 60702-2 recommended or supplied by cable manufacturer.
Gland Type
Cable grip type, internally threaded, with bush.
Gland Shroud
Thermoplastic or LSF material to match sheath.
Seal type - Plain or earth tail and self-threading pot.
Pot closure - Plastic stub cap.
Pot sealant - Compound, 105°C
Conductor insulation sleeving - Plain PVC.
Seal maximum temperature rating - 105°C.

Y61.3030A VOLTAGE SURGE SUPPRESSORS FOR CABLES:
Provide voltage surge suppressors in accordance with cable and equipment manufacturer's recommendations.

Y61.3040A CABLE TERMINATING AND JOINTING SOCKETS:
•Connection type
•As shown on drawings/schedules
Standard and type - compression to BS EN 61238-1.

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Y61.3050A LSF INSULATING TAPE:
Standard - BS 3924, LSF material.

Y61.3060A CABLE JOINTS AND TERMINATIONS:
Use only cable joints as supplied or recommended by cable manufacturer.
Cable type - Power or control and auxiliary.
Joint arrangement - Straight through or tee.
Joint type - BS 6910, cold pour or heat shrink.
Accessories - Armour bonds, BS 7197; filling compounds.
Environment - Underground.

Y61.3080A CONNECTORS FOR COAXIAL CABLES - BROADCAST RECEIVING:
BS 3041-2 or UHF to BS 3041-12.

Y61.3110A CABLE DUCTS:
Standard
BS 65, DN 90; BS 4660 provided by Electricity Supply Company.

Y61.3120A CABLE SLEEVES:
Supply and hand to others for installation non ferrous cable sleeves for incorporation into the structure where cables pass through fire compartment floors and walls.
Packing material
Weak mix mortar; intumescent, plaster or mastic; solid intumescent material; or intumescent granule filled bags.

Y61.3130A CABLE COVERS AND MARKERS:
Material - Recovered plastic, integral tape.
Marking - Electricity or telephone.
Plastic marker tape
Yellow, marked electricity or telephone.

Y61.4010 CABLE INSTALLATION - GENERAL:
Use and install cables only as directed in the appropriate standard or as directed by the manufacturer in writing. Lay cables in one length unless otherwise indicated. Obtain permission from supervising officer for all through joints, and where overall length requirement exceeds practical drum size.
Install cables when ambient temperature is 5°C or greater, using cables stored at or above this temperature for not less than 24 hours.
Use drum stands, drum axles, fair leads, rollers, cable stockings and other equipment as recommended by the cable manufacturer and as appropriate to the method of installation.

Y61.4020 CABLE INSTALLATION IN LOW TEMPERATURES:
Install cables at lower installation temperatures when authorised by manufacturer in a written statement.

Y61.4030 INSTALLATION OF LSF CABLE:
Install LSF cables in accordance with manufacturer's instructions. Ensure ambient temperature is above 5°C. Ensure oversheaths are not damaged by abrasion or scuffing.

Y61.4040 INSTALLATION OF UNARMOURED CABLES:
Install and use unarmoured cable to BS 6004, BS 6007, BS 6500, BS 7211 and BS 7919 in accordance with BS 7540-1, BS 7540-2, BS 7540-3 or the manufacturer's written instructions.

Y61.4050A CABLE TRENCHES:
Ensure that trenches for cables and cable ducts are prepared, backfilled and reinstated.
Supervise all work to cable trenches by others.
Carry out walk over survey of trench route, dig trial hole in any area considered to be potentially difficult. Establish location of any other underground service adjacent to cable route.
Re-plan cable routes after survey and trial holes. Submit report of survey and trial holes.
Carry out any instructed work to adjacent services. Set out cable trenches, excavate trench carefully setting aside any materials required for backfilling or reinstatement.

Deleted: Stage E Issue

Minimum cover in cable trenches
HV cables 800mm; LV cables 500mm; communications cables 500mm; all cables 800mm under roadways.
Trench
Common trench for all underground services.
Grade trench bottom to a maximum slope of 1:12.
Clear trench bottom of loose stones and place bedding to full width of trench.
Bedding
Riddled earth 6mm grid for cables; riddled earth 12mm grid for ducts; imported soft sand; or pea shingle, for ducts.
Bedding thickness - 75mm; or 100mm for ducts.
Install cables or ducts. Haunch cables or ducts in bedding material to a minimum depth of 75mm above highest cable or duct.
Cable or duct identification
Warning tape - Yellow with black legend.
Backfill trench using two layers 100mm thick hand rammed. Complete backfilling in layers and reinstate trench.
Backfill material - as excavated from trench.

Y61.4060 CABLE INSTALLATION IN TRENCHES:
Lay cables on newly prepared bedding. Ensure multiple layers of cable are separated vertically by a 50mm layer of hard rammed bedding material.
When using a power winch ensure tension on the cable is taken by element of the cable designed for that purpose, that is armour or conductor cores as appropriate and not plastic sheath, metal sheath or core insulation.
When hand pulling cable ensure no kinks are formed and that flaking, when used, is done in the correct direction.
Do not allow cable to twist during installation. Use swivels to connect pulling bond to cable stocking or equivalent fitting.
Check drum is suitable for jacking before commencing installation. If drum or reel is unsuitable for jacking, flake cable in correct direction in maximum size turns from drum or reel before commencing installation. Use skilled labour to supervise all unreeling, flaking or running of cable from a drum.
Lay cables in the formation shown, ensure spacing is not reduced below that indicated.
Bind trefoil groups at 1m intervals. Bind any associated earth or protective conductor to its cable or trefoil group at 1m intervals.
Ensure installation radii and permanent bending radii are not less than those recommended by the manufacturer.
Do not lay cables to BS 6004, BS 6007, BS 6500, BS 7211 or BS 7919 direct in the ground.

Y61.4070A CABLE DUCTS:
Duct work
Supervise the laying of ducts by others.
Lay ducts in the formation shown, on to newly prepared bedding. Joint ducts in accordance with the manufacturer's instructions.
Ensure that ducts slope no more than 1:60 vertically or 1:30 horizontally.
Ensure that pre-formed duct bends used at ends of duct routes meet the requirements of the cable manufacturer for bending radii.
Construct manholes, draw pits and jointing chambers.
Prove alignment of completed duct run by drawing through a mandrel 7mm diameter less than nominal duct bore for minimum length 250mm. Clean completed duct run by drawing through a circular wire brush 12mm diameter more than nominal duct bore.
Install a draw wire of corrosion resistant material and minimum breaking strength 550N in each empty duct.
Plug and seal all ducts with proprietary duct plugs, on completion.

Y61.4080 CABLE INSTALLATION INTO DUCTS:
Install cables into newly proved and cleaned duct. Use lubricants, recommended by the cable manufacturer in writing, to assist drawing process.
Flake cable if drums or reels are not suitable for jacking. At intermediate draw pits with exit duct more than 15 degrees off line of entry duct, flake cable before entering or provide comprehensive system of

Deleted: Stage E Issue

corner plates, roller and blocks. Use maximum practical size of turns when flaking and ensure direction is correct.
Do not exceed manufacturer's installation tension on cable and ensure the pulling tension is taken on cable elements designed for that purpose, that is armour or conductor cores and not on other elements, such as plastic sheath or conductor insulation.
Do not allow cables being pulled into ducts to twist. Use appropriate swivel between pulling bond and cable stocking or similar appliance.
Bind trefoil groups of single core cables installed into a single duct at 1m intervals. Install earth or protective conductors into the same duct as the associated cable where practical, through manholes, draw pits and jointing chambers. Bind the two cables together. Pull all cables in one duct as a group.
Ensure group does not twist or cross over. Report any damage to cable sheath during installation and carry out any instructed work to remedy the damage.
Seal between cable and duct ends after cable installation. Ensure cable ends in jointing chambers are temporarily sealed where required.

Y61.4090A CABLE INSTALLATION IN CONDUIT AND TRUNKING:
Install cables so that they are orderly and capable of being withdrawn.
Arrange single core wiring generally using the loop-in method.
Trunking
In vertical trunking provide pin racks at 3m intervals. Use ties at 2m intervals for all wires of the same circuit reference. Mark ties with circuit reference number at 10m intervals.
Conduit
Provide cable clamps in conduit boxes at 10m intervals in vertical conduit.
Allow for full range of movement at building construction movement joints. Make all joints to wiring at terminal blocks in conduit boxes.

Y61.4100 CABLE INSTALLATION ON TRAY AND RACK:
Place cables side by side or as indicated. Fix using cleats or cable ties so that any cable may be individually removed. Use metallic ties on cables with specified fire performance.

Y61.4110A CABLE SURFACE INSTALLATION:
Dress cables flat, free from twists, kinks and strain, and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.

Y61.4120A CABLE EMBEDDED INSTALLATION:
Dress cables flat, free from twists, kinks and strain, and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.
Ensure plaster or screed over cable is a minimum of 12mm. Protect embedded cables with metal capping or PVC oval conduit.

Y61.4130A CABLE INSTALLATION - MINERAL INSULATED CABLES:
Straighten and dress cables using methods and tools recommended by cable manufacturer.
Use thermoplastic or LSF sheathed cables in location indicated, and where cables may come into direct contact with any material that may be corrosive to copper.
Do not allow extra length on installed cables to allow for cutting back of moisture affected ends. Store mineral insulated cables in the form as supplied by manufacturer.

Y61.4140 CABLE INSTALLATION - FLEXIBLE CORDS:
Grip cords securely at connections. Where they do not form an integral part of the connected accessory or equipment, provide separate proprietary cord grips.

Y61.4150A CABLE JOINTING AND TERMINATING GENERALLY:
Ensure all joints and terminations are made by appropriately qualified cable jointers, using jointing materials, components and workmanship recommended by the cable manufacturer and the jointing accessory manufacturer. Install cable glands in accordance with BS 6121-5.
Cold pour resin and heat shrink joints.
Cut all cable ends immediately prior to jointing or terminating. Seal cables left unconnected for more that 24 hours to prevent the ingress of moisture. Seal plastic sheathed cables using proprietary

Deleted: Stage E Issue

shrink on end caps. Seal lead sheathed cables by a plumbed dressed lead cap with an airspace to allow conductor movement.
Strip cables to bring out the cores and expose conductors, for the minimum length required for connection, to leave no exposed length of conductor after termination. Ensure that strands are not damaged when stripping cable cores. Twist strands together. Do not reduce number of strands. Secure all strands at terminations.
Clean armour thoroughly prior to jointing or terminating.
At connections to equipment and switchgear without integral cable clamping terminals, use compression or solder type lugs for bolted terminal connections, of correct bore.
Form all compression connections to components using tools that cannot be released unless the correct degree of compression has been achieved.
Install and inspect compression and mechanical connectors on conductors in accordance with BS EN 60228 and BS 7609.
Bolt core terminations with lugs to equipment using washers or proprietary shakeproof devices.
Do not bunch more than three cores at clamping terminals or bolted connections.
Mark cable conductor phasing, or other core identification, at each end of all cables, and at all joints, maintaining consistency of marking with any existing system.
Connect all cores, including multicore cable spare cores, at all joints and terminations. Bond any unused cores or multicore cables to earth at both ends, unless otherwise indicated.

Y61.4170 CABLE JOINTING AND TERMINATING - ELASTOMER AND PLASTIC INSULATED CABLES:
Joint cables using glands of the type indicated, in accordance with the manufacturer's instructions.
Use shrouds at all glands, unless otherwise instructed.
At core connections to equipment without integral clamping terminals use compression lugs unless otherwise indicated.

Y61.4180A TERMINATING - MINERAL INSULATED CABLES:
Use terminations in accordance with BS EN 60702-2 and components and materials recommended or supplied by cable manufacturer.
Use seals with maximum temperature rating indicated, stub caps to the largest size available, and drilled caps and headed sleeves for larger sizes.
Use glands of type indicated. At terminations to accessory boxes within a plaster or render finish, cable clamps fixed to accessory box and firmly gripping cable sheath may be used. Use earth tail seals with sheath grip type accessory boxes.
At equipment not provided with threaded entries secure glands using lock washers and locknuts or brass conduit bush. Use gland shrouds when plastic covered MI cables are used.
Using PVC, PIB or LSF material tape to BS 3924 or BS EN 60454 to match sheath, tape overall gland any bare copper sheath and form seal to cable sheath under all shrouds.
Mark core sleeving with appropriate identification.
Install voltage surge suppressors in accordance with manufacturer's recommendations and surge suppressors to BS 7671, Section 331-01-01.

Y61.4190A CABLE JOINTS - MINERAL INSULATED CABLES:
Joint mineral insulated cables using methods and materials recommended by cable manufacturer.
Terminate cables in externally threaded glands using seals with temperature rating indicated. Join conductors using crimped connectors.
Insulate connectors using PVC tape to BS 3924 or BS EN 60454, ensuring good seal to conductor sleeving. Make off glands into either end of internally threaded brass sleeve of correct size. Protect brass sleeve using heat shrink sleeve.

Y61.4200A COMMUNICATIONS COAXIAL, OPTICAL FIBRE AND IT CABLE INSTALLATION, JOINTING AND TERMINATING:
Use methods approved by cable and accessory manufacturers.
Employ labour certified by acceptable body as qualified to install and make joints and terminations in the referenced cable. Obtain in writing approval of cable manufacturer for accessories not supplied by them.
Identify cables using structured numbering scheme.
Install communication, coaxial, optical fibre and IT cables in accordance with BS EN 50174-1, BS EN 50174-2 and BS EN 50174-3.

C0605 The New LMB Building Project Y61
Electrical Specification HV/LV CABLES AND WIRING
Revised Stage E Scheme Including Agreed VE
Deleted: Stage E Issue

Y61.4210 CABLE SLEEVES:
Pack sleeves with fire resistant material after cable installation.

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Y62 BUSBAR TRUNKING

Y62.1000 GENERAL
1010 BUSBAR TRUNKING SYSTEMS STANDARDS:
Supply and install busbar trunking systems in accordance with BS EN 60439-1, BS EN 60439-2 and in particular the requirements of BS 7671 Requirements for Electrical Installations (The IEE Wiring Regulations).

Y62.2010A GENERAL PURPOSE BUSBAR :
System characteristics
Electrical Supply - Voltage between phases 400 volts; frequency 50 Hz.
Rate system to withstand a short circuit fault current of 21 kA.
Short time rating - 0.2 seconds.
Busbar
Use high conductivity busbars and connections.
Material - Copper.
Number of Poles - 3 phase and full size neutral.

Y62.2020A GENERAL PURPOSE STEEL BUSBAR TRUNKING:
Busbar trunking type
Surface; flush; bench or underfloor.
Busbar
Y62.2010A
Steel enclosure
Comply with relevant sections of BS 4678.
Apply high standard of finish to busbar trunking. For a painted finish apply a minimum of one coat rust inhibiting primer, one undercoat and two semi-gloss finish coats.
Remove rust and degrease metal prior to application of selected finish. Zinc coated steel is acceptable as anti-rust treatment.
Use rust-proofed (e.g. cadmium plated) screws, bolts, nuts and washers.
Finish - Paint or Stove enamel.
Colour- Manufacturer's standard colour.
Fittings
Use trunking fittings of the same type and manufacture as the busbar trunking. Use screw fixed covers. Use manufacturer's purpose made units at changes of direction.
Supply termination
Provide facilities for the correct termination of supply cable.
Fixings
Provide external fixing brackets at not greater than 2m intervals. In accordance with manufacturer's instructions and recommendations.
Marking
Provide clear marking of busbars and tap-off outlet sockets with phase colours to enable sequence identification throughout system.

Y62.2025B UNDERFLOOR TRUNKING WITH LV SOCKETS:
Standard - BS EN 61534-1.
Style - Underfloor.
Fittings - Use fittings of same type and manufacturer as trunking with snap on covers.
Provide facilities for termination of supply.
Connection of LV sockets - Plug in.

Y62.2030A TAP-OFF UNITS:
•Standard BS EN 61534-1.
Provide tap-off facilities along the busbar system at intervals as indicated.
Provide tap-off units with fuses, current rating, class and type as indicated; termination points for outgoing cables in every tap-off unit; and isolating switch with number of poles as indicated.

Y62.2040A INTERNAL PROTECTIVE CONDUCTORS:
•Standard BS EN 61534-1.

Deleted: Stage E Issue

Provide protective conductor throughout busbar system length to manufacturer's standard.
Busbar pole with tap-off at each socket for wall/dado type with integral socket outlets.
Install protective conductor internally to busbar enclosure.
Bond protective conductor to trunking enclosure using a method in accordance with BS 7430 at 1.2m maximum intervals.
Use high tensile brass bolts and locking nuts.
Complete trunking system before installing the protective conductor.
Ensure the continuity of protective circuits.

Y62.3010 GENERAL:
Install busbar trunking in accordance with manufacturer's instructions and the relevant standards.
Check total length of busbar system required on site prior to manufacture commencing.
Fit covers at end of each run or provide proprietary end boxes.

Y62.3020 BONDING:
Bond between adjacent lengths of busbar trunking with approved mechanical means to maintain conductivity, where two or more parallel runs of busbar trunking occur. Tighten bolted connections between adjacent lengths of busbars to correct torque setting. Avoid damage to conductors.

Y62.3030 EXPANSION:
Anchor busbars rigidly in a minimum of one position and provide means of absorbing maximum expansion and contraction likely to occur in busbars under normal operating conditions.
Provide expansion joints in each length of run

Y62.3040 LABELS:
Fix identification and warning labels throughout system length.

Y62.3050 FIRE BARRIERS:
Provide barriers of fire-resisting materials within the busbar trunking where vertical runs pass through floors and horizontal runs pass through fire break walls to prevent spread of fire. (BS 7671 Chapter 527).

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Y63 SUPPORT COMPONENTS - CABLES

Y63.1000 GENERAL
1010 APPLICATION:
Cables referred to in this section are only those types that can be installed without further mechanical protection.

Y63.2010A CABLE SUPPORTS AND FINISHES:
Cable supports
Support all cables throughout their length using conduit; or trunking and enclosures; or cable tray; or cable racking; or special support systems; or cleat or clip fixing direct to building fabric as indicated on the drawings/schedules.
Ensure tray, racking and special support systems are continuous and firmly fixed to building fabric.
Allow space for additional cables as indicated on the drawings/schedules.
Ensure cable support system allows for spacing in accordance with BS 7671 for the design current of the cable.
Fixings finishes
Ensure finish for all support components, fixings, hangers and accessories is as cable support system or manufacturer's standard.

Y63.2020A CABLE SUPPORT SYSTEM - PERFORATED TRAY:
Type - Flanged or return flanged.
Perforations
Admiralty pattern for light or medium duty; GDCD pattern standard 23; or manufacturer's standard pattern.
Thickness - Manufacturer's standard thickness for type.
Fittings
Use factory made fittings throughout of same material, type, pattern, finish and thickness as cable tray.
Use reducers, inside angles and outside angles as manufacturer's standard.
Use flat bends, equal tees, unequal tees and crosses with corners gusseted.
Join lengths of tray and fittings using manufacturer's standard shouldered ends, fish plates, or couplers, with galvanized or zinc plated slotted domed head `roofing' bolts, nuts, washers and shakeproof washers.
Material
Hot rolled steel galvanized after manufacture to BS EN ISO 1461; or bending and profiling quality hot dipped galvanized steel to BS EN 10326, BS EN 10327 or BS EN 10143.
Finish - Self colour galvanized.

Y63.2020B CABLE SUPPORT SYSTEM - CABLE RACK:
Proprietary system of channel sections with return lip and compatible jointing and fixing accessories
Fittings
Use factory made fittings throughout of same material finish and section as rack, for risers, bends, reducers, tees, crosses and drop outs.
Material
Hot rolled steel galvanized after manufacture to BS EN ISO 1461; or bending and profiling quality hot dipped galvanized steel to BS EN 10326, BS EN 10327 or BS EN 10143.
Finish - Self colour galvanized.

Y63.2020C CABLE SUPPORT SYSTEM - CABLE CLEATS:
One piece or single way pattern or claw pattern or two bolt pattern.
Material
Die cast aluminium alloy; moulded black polyethylene; or nylon.
Finish - Self finish.

Y63.2025A CABLE SUPPORT SYSTEM - PROPRIETARY CABLE TIES:
Two piece cable tray pattern, on cable tray only. Wrap round self locking non releasable pattern on everything except cable trays.

C0605 The New LMB Building Project Y63
Electrical Specification SUPPORT COMPONENTS - CABLES
Revised Stage E Scheme Including Agreed VE

Deleted: Stage E Issue

Y63.2025B CABLE SUPPORT SYSTEM - CABLE CLIPS:
Polypropylene surface type with pre-fixed hardened steel pin for general use except on mineral insulated cables.
For mineral insulated cables use bright copper one hole `P' clips for unsheathed mineral insulated cables, PVC covered for sheathed mineral insulated cables.

Y63.2025C CABLE SUPPORT SYSTEM - TWO WAY SADDLES:
Bright copper for unsheathed mineral insulated cables. PVC covered bright copper for sheathed mineral insulated cables.

Y63.2025D CABLE SUPPORT SYSTEM - CABLE BASKET:
Proprietary system of wire basket with compatible jointing and fixing accessories.
Fittings
Use factory made fittings throughout of same material finish as basket, for risers, bends, reducers, tees, crosses and drop outs.

Y63.3010 CABLE TRAY INSTALLATION:
Support from building fabric with minimum clearance behind of 20mm. Install fixings at regular intervals to prevent visible sagging when loaded, with maximum spacing 1.2m and 230mm from fittings.
Keep cutting of cable tray to a minimum. Cut along a line of unperforated metal. Make good finish with zinc rich paint, primer and top coat, or two pack epoxy paste, as appropriate to tray material and finish.
Fit holes cut in tray for passage of cables with grommets, bushes or other lining.
Install all bolts, fixings and hangers with threaded portion away from cables.

Y63.3020A CABLE CLEATS, TIES, SADDLES AND CLIPS INSTALLATION:
For cables on horizontal tray use ties for each circuit. Use tie manufacturer's special tensioning tool where available. Crop off tie ends.
For cables on vertical tray use cleats bolted to tray for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. Use cleats sized to grip cables firmly without undue pressure or strain on cable, but preventing slipping.
For cables on vertical or horizontal rack use proprietary fixings to rack for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. On continuous flat surfaces of wood, plaster, brick etc.
Use polypropylene surface fixing clips with prefixed hardened steel pin for PVC insulated and sheathed cables and sheathed or bright mineral insulated cables. Use round or flat or flat twin pattern as appropriate, manufactured specifically for cable being fixed.
Use one hole 'P' clips or two way saddles of bright copper for unsheathed mineral insulated cable.
Use PVC covered for sheathed mineral insulated cables.
Space cleats, ties, saddles and clips
As Appendix G of Guidance Notes `Selection & Erection' published by the IEE (now IET).

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Y71 LV SWITCHGEAR AND DISTRIBUTION BOARDS

Y71.1000 GENERAL

Y71.1020A 3 PHASE ELECTRICITY SUPPLY:
Ensure all electrical equipment supplied and installed is suitable for 3 phase power supply to BS 7697.

Y71.1020B SINGLE PHASE ELECTRICITY SUPPLY:
Ensure all electrical equipment supplied and installed is suitable for single phase power supply to BS 7697.

Y71.2010A CUBICLE SWITCHBOARD - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:
Standard - BS EN 60439-1.
External design - Cubicle type assembly.
Usage - Switchboard.
Conditions of installation - Indoors.
Electrical characteristics
Rated operational voltage 400V +10% -6%
Service conditions
Ambient air temperature and altitude as BS EN 60439.

Y71.2010B CUBICLE CONTROL PANEL - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:
Standard - BS EN 60439-1.
External design - Cubicle type assembly.
Usage - Control panel.
Conditions of installation - Indoors.
Electrical characteristics
Rated operational voltage 400V +10% -6%
Service conditions
Ambient air temperature and altitude as BS EN 60439.

Y71.2020A FLOOR STANDING ASSEMBLY CONSTRUCTION:
Enclosure standard - BS EN 62208.
Material of enclosure - Manufacturer's standard.
Terminals for external conductors, main power circuits
Accommodate cross-sectional area of copper cables in accordance with BS EN 60439-1.
Terminals for external conductor, control and auxiliary circuits
Terminal block. Mounting as manufacturer's standard.
Size of neutrals on three phase supplies - Full sized.
Degree of protection to BS EN 60529, IP31 for assembly.
Protection against direct and indirect contact
Manufacturer's standard.
Accessibility for inspection
Arrange for following operations to be performed when assembly is in service and under voltage
Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.
Adjusting and re-setting of relays, releases and electronic devices.
Replacement of fuselinks and indicating lamps.
Fault location by voltage and current measuring.
Accessibility for maintenance
Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.
Removable parts and withdrawable parts as manufacturer's standard.
Internal separation - Form 4.
Input voltage variations for electronic equipment supply - BS EN 60439.
Supply frequency deviation - BS EN 60439.
Mounting - Floor standing.

Y71.2020B WALL MOUNTED ASSEMBLY CONSTRUCTION:

Deleted: Stage E Issue

Enclosure standard - BS EN 62208.
Material of enclosure - Manufacturer's standard.
Terminals for external conductors, main power circuits
Accommodate cross-sectional area of copper cables in accordance with BS EN 60439-1.
Terminals for external conductor, control and auxiliary circuits
Terminal block. Mounting as manufacturer's standard.
Size of neutrals on three phase supplies - Full sized.
Degree of protection to BS EN 60529, IP31 for assembly.
Protection against direct and indirect contact
Manufacturer's standard.
Accessibility for inspection
Arrange for following operations to be performed when assembly is in service and under voltage
Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.
Adjusting and re-setting of relays, releases and electronic devices.
Replacement of fuselinks and indicating lamps.
Fault location by voltage and current measuring.
Accessibility for maintenance
Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.
Removable parts and withdrawable parts as manufacturer's standard.
Internal separation - Form 4.
Input voltage variations for electronic equipment supply - BS EN 60439.
Supply frequency deviation - BS EN 60439.
Mounting - Wall mounted.

Y71.2030A ENCLOSURE FINISH:
Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.
Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.
Finish - Manufacturer's standard.
Colour - Manufacturer's standard colour.

Y71.2040A TYPE TESTS:
Provide certificates of verification.

Y71.2060 SITE BUILT ASSEMBLIES:
Ensure that components of site assemblies are part of a proprietary system and type tested as appropriate.
Install assemblies in accordance with manufacturer's drawings and instructions.

Y71.2070 SITE MODIFICATION:
Do not make site alterations unless authorised. Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with type test certificate obtained for arrangement of components.

Y71.2090A UTILISATION A, WITHDRAWABLE AIR BREAK CIRCUIT BREAKERS:
Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.
Standard - BS EN 60947-2
Details of equipment - Circuit breaker.
Characteristics of circuit breakers
a.c. Interrupting medium - Air.
Rated and limiting values for the main circuit.
Rated voltage (Volts) - operational, 400.
Rated frequency 50 Hertz.
Circuit breaker Utilisation category - A.
Enclosure degree of protection IP 31.
Circuit breakers and switches

Deleted: Stage E Issue

Provide metal clad withdrawable isolating removable type circuit breakers with provision for safe maintenance.
Closing mechanism
Independent manual spring operated.
Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.
Provide moulded case circuit breakers with provision for safe maintenance.

Y71.2090B UTILISATION A, MCCB AIR BREAK CIRCUIT BREAKERS:
Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.
Standard - BS EN 60947-2
Details of equipment - Circuit breaker.
Characteristics of circuit breakers
a.c. Interrupting medium - Air.
Rated and limiting values for the main circuit.
Rated voltage (Volts) - operational, 400.
Rated frequency 50 Hertz.
Circuit breaker Utilisation category - A.
Enclosure degree of protection IP 31.
Circuit breakers and switches
Provide manual closing air-break circuit breakers, (MCCB).
Closing mechanism
Independent manual spring operated.
Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.
Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.
Provide moulded case circuit breakers with provision for safe maintenance.

Y71.2100A SWITCH DISCONNECTORS:
Supply switch disconnectors in accordance with BS EN 60947.
Standard - BS EN 60947-3
Details of equipment - Switch-disconnector.
a.c. Interrupting medium - Air.
Rated and limiting values for the main circuit.
Rated voltage (Volts) 230/400.
Rated frequency 50 Hertz.
Utilisation category - AC 23A.
Enclosure degree of protection IP 65.
Fit each switch with facility to padlock in OFF position.
Provide switches with auxiliary contacts as indicated. Where switches isolate final connections between a starter and its motor, fit one set of contacts to open starter coil circuit when switch is opened.

Y71.2100B FUSE COMBINATION UNITS:
Supply fuse combination units in accordance with BS EN 60947. Fit fuse combination units with cartridge fuse links in accordance with BS EN 60269 (BS 88).
Standard - BS EN 60947-3.
Details of equipment - Fuse combination unit.
a.c. Interrupting medium - Air.
Rated and limiting values for the main circuit
Rated voltage (Volts) 230/400.
Rated frequency 50 Hertz.
Utilisation category - AC23A
Enclosure degree of protection IP 31.
Fit removable neutral link in switches controlling circuits with neutral conductor.
Fit solid links in isolating switches.

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Fit each switch with facility to padlock in OFF position.
Ensure that withdrawable chassis isolating type switches are provided with fully shrouded fixed contacts or insulated coverplates, to prevent accidental contact with live parts.
Ensure that switches in individual enclosures have an earth terminal, meet the degree of protection for the switchboard and have operating mechanisms interlinked with access door.
Provide switches with auxiliary contacts as indicated. Where switches isolate final connections between a starter and its motor, fit one set of contacts to open starter coil circuit when switch is opened.

Y71.2110A AUTOMATIC RESET PROTECTION DEVICES INTERPOSING RELAYS AND INTER-TRIPPING RELAYS:
Standard - BS EN 61810.
Housing
Flush panel mounting type. House all protection relays, excluding motor protection relays, in draw out cases.
Reset type - Automatic reset type.
Overcurrent tripping device
Provide overcurrent tripping device with overcurrent characteristic similar to a BS 2692 high voltage cartridge fuse, sized to protect the equipment/load.

Y71.2110B MANUAL RESET PROTECTION DEVICES INTERPOSING RELAYS AND INTERTRIPPING RELAYS:
Standard - BS EN 61810.
Housing
Flush panel mounting type. House all protection relays, excluding motor protection relays, in draw out cases.
Reset type - Manual reset type.
Overcurrent tripping device
Provide overcurrent tripping device with overcurrent characteristic similar to a BS 2692 high voltage cartridge fuse, sized to protect the equipment/load.

Y71.2120 VOLTAGE SENSING RELAYS:
Provide single phase inverse time undervoltage type voltage sensing relays to monitor the voltage between respective phases of supply.
Mounting
Supply suitable for flush panel mounting with relay trip indication.
Voltage settings
50-90% in five equal steps with automatic resetting at 105% of voltage setting.
Relay Inverse time characteristics
When voltage increases from zero to rated voltage with time multiplier set at 1.0, set relay resetting times as follows:-

Relay setting %	50	60	70	80	90
Resetting time (secs)	2	4	5	10	12

Y71.2130 TRIP/CLOSE SWITCHES AND CONTROL SELECTOR SWITCHES:
Provide a panel mounted heavy duty, spring return trip/close switch on each circuit breaker fitted with solenoid or motorized spring closing mechanisms.
Ensure contacts have a continuous rating of 10A minimum at between 30V to 250V ac and dc, and make and break duty rating of 30A at 250V ac or dc for a minimum period of 3 secs.
Where remote trip/close control is indicated, supply a panel mounted selector switch to select circuit breaker for local or remote closing. Ensure that selection of remote or local closing does not prevent circuit breaker tripping under operation of local or remote trip switch.

Y71.2140 CURRENT TRANSFORMERS:
Comply with BS EN 60044-1. Provide separate current transformers for each protection device and instrumentation. Ensure current transformers provide appropriate accuracy and are compatible with over current factors, characteristics, performance and VA rating required for satisfactory operation of protection devices, instruments and meters indicated.
Ensure that current transformers are capable of withstanding maximum short time withstand current of value and duration indicated for assembly.

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Provide test links in secondary connections of all current transformers to facilitate testing of instruments, meters and protection devices.

Y71.2150A INSTRUMENTS AND METERS:
Standards
Comply with BS 89 and BS EN 60051-1 for voltmeters, ammeters, watt meters, frequency indicators and power factor indicators.
Comply with BS 7856, BS EN 62053-11, BS EN 62053-22 or BS EN 62053-21 for kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters, and BS EN 62053-23 for KVAhr meters.
Protect wiring to voltmeters by separate fuses.
Protect potential coils of watt meters, frequency indicators, power factor indicators and kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters by separate fuses.
Supply instruments and meters suitable for flush mounting and type, size and accuracy as indicated.
Ensure that indicating scales for all instruments comply with BS 3693.
Supply so that normal indication is 50% to 75% of full scale deflection.
Completely segregate all instruments in instrument compartments. Panel mount meters on front of instrument compartment.

Y71.2160A ELECTRICAL RECORDING INSTRUMENTS:
Provide electrical recording instruments.
Standard - BS EN 61143.

Y71.2170A INDICATOR LIGHTS:
Supply lamps of same type throughout. Provide indicator lamps with lamp test facility.
Lamps
Supply interchangeable indicators for respective units.
Protect wiring to indicator lamp units by separate cartridge fuses.
Lens Colour in accordance with BS EN 60073.

Y71.2180 LOW VOLTAGE COILS RATING:
Ensure coils for switching relays, contactors and other applications are capable of withstanding inherent voltage drop within system without armature or switching apparatus dropping out of position.

Y71.2190A FRAMEWORK:
Construct framework for supporting electrical equipment from mild steel plate and strip, cold and hot rolled steel sections or slotted angles, in accordance with BS EN 10210 and BS 4345 respectively.
Comply with BS EN 1011-2 for metal arc welding.
Finish
Frameworks mounted inside building manufacturer's standard finish.
Frameworks mounted outside building hot dip galvanized to BS EN ISO 1461.
Supply cadmium or zinc electroplated bolts, nuts, washers and screws.

Y71.2200A FUSES:
Supply cartridge fuse links including fuse carrier, bases and associated components that comply with BS EN 60269 (BS 88), fusing factor category gG, unless otherwise indicated.

Y71.2210A DISTRIBUTION BOARDS:
Comply with BS EN 60439-1 or BS EN 60439-3 as appropriate. Make internal separation Form 1 unless otherwise indicated. Make fuseboards fully shrouded. Fit each distribution board with an isolating switch.
Install busbars in same position relative to their fuse carriers or miniature circuit-breakers (MCBs) for each pole. In TPN distribution boards supply neutral busbars with one outgoing terminal for each outgoing circuit.
Provide a multi-terminal earthing bar for circuit protective conductors for both insulated and metal-cased boards, with one terminal for each outgoing circuit. Connect directly to earthing terminal without dependence on exposed conductive parts of enclosure.
Identify each fuseway and MCB way by numbering. Identify each terminal on neutral busbar and earthing bar with its respective fuseway or MCB way.
Where specific ratings are indicated incorporate fuses or MCBs, otherwise leave ways blank for future

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additions.
Enclosures finish
Finish - Manufacturer's standard.
Colour - Manufacturer's standard colour.

Y71.2230A MINIATURE CIRCUIT BREAKERS:
Standard - BS EN 60898-1.
Supply miniature circuit-breakers with voltage and current ratings, type according to instantaneous tripping current, energy limiting class, category of duty and frequency in accordance with BS EN 60898-1.

Y71.2240A RESIDUAL CURRENT DEVICE:
Comply with BS EN 61008. Supply residual current devices (RCCDs) with rated voltage, rated current, rated tripping current, rated tripping time and rated breaking capacity as indicated.
DC component
Ensure dc component does not affect operation.
Overcurrent protection
Fit RCDs with integral overcurrent protection.

Y71.2242 RESIDUAL CURRENT MONITORS:
Supply residual current monitors.
Standard - BS EN 62020.

Y71.2245 COMBINED RESIDUAL CURRENT/OVER CURRENT OPERATED CIRCUIT BREAKERS:
Supply combined residual current/over current operated circuit breakers (RCBOs) in accordance with BS EN 61009.

Y71.2250 CABLE TERMINATIONS:
Ensure that switchgear and distribution boards are provided with facilities to terminate size, number and type of cable indicated. Where necessary use fabricated steel extension boxes for glanding large and multiple cables.
Provide non-ferrous metal glanding plates for single core cable terminations.

Y71.2270E SINGLE CUBICLE WITHIN SWITCHBOARD, AUTOMATICALLY CONTROLLED CAPACITOR BANKS:
Standard - BS EN 61921.
Voltage rating of capacitor - 400V, 3 phase, 50 Hz.
Bank unit
Provide modular bank within switchboard. Include in each module contactors, line fuses and control circuitry.
Arrangement - Single cubicle.
Switching - Block contactor switching.
Control
Provide automatic control via an automatic multi-stage kVAr sensitive, solid state relay with stage switches to operate the capacitor contactors.
Control relay
Incorporate relay into cubicle.
Fit relay with a loss of voltage no volt release re-setting feature to reset switching sequence to all contacts open position following failure of supply.
Provide visual indication by means of LED's for capacitor stages and capacitor/inductive load.
Provide Hand/Off/Auto selection switch.
Isolator - Incorporate on load break isolator.
Capacitor unit
Provide assembly housed in sheet steel enclosure complete with main terminals, comprising individual low loss, power capacitor elements and fuses to BS EN 60143-3 or BS EN 60871-4.
Capacitor unit assembly
Incorporate thermal equalizers within assembly of elements.
Fill enclosure with inorganic, inert and non-flammable granules.
Fit discharge resistors.
Ensure all internal and external connections are adequately rated and fully insulated.

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Automatic bank enclosure
Material - Manufacturer's standard.
Finish and colour - Manufacturer's standard.
Access - Front access.
Capacitor discharge devices - Manufacturer's standard.

Y71.2280A HARMONIC FILTER:
Unit - Filter conditioning to meet G5/4.
Mounting - Floor mounting. Built-in type.
Cubicle
Incorporating IGBTs, capacitors, reactors, block contactors and control gear.
Cable termination chamber
Mount cable termination chamber on side of cubicle with access through removable plates.

Y71.3010 FIXING:
Fix all equipment independently of wiring system. Use cadmium or zinc electroplated bolts, nuts, washers and screws.

Y71.3020 MOUNTING HEIGHT:
Mount single items of equipment 1450mm above finished floor level to centre of equipment, unless otherwise indicated.
Arrange groups of equipment, other than floor mounted assemblies, so that all parts of equipment requiring access for operation or maintenance are at least 500mm and no more than 2000mm above finished floor level, unless otherwise indicated.

Y71.3030 ACCESS:
Ensure that clearance in front of switchgear and controlgear is not less than 1m, or as indicated.

Y71.3040A MARKING AND DRAWING:
Number terminals, cables and component parts to correspond with manufacturer's certified drawings.

Y71.3050 CABLE TERMINATIONS:
Terminate paper-insulated cable by means of switchboard manufacturer's standard compound filled cable boxes.
Terminate PVC SWA PVC and MICS cables inside enclosure by securing cables to switchboard with glanding plates or glanding brackets; and outside enclosure with glanding plates or fabricated steel extension boxes.

Y71.3060A INSTALLATION AND COMMISSIONING:
Install and commission switchgear and controlgear in accordance with the appropriate standard and the manufacturer's recommendations. Include CT Polarity check in commission tests.

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Y72 CONTACTORS AND STARTERS

Y72.1000 GENERAL

Y72.1010A 3 PHASE SUPPLY:
Ensure all electrical equipment supplied and installed is suitable for 3 phase power supply to BS 7697.

Y72.1010B SINGLE PHASE ELECTRICAL SUPPLY:
Ensure all electrical equipment supplied and installed is suitable for single phase power supply to BS 7697.

Y72.2050C CONTINUOUS LV CONTACTORS AND MOTOR STARTERS:
Standard - BS EN 60947-4-1 or BS EN 60947-4-2.
Type of equipment - A.c. mechanical contactor. Interrupting medium, air.
Operating condition.
Method of operation - Electromagnetic.
Method of control - Automatic.
Rated and limiting values for the main circuit.
Rated voltage (Volts) - Operational, 400.
Rated duty - Continuous.
Operational performance.
One rotation direction, with motor stopping between operations.
Control circuits
Electrical - ac; rated frequency (Hertz), 50; rated voltage (Volts), 230.
Co-ordination with short-circuit protective devices - Type1
Enclosure degree of protection to BS EN 60529, IP 31.
Minimum mechanical and electrical endurance
Mechanical 0.3 million; electrical 15,000.
Provide mechanical and electrical interlocks to prevent simultaneous closure of paired contactors.

Y72.2060A CONTROL CIRCUIT DEVICES:
Standard - BS EN 60947-5-1
Type of equipment.
a.c. control circuit device
Manual control switches; emergency stop; control relays; pilot switches; position switches; associated equipment; auxiliary contacts and indicating lamps.
Interrupting medium, Air.
Operating condition.
Method of operation - electromagnetic.
Method of control - automatic.
Rated and limiting values for the main circuit.
Rated voltage (Volts) - operational, 230.
Rated frequency (Hertz), 50.
Contact element classification.
Enclosure degree of protection IP 31.

Y72.2070A ISOLATING SWITCHES:
•Isolation as shown on drawings/schedules
Standard - BS EN 60947-3.
Provide independent manual operation type isolating switches with rated duty, rated operational current and utilization category compatible with contactor.

Y72.2080A CONTROL SELECTOR SWITCHES:
Standard - BS EN 60947-5-1
Provide panel mounting independent manual operation rotary type switch to select local/off/remote control.
Ensure switch rated thermal current, rated operational current, and utilization category are compatible with contactor control circuit characteristics and circuit protection device.

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Y72.2090A IN-BUILT PUSH BUTTONS:
Provide panel mounting type push buttons with actuator colours to BS EN 60073.
Standard- BS EN 60947-5-1.
Pattern
Supply flush button type start/on and reset push buttons. Supply mushroom actuator type stop/off push buttons released by turning the actuator.
Ensure rated thermal current, rated operational current and utilization category of push button contacts are compatible with contactor control circuit characteristics and circuit protection device.

Y72.2100A INDICATOR LIGHTS:
Supply lamps of same type throughout. Provide indicator lamps with lamp test facility.
Standard - BS EN 842 and BS EN 60947-5-1.
Details
Supply interchangeable indicators for respective units. Provide neon indicators. Provide 230V indicator circuits and lamps.
Protect wiring to indicator lamp units by separate cartridge fuses.
Lens colour - In accordance with BS EN 60073.

Y72.2110A CONTACTOR CONTROL RELAYS:
Standard BS EN 60947-5-1, install relays in contactor enclosure.
Relay enclosure protection to BS EN 60529
Compatible with contactor enclosure.

Y72.2120A CONTROL AND INDICATOR LIGHT CIRCUIT FUSES:
Provide in contactor enclosure separate low voltage fuse bases, fuse carriers and cartridge fuses for protection of control circuits and indicator light circuits.
Fuses
Fully shrouded impact resistant moulded plastic fuse bases and carriers in accordance with BS EN 60269 (BS 88). Supply category gG cartridge fuses to BS EN 60269 (BS 88).

Y72.2130A MOTOR STARTERS - MOTORS BELOW 0.37 KW:
Provide fuses or circuit breakers for motors below 0.37 kW.

Y72.2130B MOTOR STARTERS - MOTORS OF 0.37KW AND ABOVE:
Provide starters incorporating overcurrent protection for motors of 0.37kW and above.
Provide starter with manual reset, adjustable, inverse time delay, and ambient temperature compensated thermal overcurrent release to BS EN 60947-4-1. Ensure overcurrent release is compatible with starting, accelerating and running characteristics of motor, starter and driven machine combination. Use phase unbalance protection on three phase equipment.

Y72.2140 CURRENT LIMITING MOTOR STARTERS:
Use static type thyristor voltage control starter to provide reduced current starting.
Provide adjustable ramp times.
Provide contactor for switching and disconnector for isolation.
Provide details of harmonic distortion content prior to ordering.

Y72.2150 DIRECT-ON-LINE MOTOR STARTERS:
Use direct-on-line starter to BS EN 60947-4-1, with single phase motors and three phase motors.

Y72.2160 STAR DELTA MOTOR STARTERS:
Use star delta starter to BS EN 60947-4-1 with three phase motors.
Incorporate adjustable time delay contactor relays, to control star delta changeover, ensuring electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

Y72.2170A AUTO-TRANSFORMER MOTOR STARTERS:
Use auto-transformer starter to BS EN 60947-4-1 with three phase motors.
Provide 2 step closed transition auto transformers suitable for 3 operating cycles per hour.
Provide auto transformers with three tappings for selection of motor starting voltage. Arrange tappings to limit motor starting current to 80 per cent, 65 per cent and 50 per cent of full voltage starting current.

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Incorporate adjustable time delay contactor relays, to control automatic changeover from selected reduced voltage to full voltage, having an electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

Y72.2180A STATOR ROTOR MOTOR STARTERS:
Use stator rotor starter to BS EN 60947-4-1 with three phase motors.
Provide starter resistors suitable for indicated operating cycles per hour.
Incorporate adjustable time delay contactor relays, to control starter resistor short circuiting contactors, having electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

Y72.2190A CONTROL PANEL INVERTOR MOTOR STARTERS:
Supply inverters to control speed of standard AC Squirrel cage motors.
Inverter type - Digital PWM.
Location - Control panel.
Control range - 0.5 to 120 Hz
Power factor - 0.95 or better.
Starting current - Not to exceed 1 x FLC.
Characteristics
Ensure acceleration and deceleration ramps are independently adjustable.
Allow connection to a turning motor without braking to a standstill.
Allow connection to a reverse windmilling fan without causing tripping and return fan to correct speed. Ensure inverters require no additional means for starting. Supply inverters that do not require electrical matching to motor. Ensure inverters are capable of running motors in parallel.
EMC characteristics to BS EN 61800.
Mains interruption
Ensure inverter does not cause tripping through a mains interruption of 200 msec.
Protection
Ensure inverter incorporates the following protection to cause electronic shut down without operating circuit protective devices.
Motor phase to phase fault; motor phase to earth fault; overvoltage; undervoltage; inverter overheat; motor overheat; loss of control signal; loss of auxiliary control voltage; current limit.
Inverter controls - Local/remote facility.
Display
Make provision for inverter to display externally, external and internal faults following a failure.
Show 1st, 2nd and 3rd up sequential faults.
Provide digital readout to show output frequency Hz; reference 1 (Hand); reference 2 (Auto); motor current (% or Amps); fault memory.
Provide volt free remote signalling contacts to indicate common fault; running/stopped conditions; healthy/tripped conditions.
Ensure parameters can be set and fault memory interrogated with door closed, and without additional instrumentation.

Y72.2190B MOTOR CONTROL CENTRE INVERTER MOTOR STARTERS:
Supply inverters to control speed of standard AC Squirrel cage motors.
Inverter type - Digital PWM.
Location - Motor control centre.
Control range - 0.5 to 120 Hz Power factor - 0.95 or better.
Starting current - Not to exceed 1 x FLC.
Characteristics
Ensure acceleration and deceleration ramps are independently adjustable.
Allow connection to a turning motor without braking to a standstill.
Allow connection to a reverse windmilling fan without causing tripping and return fan to correct speed. Ensure inverters require no additional means for starting. Supply inverters that do not require electrical matching to motor. Ensure inverters are capable of running motors in parallel.
EMC characteristics to BS EN 61800.
Mains interruption
Ensure inverter does not cause tripping through a mains interruption of 200 msec.
Protection
Ensure inverter incorporates the following protection to cause electronic shut down without

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operating circuit protective devices.
Motor phase to phase fault; motor phase to earth fault; overvoltage; undervoltage; inverter overheat; motor overheat; loss of control signal; loss of auxiliary control voltage; current limit.
Inverter controls - Local/remote facility.
Display
Make provision for inverter to display externally, external and internal faults following a failure.
Show 1st, 2nd and 3rd up sequential faults.
Provide digital readout to show output frequency Hz; reference 1 (Hand); reference 2 (Auto); motor current (% or Amps); fault memory.
Provide volt free remote signalling contacts to indicate common fault; running/stopped conditions; healthy/tripped conditions.
Ensure parameters can be set and fault memory interrogated with door closed, and without additional instrumentation.

Y72.2200 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY - SINGLE POWER SUPPLY:
•Provide system malfunction audible alarm.
Fit a control switch to starter enclosure arranged to select either motor for "run" or "standby" duty.
Indicate selection of respective motor by illumination of indicator lights on starter enclosure.
Provide facilities for connection of remote indicator lights to indicate selection/operation of system and for connection of a system malfunction audible alarm where indicated.
Arrange for selected "run" duty motor to operate in response to system controls, and in event of operation of duty motor starter overcurrent trip, for automatic changeover to "standby" motor.
Control power supply to starter by an air break isolating switch interlocked with starter enclosure access door.

Y72.2210 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY - DUAL POWER SUPPLY:
•Provide system malfunction audible alarm.
Fit a control switch to starter enclosure arranged to select either motor for "run" or "standby" duty.
Indicate selection of respective motor and availability of the two power supplies by illumination of indicator lights on starter enclosure.
Provide facilities for connection of remote indicator lights to indicate selection/operation of system and for connection of a system malfunction audible alarm where indicated.
Arrange for selected "run" duty motor to operate in response to system controls, and on loss of power supply to "run" duty motor or operation of motor starter overcurrent trip, for automatic changeover to "standby" motor.
Control the two power supplies by a single air break multiple isolating switch interlocked with starter enclosure access door.

Y72.2220 CONTROL CIRCUIT TRANSFORMERS:
Provide control circuit transformers to supply power at voltages to suit control components.
Standard
Use transformers in accordance with BS EN 61558-2-9 or BS EN 61558-1 and provide an external label of approved type and size.
Protection - Primary and secondary fuses.

Y72.2230A SWITCHING AND INDICATION:
Provide switches, indicating lamps, instruments and controls of uniform appearance and physically protected.
Switches and indicators
Fit on panel or access doors Stop/Start/Reset push buttons; Auto/Off/Manual control selector switch; run and trip indicator lights.

Y72.2240 AUDIBLE ALARMS:
Ensure that operation of any starter trip lamp, safety circuit lamp or alarm lamp operates a common audible alarm with mute and test facilities and terminals for remote alarm signal.
When an alarm condition has had the audible alarm muted, ensure that terminals for a remote "alarm accepted" light are energised. The audible alarm circuit and terminals for remote alarm signal must still be capable of indicating another fault occurring even though original fault has not been cleared. The test facilities are to test momentarily both the audible alarm and all alarm indicator lamps, whilst the push button is depressed.

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Use alarms that interface with a sensor or controller to sense set-point and measured value. Provide adjustable upper and lower limits on face of unit. Provide unit with indicating lamps to show which limit has been exceeded. Provide each unit with connections for remote alarm.

Y72.2250A PROGRAMMABLE LOGIC CONTROLLERS:
Provide programmable logic controllers in accordance with the manufacturer's recommendations and the specified control requirements.
Standard - BS EN 61131.
Provide fuse and isolator for the Programmable Logic Controller. Install PLC with control components.
Programming language standard - BS EN 61131-3

Y72.2260A STARTER AND CONTROL PANEL INTERNAL WIRING:
Standard - BS 6231.
Wiring coding - Random colours and CPC green/yellow.
Control wiring
Segregate control wiring from power circuits. Contain control wiring in ventilated plastic trunking. Identify each end of each wire with a unique number.
Power wiring
Take account of thermal effects of grouping when routing power wiring. Identify each end of each wire with a unique number.

Y72.2270A COMPONENT MOUNTING:
Mount all components of the switchgear and controlgear in accordance with the manufacturer's instructions.
Mount control components on top hat rails (35mm) to BS 5584 (EN 50022).

Y72.2280A CONTROL SYSTEM FUNCTION CHARTS:
Prepare function charts for the control system in accordance with BS EN 60848. Obtain approval of function chart before design of system hardware or writing control software.
Function chart format - Combined function chart/circuit diagram.

Y72.3010 INSTALLATION:
Install control panels, motor control centres, contactors and starters in accordance with BS EN 60947 and manufacturer's recommendations.

Y73 LUMINAIRES AND LAMPS

Y73.1000 GENERAL
1010 STANDARDS:
Supply luminaires and lamps to standards as appropriate.

Y73.2005 LAMP EFFICACY:
The system is designed to achieve an average initial circuit of at least 65 lumens/watt for fixed lighting equipment within the building.

Y73.2010# LUMINAIRES:
- Standards
  - Supply luminaires with photometric data in accordance with BS EN 13032-1.
  - Supply luminaires in accordance with BS 4533 (BS EN 60598).
    - Fixed general purpose luminaires to BS 4533-102.1 (EN 60598-2-1)
      - Supply luminaires with type N protection in accordance with BS EN 60079-15
    - Recessed luminaires to BS EN 60598-2-2
      - Supply luminaires with type N protection in accordance with BS EN 60079-15
    - Luminaires for road and street lighting to BS EN 60598-2-3 and BS 5489-1.
      - Supply luminaires with type N protection in accordance with BS EN 60079-15
    - Floodlights to BS EN 60598-2-5.
      - Supply luminaires with type N protection in accordance with BS EN 60079-15
    - Luminaires with built-in transformers for filament lamps to BS EN 60598-2-6.
    - Luminaires for swimming pools and similar applications to BS EN 60598-2-18.
    - Air-handling luminaires to BS 4533-102.19 (EN 60598-2-19).
    - Extra low voltage lighting systems for filament lamps to BS EN 60598-2-23.
    - Luminaires with limited surface temperature to BS EN 60598-2-24.
    - Luminaires for hospitals and health care buildings to BS EN 60598-2-25.
    - Electrical supply track systems for luminaires to BS EN 60570.
- Classification - to BS EN 60598-1
- Safety
  Fit luminaire with cover glass to protect against ultra-violet emission and risk from explosion of lamps.
- Safety Support for Components
  Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.
- Photometric performance
  Ensure luminaires of similar type have same photometric performance as published data within the tolerances defined by BS EN 13032-1.
- Electromagnetic compatibility
  Ensure luminaires comply with BS EN 61547 for EMC immunity.
- Physical protection
  - BS EN 62262 (IK),
  - BS EN 60529 (IP),

Y73.2010A LUMINAIRES - GENERAL PURPOSE:
Standards
Supply luminaires with photometric data in accordance with BS EN 13032-1.
Supply luminaires in accordance with BS 4533 (BS EN 60598).
Classification - To BS EN 60598-1.
Safety Support for Components
Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.
Photometric performance
Ensure luminaires of similar type have same photometric performance as published data within the tolerances defined by BS EN 13032-1.
Electromagnetic compatibility
Ensure luminaires comply with BS EN 61547 for EMC immunity.

Y73.2010B LUMINAIRES - GENERAL PURPOSE WITH SAFETY GLASS:
Standards
Supply luminaires with photometric data in accordance with BS EN 13032-1.
Supply luminaires in accordance with BS 4533 (BS EN 60598).
Classification - To BS EN 60598-1.
Safety
Fit luminaire with cover glass to protect against ultra-violet emission and risk from explosion of lamps.
Safety Support for Components
Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.
Photometric performance
Ensure luminaires of similar type have same photometric performance as published data within the tolerances defined by BS EN 13032-1.
Electromagnetic compatibility
Ensure luminaires comply with BS EN 61547 for EMC immunity.

Y73.2010C LUMINAIRES - SPECIAL APPLICATIONS:
- Emergency lighting
  - 2020A EMERGENCY LIGHTING LUMINAIRES:
    Comply with BS EN 60598-2-22.
    Comply with ICEL:1001. Ensure emergency lighting luminaires are marked with ICEL certification label.
  - 2020# EMERGENCY LIGHTING LUMINAIRES:
    - Comply with BS EN 60598-2-22.
      - Supply luminaires with type N protection in accordance with BS EN 60079-15.
      - Comply with ICEL:1001. Ensure emergency lighting luminaires are marked with ICEL certification label.
- 2030 EXIT SIGNS:
  Comply with BS 5499-1, BS 5499-4 and BS EN 60598-2-22.
- Hazardous areas
  - 2040A HAZARDOUS AREA LUMINAIRES:
    BS EN 50015; BS EN 50017; BS EN 50020; BS EN 60079-0; BS EN 60079-1; BS EN 60079-14; BS EN 60079-15 or BS EN 60079-25 as appropriate.
  - 2040# HAZARDOUS AREA LUMINAIRES:
    - Standard
      - BS EN 50015.
      - BS EN 50017.
      - BS EN 50020.
      - BS EN 60079-0.
      - BS EN 60079-1.
      - BS EN 60079-14.
      - BS EN 60079-15.
      - BS EN 60079-25.
  - Installation in potentially explosive areas
    4070 INSTALLATION IN POTENTIALLY EXPLOSIVE ATMOSPHERES:
    Comply with BS EN 60079-14.
- Signs and high voltage installations.
  - 2050A SIGNS AND HIGH VOLTAGE INSTALLATIONS:
    Comply with BS 559 and BS EN 50107-1.
    Neon transformers
    Supply transformers for tubular discharge lamps with no-load output voltage exceeding 1000 V in accordance with BS EN 61050.
    Secondary protection to BS EN 50107-2.
  - 2050# SIGNS & HIGH VOLTAGE INSTALLATIONS:
    - Standard - Comply with BS 559 and BS EN 50107-1.
    - Neon transformers

Deleted: Stage E Issue

Supply transformers for tubular discharge lamps with no-load output voltage exceeding 1000 V in accordance with BS EN 61050.
•Secondary protection to BS EN 50107-2.
•4090 SIGNS & HIGH-VOLTAGE INSTALLATION:
Comply with BS 559 and BS EN 50107-1.
Standards
Supply luminaires with photometric data in accordance with BS EN 13032-1.
Supply luminaires in accordance with BS 4533 (BS EN 60598).
Classification - To BS EN 60598-1.
Electromagnetic compatibility
Ensure luminaires comply with BS EN 61547 for EMC immunity.

Y73.2015 LUMINAIRE LIGHT OUTPUT RATIO (LOR):
Ensure all luminaires have an LOR of at least 0.6.

Y73.2020A EMERGENCY LIGHTING LUMINAIRES:
Comply with BS EN 60598-2-22.
Comply with ICEL:1001. Ensure emergency lighting luminaires are marked with ICEL certification label.

Y73.2030 EXIT SIGNS:
Comply with BS 5499-1, BS 5499-4 and BS EN 60598-2-22.

Y73.2040A HAZARDOUS AREA LUMINAIRES:
BS EN 50015; BS EN 50017; BS EN 50020; BS EN 60079-0; BS EN 60079-1; BS EN 60079-14; BS EN 60079-15 or BS EN 60079-25 as appropriate.

Y73.2050A SIGNS AND HIGH VOLTAGE INSTALLATIONS:
Comply with BS 559 and BS EN 50107-1.
Neon transformers
Supply transformers for tubular discharge lamps with no-load output voltage exceeding 1000 V in accordance with BS EN 61050.
Secondary protection to BS EN 50107-2.

Y73.2060A LAMPHOLDERS - GENERALLY:
Lamp caps - BS EN 60061-1.
Lamp holders - BS EN 60061-2.
Lampholders with enhanced safety features - BS 7895.
Bayonet lampholders - BS EN 61184.
Lampholders for tubular fluorescent lamps and starter holders - BS EN 60400.
Edison screw lampholders - BS EN 60238.
Interchangeability
Ensure lampholders in luminaires of similar type and rating are identical.
Earthing
Ensure metal lampholders incorporate an earthing terminal.

Y73.2070 LAMPHOLDERS - TUNGSTEN FITTINGS:
Use following lampholders for tungsten filament lamps unless indicated otherwise.

Lamp	Lampholder
up to 150 W	bayonet B22d
200 W	Edison screw E27 2A
300 W	Edison screw 16A

Shade rings
Provide a shade carrier ring for separately mounted lampholders for GLS tungsten filament lamps.
Polarity of Edison Screw Lampholders
Ensure phase conductor is connected to centre contact.

Y73.2080A LAMPHOLDERS - MOUNTING:
Securely mount lampholder in luminaire when it is sole support for lamp.
Cord grip

Deleted: Stage E Issue

Provide integral cord grip type when lampholders are suspended by cord.
Conduit Mounted
When mounted directly to conduit system use backplate lampholder for conduit box.

Y73.2090A CONTROL GEAR AND COMPONENTS:
Compatibility
Ensure control gear and components are suitable for lamp type, wattage and starting characteristics.
Obtain from manufacturers written confirmation of compatibility.

Y73.2095 CIRCUIT LOSSES:
Use high frequency ballasts to ensure the installed circuit load does not exceed 3 W/m^2/ 100 lux.

Y73.2100A FLUORESCENT LAMP BALLASTS AND STARTERS:
Ballasts
BS EN 61347-2-8 and BS EN 60921.
BS EN 61347-2-4, BS EN 61347-2-5, BS EN 61347-2-6 & BS EN 61347-2-7 and BS EN 60925 for d.c. supplied electronic ballasts.
BS EN 61347-2-3 and BS EN 60929 for fluorescent lamps to BS EN 60081 and BS EN 60901.
Supply thermal protectors for ballasts for tubular fluorescent lamps to BS EN 60730-2-3.
Starters - BS EN 61347-2-1 and BS EN 60927.
Use low distortion type.

Y73.2110A DISCHARGE LAMP BALLASTS AND STARTERS:
Ballasts - BS EN 61347-2-9 and BS EN 60923.
Starters - BS EN 61347-2-1 and BS EN 60927.

Y73.2120A CAPACITORS:
Use capacitors in accordance with BS EN 61048 and BS EN 61049 in tubular fluorescent, high pressure mercury and low pressure sodium vapour discharge lamp circuits.

Y73.2130 SUPPLY TERMINALS:
Use screw terminals for supply cables and circuit protective conductors, sized to terminate up to three 2.5mm^2 conductors. Provide separate terminal blocks for each incoming circuit, with marking to identify each circuit.

Y73.2140 FUSE:
Include a fuse holder and BS 1362 fuse in each incoming circuit phase connection.

Y73.2150 INTERFERENCE:
Comply with BS EN 55015.

Y73.2160 REMOTE GEAR:
Locate 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.

Y73.2165 TYPES OF HIGH EFFICIENCY LAMP FOR NON-DAYLIT AREAS:

Light source	Type
High pressure sodium	All ratings above 70W
Metal halide	All ratings above 70W
Tubular fluorescent	All 26mm diameter (T) lamps and 16mm (T5) lamps rated above 11W, provided with low loss or high frequency control gear. 38mm diameter (T12) linear fluorescent lamps 2400mm in length
Compact fluorescent	All ratings above 26W

Y73.2170A TUNGSTEN FILAMENT LAMPS:
Comply with BS EN 60064, BS EN 60432-1 and BS EN 60630. Supply electronic step-down converters for filament lamps to BS EN 61047 and BS EN 61347-2-2. Comply with BS EN 61549 for double capped and ELV lamps.

Y73.2180A FLUORESCENT LAMPS:
Internationally specified tubular fluorescent lamps to BS EN 60081.
UK tubular fluorescent lamps to BS 1853-2.
Single capped fluorescent lamps to BS EN 60901 and BS EN 61199.
Double capped fluorescent lamps to BS EN 60081 and BS EN 61195.
Self ballasted lamps to BS EN 60969 and BS EN 60968.

Y73.2185A TUNGSTEN HALOGEN LAMPS:
Comply with BS EN 60432-2 or BS EN 60357.

Y73.2190 HIGH PRESSURE MERCURY VAPOUR LAMPS:
Comply with BS EN 60188 and BS EN 62035.

Y73.2195 METAL HALIDE LAMPS:
Comply with BS EN 62035 where appropriate.

Y73.2200 HIGH PRESSURE SODIUM VAPOUR LAMPS:
Comply with BS EN 62035.

Y73.2210 LOW PRESSURE SODIUM VAPOUR LAMPS:
Comply with BS EN 60192 and BS EN 62035.

Y73.2230 LAMP MANUFACTURER:
Ensure that lamps of each type are from same manufacturer.

Y73.2240A SUPPORT SYSTEM - CONDUIT:
Use not less than 20mm conduit of same type as main conduit system.
Material - steel.

Y73.2250A SUPPORT SYSTEM - ROD:
Use continuously threaded rods with matching washers and nuts.
Diameter - 6mm.
Material - Cadmium plated steel.

Y73.2260A SUPPORT SYSTEM - CHAIN:
Use cadmium plated steel chain with load carrying capacity of not less than twice weight of complete luminaire.

Y73.2280A SUPPORT SYSTEM - WALL BRACKETS:
Provide wall brackets. Confirm wall brackets are suitable for supporting luminaire.

Y73.2290 SUPPORT SYSTEM - BALL AND SOCKET:
•Installation
4160 SUSPENSION:
Suspend luminaires at height indicated. Ensure suspensions hang vertically unless otherwise indicated.
4200 SUSPENSION BY BALL AND SOCKET:
Install cable through ball and socket connected to conduit box.
•Height
Provide ball and socket as top support, complete with cover fixed to circular conduit box.

Y73.2300A STEEL COLUMNS AND BOLLARDS:
•Finish as shown on drawings/schedules
Standards - BS EN 40-2 and BS EN 40-5.
Material - Steel.
Bracket - Match column.
Earthing
Include earthing terminal fixed within service compartment.
Column base plate - Standard.

Y73.3010A TRACK LIGHTING:
•Class, poles and current rates as indicated on drawings/schedules
Where indicated provide track for fixing fittings in accordance with BS EN 60570.

Y73.4010 ORIENTATION:
Install luminaires in positions indicated, and in horizontal plane unless otherwise indicated.

Y73.4020 CLEANLINESS:
Ensure luminaires are clean and grease free on handover.

Y73.4030 INSTALLATION OF RECESSED FITTINGS:
Install luminaires flush with finished ceiling level.

Y73.4040A INSTALLATION OF SEMI-RECESSED FITTINGS:
Install luminaires as manufacturer's detail.

Y73.4050 INSTALLATION OF WALL MOUNTED FITTINGS:
Install luminaires at height indicated.

Y73.4060 MATERIAL OF SUPPORTING SURFACE:
Ensure classification of luminaires is appropriate. Do not mount luminaires on readily flammable surfaces.

Y73.4070 INSTALLATION IN POTENTIALLY EXPLOSIVE ATMOSPHERES:
Comply with BS EN 60079-14.

Y73.4080 LUMINAIRES IN AREAS WITH INFRA-RED CONTROL SYSTEM:
Install luminaires in areas with infra-red control systems or data bearers so as to cause minimum disturbance to the infra-red transmission system in accordance with BS 7693.

Y73.4090 SIGNS & HIGH-VOLTAGE INSTALLATION:
Comply with BS 559 and BS EN 50107-1.

Y73.4100 INSTALLATION OF EXTRA LOW VOLTAGE TUNGSTEN HALOGEN LAMPS:
Use same wattage lamp on luminaires fed from common transformer. Supply each luminaire on common transformer by separate cable of same cross-sectional area.

Y73.4110 SUPPORT
Ensure support is adequate for weight of luminaires.
Number
•Provide the following minimum number of supports for each luminaire longer than 600mm.

Luminaire width (mm)	Minimum number of supports
Up to and including 300	2
Over 300	4

Y73.4120 SUPPORT FROM CONDUIT:
Where luminaire is supported from conduit provide a conduit box forming an integral part of conduit system at each point of suspension. Ensure suspensions are vertical.
Where conduit enters luminaire use back-nuts and washers to secure luminaire body to conduit support. Provide tube with corrosion resistance equal to conduit system.
Do not support luminaires directly from conduit boxes made from non-metal or heat sensitive materials, where the temperature of the material may exceed 60°C or the mass suspended exceeds 3kg.

Y73.4130 SUPPORT FROM TRUNKING:
Where luminaire is supported from trunking use proprietary clamps or brackets appropriate to the luminaire and trunking.
Do not support luminaires directly from trunking made from non-metal or heat sensitive materials,

Deleted: Stage E Issue

where the temperature of the material may exceed 60°C or the mass suspended exceeds 3kg.

Y73.4140A SUPPORT BY DIRECT FIXING:
Refer to fixing methods, use luminaire supporting coupler to BS 7001 or follow manufacturer's recommendations.

Y73.4150A SUPPORT IN SUSPENDED CEILING:
Support luminaires directly from building fabric.

Y73.4160 SUSPENSION:
Suspend luminaires at height indicated. Ensure suspensions hang vertically unless otherwise indicated.

Y73.4170 SUSPENSION BY ROD:
Use washers, nut and lock-nut at top and bottom of rod. Paint cut ends with calcium plumbate primer or zinc rich paint.

Y73.4180 SUSPENSION BY CHAIN:
Use hook cover for suspension from circular conduit box. For connection to luminaires use luminaire manufacturer's own chain hook, but if not available use hook with standard screw threaded body to be secured to luminaire body with nuts and washers. Where indicated use captive hooks.

Y73.4200 SUSPENSION BY BALL AND SOCKET:
Install cable through ball and socket connected to conduit box.

Y73.4210A COLUMNS AND BOLLARDS:
Location - Confirm location before excavation.
Bases - Install bases in accordance with bollard or column manufacturer's instructions.
Mounting
Mount column or bollard on base as recommended by manufacturer.
Ensure columns and bollards are vertical unless otherwise indicated.
Earthing
Install circuit protective conductor to connect luminaire to earthing terminal in service compartment; size circuit protective conductor same as live conductors. Bond accessible metal parts of column or bollard to earthing terminal.

Y73.4220 CONNECTIONS TO LUMINAIRES
Cable Protection
Use appropriate size of grommet where cables enter through hole in luminaire body.
Earthing
Ensure that the earthing terminal of Class 1 luminaires is connected to the conduit protective conductor of the supply circuit.
Loose Wiring
Clip or tie back with suitable proprietary devices loose wiring within luminaire, at 300mm intervals.

Y73.4230A CONNECTIONS TO LUMINAIRES - DIRECT TO CONDUIT - TERMINAL BOX:
Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cord from terminal block to luminaire.

Y73.4230B CONNECTIONS TO LUMINAIRES - DIRECT TO CONDUIT - AT LUMINAIRE:
Terminate circuit wiring at supply terminals of luminaire. Take all conductors through same cable entry into luminaire.

Y73.4240A CONNECTIONS TO LUMINAIRES - DIRECT TO TRUNKING - TERMINAL BOX:
Terminate circuit wiring in terminal block in an adaptable box located on side of trunking. Use flexible cord from terminal block to luminaire.

Y73.4240B CONNECTIONS TO LUMINAIRES - DIRECT TO TRUNKING - AT LUMINAIRE:
Terminate circuit wiring at supply terminals of luminaire. Take all conductors through same cable entry into luminaire.

C0605 The New LMB Building Project Y73
Electrical Specification LUMINAIRES AND LAMPS
Revised Stage E Scheme Including Agreed VE

Deleted: Stage E Issue

Y73.4250 CONNECTIONS TO LUMINAIRES - SUSPENDED FROM TRUNKING:
Where luminaires are suspended from trunking, secure plug and socket to BS 546, adjacent to, or on side of, trunking. Terminate circuit wiring at socket. Take flexible cord from plug of ceiling rose to supply terminals of luminaire.

Y73.4260A CONNECTIONS TO LUMINAIRES - RECESSED FITTINGS - PLUG AND SOCKET:
Where luminaires are recessed in a suspended ceiling, terminate circuit wiring at plug and socket to BS 546, located not more than 500mm from the access through the ceiling. Use flexible cord from plug of ceiling rose to supply terminals of luminaire.

Y73.4260B CONNECTIONS TO LUMINAIRES - RECESSED FITTINGS - TERMINAL BOX:
Where luminaires are recessed in a suspended ceiling, terminate circuit wiring in terminal block within conduit box. Install wiring to luminaire as indicated in wiring diagram.

Y73.4270 CONNECTIONS TO LUMINAIRES - CONDUIT SUSPENSION:
Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cable from terminal block to luminaire, installed within tube.

Y73.4280 CONNECTIONS TO LUMINAIRES - ROD OR CHAIN SUSPENSION:
Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cord from terminal block to luminaire and clip cable to one of the rods or chains, do not weave cable through links of the chain.

Y73.4290 CONNECTIONS TO LUMINAIRES - MICS CABLE:
Fix cable gland to luminaire and continue conductors to supply terminals of luminaire.

Y73.4300A SEPARATE LIGHTING SWITCHES ON DIFFERENT PHASES:
Install lighting switches on different phases at least 2m apart.

Y73.4300B PHASE BARRIER LIGHTING SWITCHES ON DIFFERENT PHASES:
When lighting switches on different phases are in a common box, use phase barrier switches in accordance with BS 7671.

Deleted: Stage E Issue

Y74 ACCESSORIES FOR ELECTRICAL SERVICES

Y74.1000 GENERAL:
1010 APPLICATION:
Supply fixed electrical wiring accessories for use with fixed and portable peripheral equipment using either power or signalling cables.
1020 SAMPLES:
Where indicated submit samples of proposed materials and equipment for approval before work is started. Label each sample with name, catalogue number and services in connection with item.

Y74.2010A ACCESSORIES COMMON REQUIREMENTS - WHITE PLASTIC PLATES, FLUSH INSTALLATION:
Area of installation - Interior.
Enclosure pattern - Flush.
Accessory mounting
Adjustable steel grid for grid switches or direct to enclosure for all other accessories.
Enclosure material- Pressed steel.
Enclosure finish - Galvanized.
Coverplate finish, all accessories to match
Moulded plastic, colour - white.
Coverplate pattern - Overlapping; with architrave where indicated.
Ancillaries
Earthing terminal integral within switch box.
Neon indicator with red lens, illuminated in "ON" position, for connection units.
Switch rocker bar colour - white.
Operating keys for key operated switches, minimum number 2.
Fuses to BS 1362.
Blank inserts for spare ways on grid switches.
Marking
Method - engraving. Mark front plate to indicate equipment served on connection units.
Conduit and cable entries
Knockouts side, top and rear.
Cable termination - Manufacturer's standard.

Y74.2010B ACCESSORIES COMMON REQUIREMENTS - MATT FINISH METAL PLATES, FLUSH INSTALLATION:
Area of installation - Interior.
Enclosure pattern - Flush.
Accessory mounting
Adjustable steel grid for grid switches or direct to enclosure for all other accessories.
Enclosure material - Pressed steel.
Enclosure finish - Galvanized.
Coverplate finish, all accessories to match
Brass with matt chrome surface.
Coverplate pattern - Overlapping; with architrave where indicated.
Ancillaries
Earthing terminal integral within switch box.
Neon indicator with red lens, illuminated in "ON" position, for connection units.
Switch rocker bar colour as indicated.
Operating keys for key operated switches, minimum number 2.
Fuses to BS 1362.
Blank inserts for spare ways on grid switches.
Marking
Method - engraving. Mark front plate to indicate equipment served on connection units.
Conduit and cable entries
Knockouts side, top and rear.
Cable termination - Manufacturer's standard.

Y74.2010C ACCESSORIES COMMON REQUIREMENTS - WHITE PLASTIC PLATES, EMBEDDED

Deleted: Stage E Issue

CABLES, SURFACE INSTALLATION:
Area of installation - Interior.
Enclosure pattern - Surface.
Accessory mounting - Direct to enclosure.
Enclosure material - White moulded plastic.
Coverplate finish, all accessories to match
Moulded plastic, colour - white.
Coverplate pattern - Surface type.
Ancillaries
Earthing terminal integral within switch box.
Neon indicator with red lens, illuminated in "ON" position, for connection units.
Switch rocker bar colour as indicated.
Operating keys for key operated switches, minimum number 2.
Fuses to BS 1362.
Marking
Method - engraving. Mark front plate to indicate equipment served on connection units.
Conduit and cable entries
Knockouts side, top and rear.
Cable termination - Manufacturer's standard.

Y74.2010D ACCESSORIES COMMON REQUIREMENTS - METAL CLAD PLATES, SURFACE STEEL CONDUIT INSTALLATION:
Area of installation - Interior.
Enclosure pattern - Surface.
Accessory mounting - Direct to enclosure.
Enclosure material
Pressed steel or cast iron.
Enclosure finish
As conduit system or galvanized.
Coverplate finish, all accessories to match
Metal clad.
Coverplate pattern - Surface type.
Ancillaries
Earthing terminal integral within switch box.
Neon indicator with red lens, illuminated in "ON" position, for connection units.
Switch rocker bar colour as indicated.
Operating keys for key operated switches, minimum number 2.
Fuses to BS 1362.
Marking
Method - engraving. Mark front plate to indicate equipment served on connection units.
Conduit and cable entries
Threaded entries, top, bottom or side to suit conduit system.
Cable termination - Manufacturer's standard.

Y74.2010E ACCESSORIES COMMON REQUIREMENTS - SURFACE, STEEL CONDUIT, WEATHERPROOF INSTALLATION:
Area of installation - Exterior.
Enclosure pattern - Surface and weatherproof.
Accessory mounting - Direct to enclosure.
Enclosure material - Cast iron.
Enclosure finish - As conduit system or galvanized.
Coverplate finish, all accessories to match
As enclosure.
Coverplate pattern - Surface type.
Ancillaries
Earthing terminal integral within switch box.
Neon indicator with red lens, illuminated in "ON" position, for connection units.
Screwed weathering cap and chain for socket outlets.
Operating keys for key operated switches, minimum number 2.
Fuses to BS 1362.

Deleted: Stage E Issue

Marking
Method - engraving. Mark front plate to indicate equipment served on connection units.
Conduit and cable entries
Threaded entries, top, bottom or side to suit conduit system.
Cable termination - Manufacturer's standard.

Y74.2010F ACCESSORIES COMMON REQUIREMENTS - SURFACE, PLASTIC, WEATHERPROOF INSTALLATION:
Area of installation - Exterior.
Enclosure degree of protection to BS EN 60529, IP 54.
Enclosure pattern - Surface and weatherproof.
Accessory mounting - Direct to enclosure.
Enclosure material - Impact resistant plastic.
Enclosure finish - Natural or self coloured.
Coverplate finish, all accessories to match
Moulded plastic, colour as indicated.
Coverplate pattern - Surface type.
Ancillaries
Earthing terminal integral within switch box.
Neon indicator with red lens, illuminated in "ON" position, for connection units.
Protective shrouds to rocker bars.
Screwed weathering cap and chain for socket outlets.
Switch rocker bar colour as indicated.
Operating keys for key operated switches, minimum number 2.
Fuses to BS 1362.
Conduit and cable entries
Threaded entries to suit cable/conduit system.
Cable termination - Manufacturer's standard.

Y74.2020A INTERIOR LIGHTING SWITCHES - GENERAL PURPOSE MOULDED PLASTIC:
Standard - BS EN 60669-1, enclosure box to BS 4662.
Switch type - Rocker bar - moulded plastic.
Rating - 5A or 15A.
Gangs as indicated.
Switch mechanism - Snap action microgap.
Pole configurations
Single pole, double pole, 2 way or intermediate as indicated.

Y74.2020B INTERIOR LIGHTING SWITCHES - GRID MOULDED PLASTIC:
Standard - BS EN 60669-1, enclosure box to BS 4662.
Switch type - Rocker bar - moulded plastic.
Rating - 5A or 15A.
Switch mechanism - Snap action microgap.
Pole configurations
Single pole, 1 way, 2 way or intermediate as indicated.

Y74.2020C INTERIOR LIGHTING SWITCHES - PULL CORD:
Standard - BS EN 60669-1, enclosure box to BS 4662.
Switch type - Cord to BS EN 61058-2-1.
Rating - 5A. Pole configurations - Single pole.

Y74.2020D INTERIOR LIGHTING SWITCHES - GENERAL PURPOSE SECRET KEY:
Standard - BS EN 60669-1, enclosure box to BS 4662.
Switch type - Rocker bar - secret key.
Rating - 5A or 15A.
Gangs as indicated.
Switch mechanism - Snap action microgap.
Pole configurations - Single pole, double pole, 2 way or intermediate as indicated.

Y74.2020E INTERIOR LIGHTING SWITCHES - GENERAL PURPOSE DIMMER:

Deleted: Stage E Issue

Standard - BS EN 60669-1, enclosure box to BS 4662.
Switch type - Rocker bar - dimmer.
Rating - 5A or 15A.
Gangs as indicated.
Switch mechanism - Snap action microgap.
Pole configurations - Single pole, double pole, 2 way or intermediate as indicated.

Y74.2020F INTERIOR LIGHTING SWITCHES - GRID SECRET KEY:
Standard - BS EN 60669-1, enclosure box to BS 4662.
Switch type - Rocker bar - secret key.
Rating - 5A or 15A.
Switch mechanism - Snap action microgap.
Pole configurations - Single pole, 1 way, 2 way or intermediate as indicated.

Y74.2030B EXTERIOR LIGHTING SWITCHES - SEALED ROCKER BAR:
Standard - BS EN 60669-1, enclosure box to BS 4662.
Switch type - Rocker bar with sealed in plastic membrane.
Rating - 5A.
Gangs as indicated.
Action - Two position.
Pole configurations as indicated.

Y74.2040A TIME SWITCHES - 24 HOUR:
Wire timer and switch circuits to separate terminals.
Standard - BS EN 60730-2-7.
Time switch type - Quartz stabilized solid state 50 hour nickel cadmium battery backup.
Contacts duty - Inductive.
Contacts rating - 15A.
Special programme facilities
Number of 'ON' and 'OFF' operations - 4
Programme repeat cycle - 24 hour.

Y74.2040B TIME SWITCHES - 7 DAY:
Wire timer and switch circuits to separate terminals.
Standard - BS EN 60730-2-7.
Time switch type
Quartz stabilized solid state 50 hour nickel cadmium battery backup.
Contacts duty - Inductive.
Contacts rating - 15A.
Special programme facilities
Number of "ON" and "OFF" operations - 4
Programme repeat cycle - 7 day.

Y74.2050A LUMINAIRE CONNECTORS - GENERAL AND EMERGENCY LIGHTING:
Rating - 2A.
Connector type
Fixed terminal strip, screw cover and cord grip to BS 67.
Load carrying capacity to match selected luminaire.

Y74.2050B LUMINAIRE CONNECTORS - GENERAL LIGHTING:
Rating - 2A.
Connector type
3 pin plug/socket to BS 546.
Load carrying capacity to match selected luminaire.

Y74.2050C LUMINAIRE CONNECTORS - CORD GRIP GENERAL AND EMERGENCY LIGHTING:
Rating - 2A.
Connector type
Cord grip type plug/socket and screw on retaining cover to BS 5733 3 pin or 4 pin.
Luminaire supporting coupler to BS 7001.

Deleted: Stage E Issue

Load carrying capacity to match selected luminaire.

Y74.2070A ISOLATING SWITCHES - BS EN 60669-1:
Provide isolating switches for fixed appliances.
Utilization category as indicated.
Making capacity as indicated.
Standard - BS EN 60669-1, enclosure box to BS 4662.
Switch type - Rocker bar.
Rating as indicated.
Pole configuration - DP, three pole or TPN as indicated.

Y74.2070B ISOLATING SWITCHES - BS EN 60947-3:
Provide isolating switches for fixed appliances.
Utilization category as indicated.
Making capacity as indicated.
Standard - Enclosure box to BS 4662, BS EN 60947-3.
Switch type - Rocker bar.
Rating as indicated.
Pole configuration - DP, three pole or TPN as indicated.

Y74.2080A FUSE CONNECTION UNITS - SWITCHED:
Standard - BS 1363-4, enclosure box to BS 4662 and switched.
Unit type - Rocker bar - plastic.
Pole configuration - DP.
Ancillaries
Cord outlet or cord grip and fuse as indicated.

Y74.2080B FUSE CONNECTION UNITS - UNSWITCHED:
Standard - BS 1363-4, enclosure box to BS 4662 and unswitched.
Pole configuration - DP.
Ancillaries
Cord outlet or cord grip and fuse as indicated.
Lockable fuse carrier.

Y74.2090A SOCKET-OUTLETS - SINGLE, SWITCHED:
Standard - 13A socket-outlet to BS 1363, enclosure box to BS 4662.
Switching - Switched.
Switch type - Rocker bar - plastic.
Rating - 13A.
Ancillaries
Plug tops 25% of number of sockets, fused as indicated.
Gangs - 1

Y74.2090B SOCKET-OUTLETS - SINGLE WITH INTEGRAL RCD, SWITCHED:
Standard - Enclosure box to BS 4662, BS 7288.
Switching - Switched
Switch type - Rocker bar - plastic.
Rating - 13A.
Ancillaries
RCD, BS 7288. Mains failure trip, sensitivity as indicated. Plug tops 25% of number of sockets, fused as indicated.
Gangs - 1

Y74.2090C SOCKET-OUTLETS - DOUBLE SWITCHED:
Standard - 13A socket-outlet to BS 1363, enclosure box to BS 4662.
Switching - Switched
Switch type - Rocker bar - plastic.
Rating - 13A.
Ancillaries
Plug tops 25% of number of sockets, fused as indicated.

Deleted: Stage E Issue

Gangs - 2

Y74.2090D SOCKET-OUTLETS - SINGLE, UNSWITCHED:
Standard - 13A socket-outlet to BS 1363, enclosure box to BS 4662.
Switching - Unswitched.
Rating - 13A.
Gangs - 1

Y74.2090E SOCKET-OUTLETS - SINGLE WITH INTEGRAL RCD, UNSWITCHED:
•Standard
•Enclosed box to BS 4662, BS 7288.
•HBES systems BS EN 50428, enclosure box to BS 4662.
Switching - Unswitched.
Rating - 13A.
Ancillaries
RCD, BS 7288. Mains failure trip, sensitivity as indicated.
Gangs - 1

Y74.2110A CORD OUTLETS - COOKER CONNECTION UNIT:
Standard - BS 5733, enclosure box to BS 4662.
Format - Cooker connection.
Rating - 45A
Pole configuration - DP&E.

Y74.2120A CABLE AND APPLIANCE COUPLERS - 16A, 240V SINGLE PHASE, GENERAL PURPOSE:
Standard - BS EN 60309-2.
Material - Polycarbonate male and female connectors.
Rating - Voltage 220 - 240V; Current 16A.
Configuration - 2PE.
Colour - 220 - 240V, Blue.
Ancillaries as indicated.
ON/OFF switch; gang combinations 1, 2, 3 and 4; RCD.

Y74.2130A TELEPHONE AND DATA OUTLET SOCKETS - GENERAL PURPOSE:
Standard
For jack socket to telephone service provider requirements and enclosure box to BS 4662.
Size - Standard.
Circuit configurations as indicated.

Y74.2140A TELEPHONE CORD OUTLETS - GENERAL PURPOSE:
Standard - BABT approved.
Circuit configurations - Single or twin as indicated.

Y74.2150A D TYPE MULTIPIN CONNECTORS - GENERAL PURPOSE:
Circuit configurations - Single or twin as indicated.
Size - 25 pin.

Y74.2160A BNC SOCKETS - GENERAL PURPOSE:
Circuit configurations - Single or twin as indicated.
Impedance - 75 ohm.
Mounting - Insulated.
Ancillaries - Dust caps for sockets.

Y74.2170A AERIAL SOCKETS - TV AND FM AERIALS:
Standard - BS 3041-2.
Circuit configurations - Dual TV and FM.
Ancillaries
Safety isolation to BS 6330 for communal aerial systems.

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Y74.2170B AERIAL SOCKETS - SINGLE TV AERIALS:
Standard - BS 3041-2.
Circuit configurations - Single TV.
Ancillaries
Safety isolation to BS 6330 for communal aerial systems.

Y74.2180A LOW VOLTAGE ISOLATING TRANSFORMER UNITS - 240/25V:
•(VA)
Standard - BS EN 61558-1 or BS EN 61558-2-23.
Configuration - Single phase, double wound.
Rating - Input 240V; output 25V; (VA) as indicated.
Ancillaries
Plug and socket for 25V; DP switch primary supply; secondary side fusing.

Y74.2200A INDICATOR LAMPS - GENERAL PURPOSE NEON:
Lamp - Neon.
Lamp rating - 230V supply.
Lens cover - Moulded plastic.
Lens colour - BS EN 60073.
Lens retaining rings - Moulded plastic.

Y74.3010 EARTHING:
Ensure metal framework of equipment is bonded to main earth point. Ensure that cable CPC's are connected to earth bar.
Provide earth CPC between earth lug on metal box and accessory casing except where accessory is encased in plastic.

Y74.3020 PROTECTION:
Ensure there is no physical or electrical damage to accessories when they are removed from their packaging and during installation.
Provide masking covers for surface mounted accessories to protect surface from paint.
Where accessories are flush mounted install front plate after painting is finished.

Y74.3030 FIXING:
Align accessories horizontally and vertically. Where accessories are grouped, mount horizontally in line and parallel to each other and equidistant.
Fix cover plates to boxes with brass fixing screws.

Y74.3040 MEASURING MOUNTING HEIGHTS:
Take measurement for position of electrical accessories to the centre line of equipment from either finished floor or worktop. Where specified height coincides with top of tiling, leave a clear gap of 50mm above tiling.
Mount equipment below a worktop 100mm below underside of worktop.

Y74.3050 STANDARD ACCESSORIES MOUNTING HEIGHTS:
Accessory Location Height (mm)
Lighting switch 1200
Socket outlet General 450
Kitchen 1000
Above worktop 200
Shaver socket outlet 1000
Fused connection unit General 450
Above worktop 200
Fused connection unit
controlling Radiator heater, wall 1800
Radiator heater, focal point 450
Tubular heater 450
Clock 1900
Cooker control unit Above worktop 200
Cooker connection unit 600

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Safety isolating transformer 1200
Room thermostat 1400
Telephone outlet 450
Radio/TV outlet 450
Push button 1200
Fire alarm manual call point 1200
Bell or buzzer 2000
Visible alarm indicator 2000
In car parks and garages comply with appropriate petroleum regulation for mounting heights of socket outlets.

Y74.3070 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.

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Y80 EARTHING AND BONDING COMPONENTS

Y80.1000 GENERAL
1010 MATERIALS GENERALLY:
Use materials and installations methods in accordance with BS 6651, BS 7671, BS 7430, Electricity Safety, Quality and Continuity Regulations and Local Electricity Supply Authority Requirements as appropriate.

Y80.2010A CONDUCTORS FOR LIGHTNING PROTECTION SYSTEMS - HORIZONTAL AIR TERMINATIONS:
•Covering colour
Use - Horizontal air termination or down conductor.
Minimum dimension - BS EN 50164-2 Table 1.
Form - Strip.
Material - Copper, annealed.
Coverings - None or PVC.
Accessories - Ridge Saddle; conductor clips - non-metallic; glazing bar holdfast; slate holdfast; backplate holdfast; all accessories sized to suit conductors.

Y80.2010B CONDUCTORS FOR LIGHTNING PROTECTION SYSTEMS - SELF SUPPORTING AIR TERMINATIONS:
Use - Air termination, vertical.
Minimum dimension - BS EN 50164-2 Table 1.
Form - Rod.
Material - Copper, hard drawn.
Coverings - None.
Accessories - Terminal base; ridge saddle; rod brackets; rod to tape coupling.

Y80.2010C CONDUCTORS TO EARTHING SYSTEMS TO BS 7430:
Use - Earthing conductor.
Minimum dimension - BS 7430, current density 50A/mm^2.
Form - Strip.
Material - Copper, annealed.
Coverings - None.
Accessories - Conductor clips, metallic.

Y80.2020A LIGHTNING PROTECTION CONDUCTOR JOINTS:
First Conductor
Form - strip; material - copper.
Dimensions - To BS EN 50164-2 Table 1 minimum for lightning protection system.
Second conductor
Form - rod; material - copper.
Dimensions - To BS EN 50164-2 Table 1 minimum for lightning protection system.
Solid joint - Brazed or welded, thermic.
Disconnecting test joint
Square clamp, oblong clamp, plate clamp or screw-down clamp.

Y80.2020B EARTHING SYSTEMS CONDUCTOR JOINTS:
First Conductor
Form - strip; material - copper.
Dimensions - For conductor current density 50A/mm^2 earthing systems.
Second conductor
Form - rod; material - copper.
Dimensions - For conductor current density 50A/mm^2 earthing systems.
Solid joint - Brazed or welded, thermic.
Disconnecting test joint
Square clamp, oblong clamp, plate clamp or screw-down clamp.

Y80.2030A TAPE FIXING DEVICES:

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Secure bare conductor tape to structure with fixing devices which avoid piercing tape and ensure 3mm (minimum) clearance of tape from structure, at 450mm maximum, centres.
Material for lightning protection systems
Non-conducting.
Material for system earthing
Bronze.

Y80.2040A ROD EARTH ELECTRODES FOR LIGHTNING PROTECTION SYSTEMS:
Standard - BS 6651. Form - Roll threaded rod.
Dimensions
Rod Diameter - 15 mm - nominal.
Rod Length - 2.4m (2 x 1.2) minimum.
Earth electrode couplings
Use silicon bronze alloy or aluminium bronze alloy, counter bored to completely enclose rod threads. Ensure rods meet in centres of coupling.
Use high strength driving cap in contact with driven rod and couplings of compatible material fully enclosing the rod threads.
Interconnect electrodes using 25 x 3 mm bare copper tape.
Earth electrodes in drawpits
Provide concrete cover, permanently labelled, for electrodes installed through cable drawpit bases.
Material, minimum size as BS 7430 Table 4
Molecularly bonded copper clad steel rods to BS 7430 or BS 6651.
Accessories
Rod to tape clamp or U-bolt clamp. Accessories sized to suit earth rod and connector.

Y80.2040B ROD EARTH ELECTRODES FOR SYSTEM EARTHING:
Standard - BS 7430.
Form - rod with female thread each end.
Dimensions
Rod Diameter - 15 mm - nominal.
Rod Length - 2.4m (2 x 1.2) minimum.
Earth electrode couplings
Use high strength driving cap in contact with driven rod and couplings of compatible material fully enclosing the rod threads.
Interconnect electrodes using bare copper tape 25mm x 6mm.
Earth electrodes in drawpits
Provide concrete cover, permanently labelled, for electrodes installed through cable drawpit bases.
Main earth conductor connection
Connect main earth conductor to first electrode using heavy duty purpose made silicon aluminium bronze body conductor clamp and high tensile phosphor bronze bolt.
Material, minimum size as BS 7430 Table 4 - Copper.
Accessories
Rod to tape clamp. Sized to suit earth rod and connector.

Y80.2040C BUILDING OR STRUCTURAL ELEMENT EARTH ELECTRODES FOR LIGHTNING PROTECTION SYSTEMS:
Standard - BS 6651.
Form - Building or structural element.
Earth electrode couplings
Use silicon bronze alloy or aluminium bronze alloy, counter bored to completely enclose rod threads. Ensure rods meet in centres of coupling.
Use high strength driving cap in contact with driven rod and couplings of compatible material fully enclosing the rod threads.
Interconnect electrodes using 25 x 3 mm bare copper tape.
Earth electrodes in drawpits
Provide concrete cover, permanently labelled, for electrodes installed through cable drawpit bases.
Material, minimum size as BS 7430 Table 4
Molecularly bonded copper clad steel rods to BS 7430 or BS 6651.
Accessories
Rod to tape clamp or U-bolt clamp. Accessories sized to suit earth rod and connector.

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Y80.2040D BUILDING OR STRUCTURAL ELEMENT EARTH ELECTRODES FOR SYSTEM EARTHING:
Standard - BS 7430.
Form - Building or structural element.
Earth electrode couplings
Use high strength driving cap in contact with driven rod and couplings of compatible material fully enclosing the rod threads.
Interconnect electrodes using bare copper tape 25mm x 6mm.
Earth electrodes in drawpits
Provide concrete cover, permanently labelled, for electrodes installed through cable drawpit bases.
Main earth conductor connection
Connect main earth conductor to first electrode using heavy duty purpose made silicon aluminium bronze body conductor clamp and high tensile phosphor bronze bolt.
Material, minimum size as BS 7430 Table 4 - Copper.
Accessories
Rod to tape clamp. Sized to suit earth rod and connector.

Y80.2060A EARTH ELECTRODE CLAMPS:
Connect tape to electrode head using heavy duty purpose made silicon aluminium bronze body connector clamps or leaded gunmetal body connector clamps, and high tensile phosphor bronze bolts to BS EN 12163.

Y80.2070A EARTH ELECTRODE INSPECTION FACILITIES:
Provide enclosure for each connection between earth conductor and associated earth electrode system. Install so that top is flush with finished ground or floor level. Ensure enclosure provides adequate access for testing purposes. Provide pit details for builders work.
Labelling - Wording, Earth.

Y80.2080A EARTH ELECTRODE TANK PENETRATION SEAL:
Dimensions
Screed depth (mm) 54 minimum.
Slab depth (mm) 158 maximum.
Flange area (m^2) 0.125 minimum.
Form - Earth rod to tube seal by compression ring and seal.
Slab former - Standard earth rod pit.

Y80.2090A MAIN EQUIPOTENTIAL BONDS:
Provide main equipotential bonds in accordance with BS 7430 and BS 7671.
Material - Insulated cable, single core to BS 6004.
Use no joints in main equipotential bonds.

Y80.2100A SUPPLEMENTARY EQUIPOTENTIAL BONDS:
Provide supplementary equipotential bonds to BS 7430 and BS 7671. Joints not allowed in these bonds.
Material - Insulated cable, single core to BS 6004.

Y80.2110A CIRCUIT PROTECTIVE CONDUCTORS:
Material
Insulated cable, single core to BS 6004 as indicated; metallic screwed conduits (excluding flexible); metallic trunking with tinned copper links; armouring and/or metallic sheathing of armoured cables or integral conductor of multi-core cable.
Size
Provide protective conductors sized in accordance with BS 7671 (IEE Regulations) 543-01-03 and Tables 54B, 54C, 54D, 54E and 54F or provide protective conductors sized in accordance with BS 7671 (IEE Regulations) 543-01-04 and Table 54G.

Y80.2120 EARTHING CLAMPS:
Use clamps complying with BS 951, for bonding pipes and lead sheathed cables.

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Y80.2130A EARTH BUSBARS:
Material
Manufacture earth busbars from hard drawn, tinned, high conductivity copper bar.
Substation Earth busbar
75 x 13mm cross section 600mm minimum length.
Main Earth Terminal busbar
25 x 6 mm minimum for incoming live conductor not exceeding 50mm and 50 x 6 mm minimum for incoming live conductor over 50mm^2.

Y80.2140 TEST LINKS:
Provide two test links, in connections between main earth conductors and earth busbar. Fabricate each from two additional sections of earth busbar. Mount one section on stand-off insulators matching earth busbar; use remaining section as removable test link. Secure 12mm high tensile brass studs to fixed sections of busbar and drill corresponding clearance holes in test links and provide brass washers, nuts and locking devices to secure frame/neutral earthing and test links.

Y80.2150 LUGS/TAGS:
Provide lugs or tags to enable connection of bonding conductors to equipment earth terminals.

Y80.2160 PROTECTIVE CABLE TERMINATIONS:
For bolted connections use crimp type lugs compressed by automatic tool to achieve correct pressure and crimp depth.

Y80.2170 PROTECTIVE CONDUCTOR WARNING NOTICES/LABELS:
Provide a permanent label durably marked in letters 4.75mm minimum height "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE", in visible position, at each bonding conductor connection to extraneous conductive parts.

Y80.2180 MAIN EARTH CONDUCTOR - WARNING TAPES:
Provide green/yellow PVC tapes labelled "EARTHING CONDUCTOR" over complete external lengths of main earth conductors at 300mm depth below finished ground.

Y80.2190 EARTH BAR LABEL:
Label earth bar "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE" with wall mounted laminated plastic tablet engraved in 10mm high red letters on white ground.

Y80.3010 CLEAN EARTH DISTRIBUTION:
Install clean earth distribution in double insulated cables from earth electrodes to equipment points. Mount all busbars with insulators and separate from other earthing systems.

Y80.3020 DISSIMILAR METALS:
Ensure, where dissimilar metals are used for system, that purpose made jointing materials are used such that corrosion and deterioration of the electrical connection are not caused. Ensure bonding connections to other metal parts of building are electrolytically compatible with those metal parts. Use the guidance given in BS 7430 Table 8 when bonding dissimilar materials.

Y80.3030A COPPER TAPE JOINTS:
Provide waterproof protection at joints subject to moisture.
Joint copper tapes by brazing, using zinc-free brazing metal with melting point at least 600^oC or thermic welding.

Y80.3030B ALUMINIUM TAPE JOINTS:
Provide waterproof protection at joints subject to moisture.
Joint aluminium tapes by welding to BS EN 1011-4.

Y80.3040 STRANDED CONDUCTOR JOINTS:
Provide waterproof protection at joints subject to moisture.
Joint copper stranded conductors with compression joints to BS EN 61284.

Y80.3050A PROTECTIVE CABLE TERMINATIONS:

For bolted connections use crimp type lugs compressed by automatic tool to achieve correct pressure and crimp depth.
Make connections between tape and equipment using high tensile grade brass bolts with brass nuts, washers and locking devices. Use phosphor bronze bolts, nuts and washers where connections are liable to corrosion.

Y80.3060A EARTH ELECTRODES:
Location
Locate electrodes not less than 2m distant from building/structure protected, and away from telecommunication and pilot cables and metallic fences.
Driving
Drive rods vertically into ground with purpose designed electric hammer. (Where impenetrable strata encountered at shallow depth, drive at 30° to horizontal).
Depth of rod
2.4m minimum below finished ground surface.
Depth of Electrode heads
Locate electrode heads just below ground level.
Spacing
Where electrodes are installed in a group ensure minimum distance between electrodes is twice depth of rods. Where rods for clean earth are installed ensure distance from any other system rods is six times depth of clean rods.
Tape Depth
Install interconnecting or electrode tape 750mm below finished ground level, rising vertically at each electrode.
Connect groups of electrodes to main earth conductor via bolted link in inspection pit as BS 7430 for test purposes.

Y81 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES:

Y81.1000 GENERAL
1010 INSPECTION AND TEST PROCEDURE:
Comply with BS 7671 Requirements for Electrical Installations (the IEE Wiring Regulations), IEE Guidance Notes Number 3 Inspection & Testing and other British Standards as appropriate.
1020 SUPPLY CHARACTERISTICS:
Obtain information called for in BS 7671 about supply characteristics from Supplier, other than where to be measured as part of testing procedure.
1030 DESIGN INFORMATION:
Obtain all design assumptions, calculations and any other information to enable compliance with BS 7671 to be verified.

Y81.2010A INCORPORATED EQUIPMENT CHARACTERISTICS:
Obtain and use information from manufacturers of equipment provided.
Use information provided, for equipment supplied by others and incorporated into installation.

Y81.2020A PROSPECTIVE SHORT CIRCUIT CURRENT:
Determine values of I_P by measurement, unless other means are indicated. Determine I_P at all necessary points within installation to confirm correct equipment selections.
Obtain from supply undertaker written confirmation of maximum and minimum values of I_P at origin of installation. Adjust subsequent measured values of I_P accordingly.

Y81.2030A INITIAL VERIFICATION:
Carry out detailed inspection to verify the requirements of BS 7671, Section 712 in the order given in clause 712-01-03 for New Installation or Altered or Added Installation as appropriate.

Y81.2040A TEST EQUIPMENT AND CONSUMABLES:
Provide test equipment and consumables to complete tests satisfactorily, and to retest any failed installations following corrective measures.
Test equipment quality assurance requirements to BS EN ISO 10012.

Y81.2050A TESTING
Carry out in the same order as published the tests required by BS 7671, Section 713 for New Installation or Altered or Added Installation as appropriate.

Y81.2060A CONTINUITY OF PROTECTIVE CONDUCTORS:
Confirm continuity. Use ac source or dc source.

Y81.2070A EARTH FAULT LOOP IMPEDANCE:
Use 25 A test current. Measure and record source impedance (Z_E).
If alternative LV supply arrangements are available, measure Z_S when using supply with highest impedance.
Measure Z_S with main equipotential bonding conductors connected. Do not summate values of several parts of each loop.

Y81.2080 SETTINGS AND ADJUSTMENTS:
Confirm characteristics and settings of protective devices are within maximum and minimum specified tripping times. Check correct operation of devices. Confirm interlocks and sequences operate safely and as indicated.

Y81.2090A STANDBY GENERATORS:
Perform works tests on standby generators and provide test certificates. Comply with BS 5000-3 and BS 5000-11 or BS EN 60034-3 as appropriate.

Y81.2100A HV AND LV TRANSFORMERS:
Perform works tests on HV and LV switchgear in accordance with BS EN 62271-200 and BS EN 60439-1, as appropriate, and provide test certificates.

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Y81.2110A HV POWER TRANSFORMERS:
Perform works tests on HV power transformers in accordance with BS EN 60076-3, BS EN 60076-4 and BS EN 60076-5. Provide test certificates.
Perform all routine tests.

Y81.2120A FIRE DETECTION AND ALARM INSTALLATIONS:
Carry out site testing and inspection and provide test certificates for fire detection and alarm systems in accordance with BS 5839-1.

Y81.2120B LIGHTNING PROTECTION INSTALLATIONS:
Carry out site testing and inspection and provide test certificates for lightning protection installations in accordance with BS 6651.

Y81.2120E EMERGENCY LIGHTING INSTALLATIONS:
Carry out site testing and inspection and provide test certificates for emergency lighting installations in accordance with BS 5266 and BS EN 50172.

Y81.2130 CALIBRATION:
Provide current certificates of calibration for all instruments used during test procedures. Record particular instrument identity on record sheets.

Y81.2140A CERTIFICATION AND REPORTING:
Complete and hand over to the Client a Completion and Inspection Certificate to BS 7671 Appendix 6 for New Installation or Altered or Added Installation as appropriate.

Y81.2150A INSTALLATION CERTIFICATES:
Provide installation certificates for electrical installations in accordance with BS 7671 (IEE Regulations).
Record details of departures from BS 7671 (IEE Wiring Regulations) on certificate.
Provide copies of calculations justifying departure from BS 7671 (IEE Wiring Regulations) and attach to certificates.

Y81.2160 RECORDS:
Record all results and instrument readings on approved Record Sheets and hand over to the client two copies for each inspection and test.
Hand over copies of complete Record Sheets to
- Client.

Provide copies of Record Sheets
- 2.

Y81.3010 CONDUCTIVE PARTS:
Test conductive parts simultaneously accessible with exposed conductive parts of extraneous conductive parts. Establish that they are either not an extraneous conductive part, or that they are reliably connected by metal to main equipotential bonding.
Confirm conductive parts which are not extraneous conductive parts are separated from earth by an impedance greater than 50,000 ohms. Confirm other conductive parts are bonded to equipotential zone earthbar by an impedance not exceeding 0.1 ohms.

Y81.3020 PHASE SEQUENCE:
Check and confirm correct polarity of all conductors in all circuits.

Y81.3030A HIGH VOLTAGE TESTS:
Conduct high voltage tests for equipment indicated. Comply with BS 923-1, BS EN 61180 and BS EN 60060-2. Comply with BS EN 61180.

Y81.3040A LV BURIED CABLES:
Test continuity and insulation of buried cables immediately after back-filling. Test continuity and insulation of buried cables prior to handover.

Y81.3040B HV AND LV BURIED CABLES:

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Test continuity and insulation of buried cables immediately after back-filling. Test continuity and insulation of buried cables prior to handover. Perform HV tests on buried HV cables prior to handover.

Y81.3050 CONDUIT, TRUNKING AND DUCTING:
Test and confirm electrical continuity before installing cables.

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Y82 IDENTIFICATION - ELECTRICAL

Y82.1000 GENERAL

Y82.2010A LABELS AND NOTICES:
Apply identification labels and notices in accordance with BS 7671 (IEE Wiring Regulations), Clause 514 to all electrical cables plant and equipment including components of mechanical systems.
Identification of protective devices.
Diagrams, charts or tables to comply with Clause 514-09.
Warning notices, voltages in excess of 250 volts.
Periodic inspection and test notices.
Residual current device notices.
Earth electrode safety electrical connection label.
Bonding conductor connector point to extraneous conductive parts label.
Earth free local equipotential bonding areas warning notice.
Electrical separation areas warning notice.
Outdoor equipment socket outlet notice.

Y82.2020A MATERIALS:
Use materials for labels and notices with a predicted life equal to or greater than the design life of the electrical cables, plant, equipment or installation to which it refers.
External
Signwritten, or stencil in paint compatible with surface.
Colour - Background, plant standard finish. Lettering, white.
Internal
Engraved thermosetting plastic laminate.
Colour - Background, white or red. Lettering, red or white.

Y82.2030A FIXING - INTERNAL:
Fix labels and notices using materials compatible with label or notice and surface to which it is fixed by screws into tapped hole or bolted complete with washer nut and locking device.

Y82.2040A ARRANGEMENT:
Obtain approval prior to manufacture, with regard to style, colour, lettering, size and position of all labels and notices.
Provide sample showing style, colour, lettering and size, for approval.

Y82.2050A LETTERING AND SIZE OF LABELS AND NOTICES:
Ensure that all lettering and symbols comply with the requirements laid out in BS 7671 (IEE Wiring Regulations), paragraph 514 and BS 5499. Use BS 5499-1 for height of lettering where not otherwise indicated. Ensure labels and notices of adequate size for the lettering required, and allow a minimum margin around all lettering of one line space vertically and two letter spacing horizontally.
Font - Helvetica Medium.
Size - BS 5499-1 or 5mm minimum high letters.

Y82.2060A CONDUCTOR ARRANGEMENT:
Arrange circuit polarity so that phases read in phase rotation order followed by the neutral, if any, from top to bottom in horizontal conductor layouts and left to right in vertical conductor layouts. Ensure flat horizontal arrays have leading phase to the left and neutral to the right from left to right when viewed from supply point. Arrange phase or live pole of two wire apparatus at top or left hand and neutral and earth both at bottom or right hand side. In all cases, ensure conductor arrangements defined are when viewed from front face of all equipment and terminating facilities. Apply identification markers in accordance with BS 7671 (IEE Wiring Regulations), Clause 514 to all conductor termination points.

Y82.2070A SAFETY SIGNS:
•Details of supplementary or text signs to BS 5499-5 as indicated on drawing
Label all electrical plant and equipment using safety sign 8.A.0044 of BS 5499-5 where voltages above ELV exist.
Provide supplementary or text signs complying with BS 5499-5 with each safety sign 8.A.0044 as

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indicated.
Label all electrical plant and equipment with the labels specified in the appropriate British Standards for that plant or equipment.
Identify each substation and main switchroom with safety sign 8.A.0044 to BS 5499-5 with supplementary signs to BS 5499-5, notices and signs required by BS 5499-5 for any fire extinguishing system and notice giving details of,
Name of the Substation or switchroom
The presence of Medium and Low Voltages.
Administrative instructions for access.
Location and method of contacting controlling authority.
Actions to be taken in an emergency.

Y82.2080A PLANT AND EQUIPMENT LABELS:
Fit labels on all items of plant, equipment, switches, etc., include the following information: service controlled, circuit reference, voltage, type of supply and phase etc., circuit protection type and rating.

Y82.2085 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:
Graphical symbols for use on equipment to be created and applied in accordance with BS EN 80416-1, BS EN 80416-2, BS EN 80416-3.

Y82.2100 COLOUR CORRECTED LIGHT FITTINGS:
Fix a warning or identification disc to light fittings containing colour corrected fluorescent tubes or other colour corrected light sources to ensure that maintenance staff install the correct lamps.

Y82.2110A MOTORS AND STARTERS LABELS:
Fit identification labels to all motors, starters and starter panels. Ensure positive identification of respective motors and starters. Provide motors with non-corrodible labels attached adjacent to each bearing giving details of the lubricant to be used. Mark direction of normal rotation on motor casing. Provide labels to identify motor equipment fitted with surge suppressors and thermistors stating that insulation test voltages must not be applied to thermistors and thermistor control units. Ensure labelling is compatible with schematic and wiring diagrams, and complies with BS EN 60034-8.

Y82.2120A ENGRAVED ACCESSORY PLATES:
Engrave switchplates, spur units, pushes and special plates for bed head units, call systems, fire alarms, etc. Use 6mm high letters with engraving coloured red.

Y82.2130A SWITCHGEAR:
Fit labels on switchgear as required by BS 7671 and BS EN 60439 to indicate duty of unit, its voltage, phase and current rating, protective device rating size of conductor involved, and all other necessary details.
Use an agreed serial coding system, provide at the switch a key to the coding system.

Y82.2140 DISTRIBUTION BOARDS:
On each distribution board 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.

Y82.2150A SCHEMATIC DIAGRAMS:
Provide a purpose made schematic diagram permanently fixed showing the connections of the equipment and plant.
Locations and materials as indicated in contract preliminaries.

Y82.2160A SPECIAL PURPOSE EARTHING:
Fit labels to special purpose earthing conductors and connection points, describing their purposes and any instructions necessary for their operation and maintenance.
IT equipment "Clean Earths".
Telecommunications functional earths.

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Y82.2170A INDICATOR LAMPS AND PUSH BUTTONS FOR POWER SYSTEMS:
Use indicator lamp and push button colours in accordance with BS EN 60073.
Indicator lamp
Red, danger or alarm; yellow, caution; green, safety.
Push buttons
Red, emergency action; red, stop or off; yellow, intervention; green, start or on.
Illuminated push buttons - Type a.

Y82.2180A CONDUIT AND TRUNKING COLOUR CODING:
In areas of mechanical plant or voids accommodating mechanical services, or where otherwise indicated, identify electrical conduits and ducts in accordance with BS 1710. Apply colour orange to BS 4800 by painting on service as a band over 150mm or applying an adhesive tape type wrap around services over a length of 150mm.
Place identification colours at bulkheads, wall penetrations and any other place where identification is necessary.

Y82.2190A CABLE IDENTIFICATION:
Provide all cables, other than final sub-circuit wiring enclosed in conduits or trunking, with labels fixed at each end of cable either side of wall and floor penetrations at approximately 12m intervals at convenient inspection points by means of non-releasable plastic straps, minimum width 4mm.
Ensure labels show the reference number of cable.

Y82.2200A TERMINAL MARKING AND CONDUCTOR IDENTIFICATION:
Provide for switchgear and control gear elements whose terminals are marked in accordance with BS 5472 (EN 50005) and BS 6272 (EN 50042). Use a unique reference to identify each element in the switchgear or control gear. Mark on or adjacent to each element its reference. Identify each terminal for connection to external wiring or cabling using a reference system complying with BS EN 60445 based on the element reference and the appropriate element terminal reference.
Adjacent to terminals.
Use lettered or numbered ferrules or sleeves to BS 3858 to mark each auxiliary conductor or control cable core with the identity of the terminal to which it is connected and the reference of plant or equipment to which it is connected and the identity of the terminal at the remote end. Ensure that main circuit conductors are identified in accordance with BS 7671 (IEE Wiring Regulations) paragraph 514.
Ensure that all identification of terminals and conductors is recorded and included on record drawings and in operation and maintenance documentation.

Y82.2210A 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 on such routes. Provide cables markers with a brass plate or impress concrete to clearly indicate the reference of group of cables or reference number of cable and operating voltage of cable. Provide key to any reference system used at switchgear. Mark and protect direct buried cables with plastic tape yellow printed black "DANGER ELECTRIC CABLES" elsewhere.

Y82.2220A CABLE CONDUCTOR COLOUR CODING:
Identify cable conductors in accordance with BS 7671 (IEE Wiring Regulations) paragraph 514, note that a lighting sub-circuit switch wire is a phase conductor in a single phase circuit.
All single phase final sub-circuit phase wiring coded Brown.

Y82.2230 CABLE JOINTING AND TERMINATION:
Connect all cables in the installation so that the correct sequence of phase rotation is maintained throughout. Where straight through joints are approved joint medium voltage conductors as they lie, ensuring their complete length is phased out on completion. Ensure connections at terminations of MV cables are made in the correct phase rotation and ensure cable conductor termination marking if any, complies with this phase sequence. Where straight through joints are approved on low voltage cables, whether power cables or control or auxiliary cables, joint conductors strictly in accordance with their colour or numeric coding. Where such joints are approved on mineral insulated or other non-coded conductor cables, identify each core at the joint and make the joint core to core.

Y82.2240A CABLE SHEATH IDENTIFICATION - INTERNAL:

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Use to identify coloured cables sheaths for various services as follows.
Fire alarm, red;
Clock circuits, brown;
Telecommunications, grey;
Data as system suppliers' requirements;
Control, black;
LV, black;
LV mineral insulated, orange;
MV red.
Code cables for various services using alpha numeric symbols as follows.
Code letters preceding cable reference.
Fire alarm, FA.
Clock, CL.
Telecommunications, T.
Data, D.
Control, C.
Low voltage, LV.
Extra low voltage, ELV.
LV Essential circuits EM.
Medium voltage, HV.

Y82.2250A CABLE SHEATH IDENTIFICATION - EXTERNAL:
Identify cable sheaths for various services in accordance with NJUG Guidelines on the Positioning and Colour Coding of Utilities' Apparatus, as follows.
MV Red; LV Black; telecommunications and data, Grey.

Y82.2260A ADDITIONAL SAFETY SIGNS:
Provide at locations shown or as appropriate safety signs to BS 5499 with colours and dimensions as of BS 5499-1.
Application
For main switch and electrical plant room access doors. BS 5499-5, complete with supplementary signs as shown.
6.C.0019. 6.A.002, with supplementary sign "Authorised persons only".
7.A.022
Application
For use with permit to work systems, BS 5499-5, complete with supplementary signs as shown.
6.C.0021. Printed on rigid plastic, with hanging loop, with supplementary wording "Do not operate. Work in progress".
Application
For use at each emergency stop. BS 5499-5, complete with supplementary signs as shown.
9.B.0097. With supplementary sign "Emergency stop push-button".

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Y90 FIXING TO BUILDING FABRIC

Y90.1000 GENERAL
1010 PREPARATION:
Mark-out, set-out and firmly fix all equipment, components and necessary brackets and supports.
1020 MANUFACTURER'S DRAWINGS:
Use manufacturer's drawings and templates for purposes of marking and setting out.
1030 FIXINGS:
Ensure structure and fixings are suitable for items to be fixed.
1040 LOADING DETAILS:
Provide loading details for all fixing types.
1050 BUILDING-IN BY OTHERS:
Provide all necessary assistance to enable any item of building-in type to be built in by others.
1060 SIZE OF FIXING:
Use largest size of bolt, screw or other fixing permitted by diameter of hole in item to be fixed.
1070 GREASING OF FIXINGS:
Ensure all bolts, screws or other fixings used are greased or lubricated in accordance with manufacturer's instructions.

Y90.2010 STANDARDS:
Ensure that fixings such as expanding anchors are tested for tensile loading in accordance with BS 5080-1.

Y90.2020 PLUGS:
Use plugs of suitable size and length for fixings. Use plastic, fibrous or soft metal non-deteriorating plugs to suit application. Do not use wood plugs.
Ensure that when screw is in place, threaded length is in plug. Ensure plugs used for screw fixing are set-in to correct depth prior to final tightening.

Y90.2030 SCREWS:
Use screws to BS 1210. Generally use sherardized steel wood screws for fixing to concrete, brickwork or blockwork.
In damp or exposed situations use greased brass wood screws.

Y90.2040 CAST-IN FIXINGS:
Where cast-in fixings are permitted, mark out and set fixings in accordance with manufacturer's instructions.

Y90.2050 SHOT FIRED FIXINGS:
Obtain approval prior to using shot fired type fixings.

Y90.2060 SELF ADHESIVE FIXINGS:
Obtain approval prior to using self adhesive type fixings.

Y90.2070 PROPRIETARY CHANNEL INSERTS:
Provide proprietary channel inserts for casting in where indicated.

Y90.3010 DRILLING:
Drill holes squarely. Use drills of requisite size and depth, and appropriate to fabric. Do not flame-cut holes in metal work.

Y90.3020 PROPRIETARY FIXINGS:
Comply with manufacturer's instructions for all fixings.

Y90.3030 FIXING TO REINFORCED CONCRETE:
Take precautions to avoid fixing through reinforcement.

Y90.3040 FIXING TO BRICKWORK:
Do not fix to unsound material or mortar between brickwork courses.

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Y90.3050 FIXING TO TIMBER RAILS:
Fix equipment, brackets and supports by drilling hole through timber rail and fixing with bolt, back plate, washer and loose nut.

Y90.3060A FIXING TO HOLLOW STUD/TILE/BLOCK WALLS:
Fix equipment, brackets and supports where there is access at rear of wall, by drilling hole through wall and fixing with bolt, back-plate, washer and loose nut.
Fix equipment, brackets and supports where there is no access at rear of wall, drill hole and use screw anchor type fixing or gravity type toggle fixing.

Y90.3070A FIXING TO CONCRETE, BRICKWORK OR BLOCKWORK:
Fix equipment, brackets and supports using wood screws in plugs.
Drill holes and fix using steel bolts of grouted bolt type or expanding bolt type fixing.

Y90.3080A FIXING TO METALWORK:
Fix equipment, brackets and supports by drilling holes and fixing using set screws or bolts complete with washers, shakeproof washers and loose nuts.

Y90.3090A FIXING TO STRUCTURAL STEELWORK AND CONCRETE STRUCTURES:
Provide manufacturer's information on recommended fixing. Obtain approval for any fixing to structure steel work and concrete structures.
Generally use proprietary fixings to structural steelwork and concrete structures.
Obtain approval to cut holes in structural steelwork or concrete structures or weld to structural steelwork.

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C0605 The New LMB Building Project
Electrical Specification
Revised Stage E Scheme Including Agreed VE

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Y91 OFF-SITE PAINTING AND ANTI-CORROSION TREATMENT

Y91.1000 GENERAL:

1010 GENERAL REQUIREMENTS:

Where particular methods of finish and painting are not specified, ensure following requirements are met.

Protect all metal work, plant, equipment, pipelines, ductlines, ancillaries, brackets and supports against corrosion and oxidization.

Provide ferrous metals, machined or otherwise with protective coatings at manufacturer's works.

Ensure all items requiring on-site decorative finishes are provided primed to suit base material and required finish.

1020 DAMAGED FINISHES:

Following delivery to site, storage on site and installation make good any damage to finishes, by cleaning, degreasing and re-furbishing.

KJ TAIT ENGINEERS

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MEDICAL RESEARCH COUNCIL

THE NEW LMB BUILDING PROJECT
CAMBRIDGE

SPECIFICATION FOR ELECTRICAL SERVICES INSTALLATION

APPENDIX 1 – LUMINAIRE SCHEDULE

ISSUE 6.0 Deleted: 3.0

REVISED STAGE E DESIGN

JANUARY 2009 Deleted: NOVEMBER 2007

C0605

KJ TAIT ENGINEERS

NOTES

1. All luminaires shall be as detailed in the Luminaire Schedule and no alternatives shall be considered.
2. Contractor to offer list of luminaires and samples of each in it's specified finish to the Engineer prior to ordering, for comment and acceptance. The list shall include all necessary parts, accessories, reference numbers and details of finishes.
3. Luminaires to be installed in strict accordance with manufacturer's latest recommendations and advice. Contractor to contact manufacturer for latest information prior to any installation work taking place.
4. Internal luminaires to be installed after all dirty works are complete. Luminaires to be suitably protected until the site is cleaned of all dust and debris. All luminaires shall be clean before sign-off.
5. External luminaires to be installed after site is cleared of mortar, sand and debris, and when use of all machinery likely to damage luminaires is complete.
6. Supply all luminaires complete with lamps. All lamps shall be Philips, Osram or Sylvania unless specifically noted otherwise.
7. All luminaires shall be supplied c/w 5-core modular wiring flex and connector for connection to lighting control system. Luminaire manufacturer to liaise with lighting controls vendor to co-ordinate requirements.
8. All luminaires shall be supplied with all necessary fixing equipment and any accessories required to install in the specified location or type.
9. All emergency luminaires shall be complete with appropriate control gear to allow automatic emergency lighting testing, monitoring and central reporting via lighting control system (refer to section V21 of Electrical specification for details of control system).

REVISION HISTORY

Issue No.	Description	Date	Initial
1.0	**Draft Stage D Issue**	23.09.06	BH
2.0	**Stage E Costing Issue** General revisions in line with detailed design development	06.06.07	BH
3.0	**Draft Stage E Issue** Images added. Luminaire refs. E9, L2, EX13, EX14, AA/E, BB/E, EE1 and EE2 added. Luminaire refs. AA and BB revised.	05.07.07	BH
4.0	**Final Stage E Issue** Minor revisions	30.11.07	BH
5.0	**Revised Stage E Issue** V.E. revisions incorporated, as per tracked changes.	28.10.08	BH
6.0	Refs. A, A2, A15, B1, B2, E7, E11, G, S, EX1 revised. Ref. A20 deleted. Refs. G3, G3/E added.	30.01.09	BH

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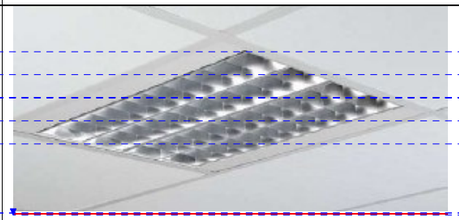
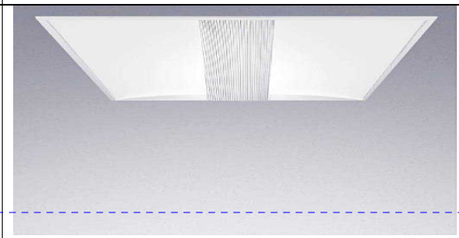
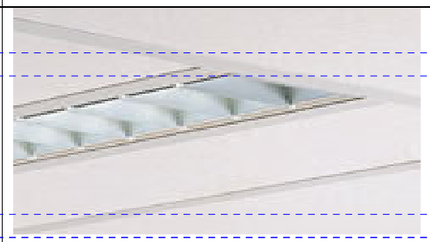
Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
A	1 x 28W T5	4000º K	1200mm x 300mm ceiling recessed non-air handling luminaire, IP20 above and below ceiling, double parabolic, satin-matt MIRO7 metalised aluminium louver in compliance with LG3 brightness limits, 92% reflection, clip-in louver for easy lamp replacement, louver remains attached when removed, control gear fully accessible for maintenance with louver removed , LOR ≥ 84% integral DALI control gear, powder coated sheet steel construction finished in white, suitable for installation in concealed grid suspended ceiling as SAS International 150 plank system and for installation in plasterboard ceiling, consistent ceiling trim detail on all four sides, luminaire c/w easily removed protective plastic foil covering louver opening.	Riegens Fagerhult or approved equivalent	Mirac Recesso (non-air handling) Multifive Basic Beta		Laboratories, Equipment Rooms
A/E			As ref. A but c/w integral 3 hour battery pack and inverter (maintained).				
A1	1 x 28W T5	4000ºK	1200mm x 300mm ceiling recessed luminaire, IP20, powder coated sheet steel upper lighting chamber made of high-purity pearl material with die-cast fixings for the optic, TP(a) polycarbonate gridlens controller optic for directional light distribution with all-round glare control, optic fastened without tools, optic with “fly-proof” seal, LOR ≥ 70%, integral dimmable DALI control gear, suitable for installation in concealed grid suspended ceiling as SAS International 150 plank system and for installation in plasterboard ceiling.	Zumtobel Staff or approved equivalent	Mellow Light IV		Library Security Room, Reception Office
A1/E			As ref. A1 but c/w integral 3 hour battery pack and inverter (maintained).				
A2	1 x 28W T5	4000ºK	1200mm x 150mm recessed non-air handling linear fluorescent luminaire, IP20 above and below ceiling, asymmetric reflector of satin-matt MIRO material, double parabolic louvre, >92% reflection, clip-in louver for easy lamp replacement, louver remains attached when removed, control gear fully accessible for maintenance with louver removed LOR ≥ 82%, integral DALI control gear, enamelled sheet steel construction, finished in white, suitable for installation in plasterboard ceiling.	Fagerhult or approved equivalent	MultiFive Basic Beta		Lab. Corridors

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Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
A2/E			As ref A2 but c/w integral 3 hour battery pack and inverter (maintained).				
A3	2 x 28W T5	4000ºK	Surface mounted linear fluorescent IP65 luminaire, transparent direct/indirect diffuser, high-impact resistant polycarbonate, single-piece diffuser, translucent white reflector louvre of highly specular anodised aluminium, c/w integral DALI control gear.	Zumtobel Staff Fagerhult Riegens or approved equivalent	Chiaro Kaptor 200 Certus		Cold Rooms
A3/E			As ref. A3 but c/w integral 3-hour battery packed inverter (maintained). Emergency gear suitable for use in Cold Room (+4°C and -20°C)				
A4	2 x 28W T5	4000ºK	As ref. A1 but twin lamp.				
A4/E			As ref. A4 but c/w integral 3 hour battery pack and inverter (maintained).				
A5	2 x 18W	4000ºK	Surface mounted linear fluorescent Zone 1/Zone 2 luminaire, BASEEFA and ATEX certified, EExd IIB T6, with single borosilicate glass tube sleeve.	Crompton or approved equivalent.	Zone 1		Flammables Stores, Chemical Waste Store.
A5/E			As ref. A5 but c/w integral 3 hour battery pack and inverter (maintained).				

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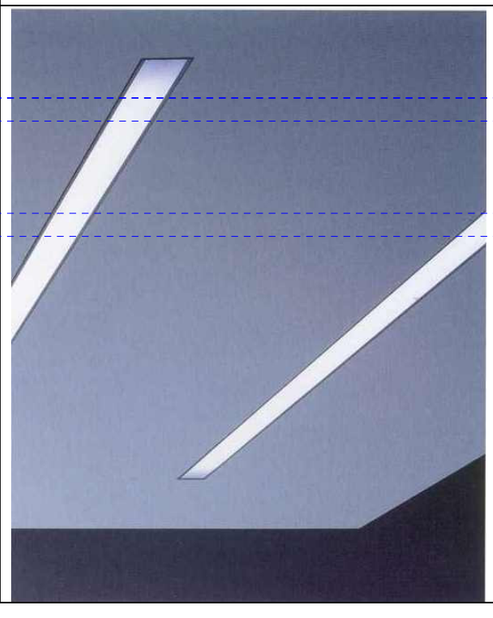
Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
A6	2 x 28W T5	4000ºK	Suspended linear fluorescent luminaire, direct/indirect distribution, Class I, IP20, housing constructed from powder coated sheet steel, double parabolic satin-matt louvre optic in aluminium MIRO7, LOR=82%, wire suspension, twin 2m wire suspension kit, integral DALI control gear, finished in white.	Riegens or approved equivalent	Blocks		Hardware Room
A6/E			As ref. A6 but c/w integral 3 hour battery pack and inverter (maintained).				
A7			Deleted.				
A7/E			Deleted.				
A8			As ref. A4 but c/w dimmable control gear.				Graphics Room
A8/E			As ref. A8 but c/w integral 3 hour battery pack and inverter (maintained).				
A9	1 x 28W T5	3500ºK	Recessed decorative linear fluorescent luminaire, extruded aluminium section finished in silver grey RAL9006 30% gloss finish, continuous polycarbonate lens, suitable for continuous row installation, overlapping lamps for appearance of unbroken light along length of extension, through wiring, integral dimmable DALI control gear, suitable for installation in plasterboard ceiling c/w continuous ceiling trim for fixing to plasterboard and skimming over (no visible fixing once installed), access to lamps and control gear via removable lens without removal of fitting body.	Luxonic Zumtobel Staff Concord:Marlin or approved equivalent	Slimlux Slotlight Channel		Atrium Entrance Foyer Foyer Meeting Room

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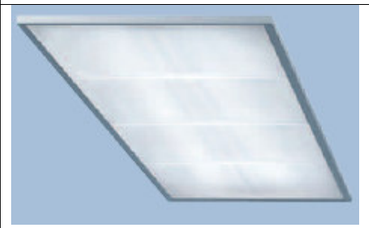
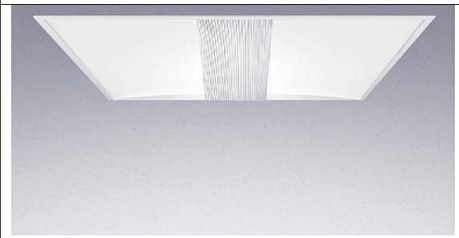
Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
A9/E			As ref. A9 but c/w integral 3 hour battery pack and inverter (maintained).				
A10	2 x 28W T5	4000ºK	Recessed luminaire with micro-pyramidal structure optic, housing of powder coated special pure white sheet steel, optic frame of anodised aluminium, direct component via MPO micro-pyramidal optic in multi-layer design, with defined glare-free light transmission L<1000cd/m^2 at 60º/65º, LOR=70%, integral dimmable DALI control gear, suitable for installation in plasterboard ceiling.	Zumtobel Staff Riegens or approved equivalent	Lightfields E Cirrus TLO		Atrium offices & Seminar Rooms
A10/E			As ref. A10 but c/w integral 3-hour battery pack and inverter (maintained).				
A11	2 x 24W T16	4000ºK	600mm x 600mm ceiling recessed luminaire, IP20, powder coated sheet steel with die-cast fixings for the optic, upper lighting chamber made of high-purity pearl material, TP(a) polycarbonate gridlens controller optic for directional light distribution with all-round glare control, optic fastened without tools, optic with “fly proof” seal, LOR = 70%, integral dimmable DALI control gear, suitable for installation in plasterboard ceiling.	Zumtobel Staff or approved equivalent	Mellow Light IV		Western Stack offices
A11/E			As ref. A11 but c/w integral 3-hour battery pack and inverter (maintained)				
A12			As ref. A but c/w 2 x 28W T5 lamps				Laboratories
A12/E			As ref. A12 but c/w integral 3-hour battery pack and inverter (maintained)				
A13			As ref. A but c/w dimmable control gear				Laboratories
A13/E			As ref. A13 but c/w integral 3-hour battery pack and inverter (maintained)				
A14	1 x 28W T5	4000ºK	1200mm x 300mm linear fluorescent luminaire mounted in surface mounted continuous channel system fixed and sealed to ceiling, IP65, double parabolic, satin-matt, MIRO7 aluminium louvre in compliance with LG3 brightness limits, 3mm clear toughened glass cover sealed within a one piece	Riegens Zumtobel Staff Concord:Marlin	Special	No image available.	Containment Laboratories

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Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
			sheet steel frame with no visible fixings to the underside, frame to be push-fit spring loaded and removed by suction tool and hinged to one side for ease of maintenance, integral DALI control, gear. Channel system to be powder coated sheet steel construction, finish to match dado trunking, backplate to be flat for flush mounting to ceiling with minimal number of penetrations required to provide suspension/fixing only, channel system supported from soffit, support penetrations in back plate to be sealable on site to IP68. Provide 2 No. separate accessible cable compartments (ELV&LV). Channel system c/w blanking plates to dummy sections, c/w cable entry points for other ceiling mounted services, e.g. CCTV cameras, smoke detectors, etc. which are to be mounted on dummy sections. Luminaire manufacturer to liaise with all associated specialist vendors to co-ordinate cabling and fixing requirements. Refer to drg. no. 2053-Z-(69)-508 for design intent.	or approved equivalent.			
A14/E			As ref. A14 but c/w integral 3-hour battery pack and inverter (maintained).				
A15			Self-contained LED luminaire c/w cluster of 20No. LEDs in film-safe red spectrum, arrayed in screw-type traditional incandescent lamp housing, 3 year manufacturer's maintenance free warranty. Provide c/w ceiling-mounted lamp housing.	KODAK	Darkroom illuminator LED Safelight		X-ray generator labs, Electrophysiology labs, Electron Microscopy suite, Dark lab, X-omat lab.
A16	1 x 28W	4000°K	Suspended linear fluorescent luminaire, direct/indirect distribution, Class I, IP20, housing constructed from powder coated sheet steel, double parabolic satin-matt louvre optic in aluminium MIRO7, LOR=82%, wire suspension, twin 2m wire suspension kit integral DALI control gear, finished in white.	Riegens Or approved equivalent	Blocks		Interstitial Comms Rooms
A16/E			As ref. A16 but c/w integral 3 hour battery pack and inverter (maintained).				

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Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
A17	2 x 24W T5	6500ºK	600mm x 600mm recessed modular luminaire, direct/indirect distribution, daylight lamps, sheet steel body, polyester paint finish, reflector wings, curved VDT polarising lens, LOR = 72.7%, integral dimmable DALI control gear.	Clear Vision or approved equivalent.	Kallista Optika		Visual Aids
A17/E			As ref. A17 but c/w integral 3-hour battery pack and inverter (maintained).				
A18	4 x 18W T8	4000º K	600mm x 600mm recessed modular luminaire, IP65, for use in food preparation areas, direct distribution, powder coated sheet steel construction, gasketted sealed frame & prismatic diffuser, frame fixed to housing by tamper-proof fixings, integral DALI control gear.	Riegens Or approved equivalent	Tarue		Kitchen
A18/E			As ref. A18 but c/w integral 3-hour battery pack and inverter (maintained).				
A19			As A14 but c/w 2 x 28W T5 lamps.				
A19E			As A19 but c/w integral 3-hour battery pack and diameter (maintained).				
A20			DELETED				
A21			As ref A12 but c/w dimmable control gear.				
B1	1 x 24W T5	4000º K	630mm long linear fluorescent task light luminaire, IP20, asymmetric reflector, LOR ≥ 77%, stainless steel bracket mounted to spur shelving uprights, integral DALI control gear, powder coated sheet steel construction, individually switched, luminaire fitted with 3-core flex and standard 13A 3-pin plug. Refer to drg. no. 2053-Z-(63)-006 for design intent details.	Riegens Concord : Marlin Martini Lighting Fagerhult or approved equivalent	Special	No image available.	Laboratories

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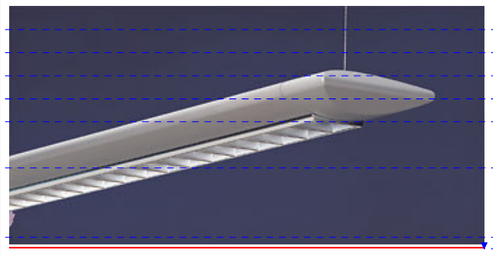
Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
B2	1 x 28W T5	4000ºK	1260mm long linear fluorescent task light luminaire, IP20, asymmetric reflector, LOR ≥ 77%, stainless steel bracket mounted to spur shelving uprights, integral DALI control gear, powder coated sheet steel construction, individually switched, luminaire fitted with 3-core flex and standard 13A 3-pin plug. Refer to drg. no. 2053-Z-(63)-006 for design intent details.	Riegens Concord : Marlin Martini Lighting Fagerhult or approved equivalent	Special	No image available.	Laboratories
B3	1 x 21W T5	4000ºK	Bracket mounted linear fluorescent luminaire, fixed to top of bookshelf, extruded aluminium body, cast zinc end caps, sheet steel installation fittings, asymmetrical distribution for optimal lighting on shelf, optic in aluminium MIRO 7, integral DALI control gear.	Fagerhult or approved equivalent	Libraline Display		Library (bookshelves)
B4	1 x 14W T5	4000º K	Decorative task light integrated into bespoke library study desk furniture. Extruded aluminium profile, thermo painted silver RAL 9006, extruded polycarbonate diffuser, short wall suspension brackets, intelligent integral electronic control, direct light emission, 360° rotation of luminaire elements around longitudinal axis, integral switch.	Concord:Marlin or approved equivalent	NoLimit		Library (work desks)
C	2 x 28W T5	4000º K	Linear fluorescent suspended direct/indirect luminaire, 80/20 distribution, LOR=92%, extruded aluminium body and cast metal end caps, alu-grey lacquer finish (RAL 9006)double parabolic louver satin matt optic in aluminium MIRO 7, >92% reflection, louver remains attached when removed, integral dimming DALI ballast, adjustable steel wire suspension 2m suspension kit, Class I, IP20, performance of luminaire to meet requirements of LG7.	Fagerhult or approved equivalent	Loop Light Beta		Offices, Write Up areas.
C/E			As ref. C but c/w integral 3-hour battery pack and inverter (maintained).				
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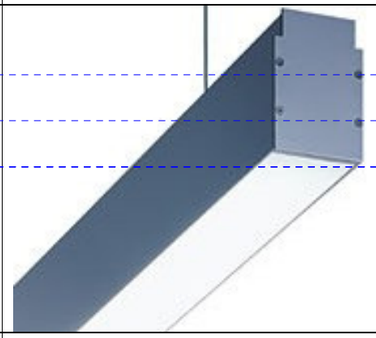
Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
D	1 x 28W T5	3500º K	Surface mounted decorative linear fluorescent luminaire, extruded aluminium section in silver grey RAL 9006 30% gloss finish, continuous polycarbonate optic, suitable for continuous row installation, through wiring, integral dimmable DALI control gear, access to lamps and control gear via removable lens without removal of fitting body.	Luxonic Zumtobel Staff Concord:Marlin or approved equivalent	Slimlux Slotlight Channel		Stairs
D/E			As ref. D but c/w integral 3 hour battery pack and inverter (maintained).				
E1	LED		Surface-mounted, shallow profile self-contained emergency exit sign luminaire fully compliant with EN1838 c/w trim/legend assembly, edge-lit with ultra long life, high intensity LED, powder-coated sheet steel body, integral 3-hour battery pack and inverter (maintained).	Menvier or approved equivalent	Britesign		Stairs
E2	1 x 26W TC-DE4	3500ºK	IP55 surface mounted fluorescent bulkhead luminaire c/w integral DALI ballast, corrosion resistant powder coated die cast aluminium body and frame with polycarbonate opal diffuser, integral 3 hour battery pack and inverter (maintained).	We-ef Lighting Concord:Marlin iGuzzini Lighting or approved equivalent	DL 0259 Sterling Bulkhead Grid		Externally at emergency exits.

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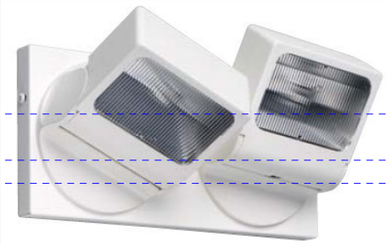
Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
E3	LED		Surface mounted, edge-lit self contained single sided emergency exit sign c/w high intensity LED source, toughened glass lens below ceiling printed with suitable legend, integral 3-hour battery pack and inverter (maintained).	Philip Payne Ltd. or approved equivalent	Architectural		Main Entrance West Atrium exit, Library exit (above doors)
E4	LED		Semi-recessed, edge-lit self-contained double sided emergency exit sign c/w high intensity LED source, toughened glass lens below ceiling printed with suitable legend, integral 3-hour battery pack and inverter (maintained).	Philip Payne Ltd. or approved equivalent	Architectural		Atrium, Central Core areas. Lecture Theatre & associated exits.
E5			DELETED.				
E6			DELETED.				
E7	2 x 12W tungsten halogen		Architectural beam projector, self-contained emergency luminaire, first fix back plate and multi-directional swivel and turn lamp heads, high intensity tungsten halogen lamps, c/w remote, 3-hour battery pack and inverter (non-maintained) installed in accessible ceiling void, riser or service void.	JSB or approved equivalent	Metrolite		Library.
E8	1 x 8W T5		Surface mounted, edge-lit self contained single sided emergency exit sign, IP65, high-impact polycarbonate housing, printed with suitable legend, integral 3-hour battery pack and inverter (non-maintained).	Philip Payne Ltd. or approved equivalent.	TR Range		External areas

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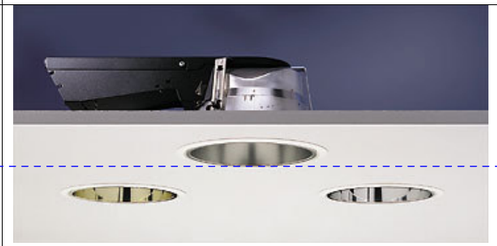
Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
E9	2 x 20W tungsten halogen		Architectural beam projector, IP65, self-contained emergency luminaire, first fix back plate and multi-directional swivel and turn lamp heads, high intensity tungsten halogen lamps, c/w integral 3-hour battery pack and inverter (non-maintained).	Philip Payne Ltd. or approved equivalent.	TR Range		Service Yard
E10			DELETED				Plant Areas
E11			As ref. E7 but integrated with ref. S floodlight luminaires on special mounting bracket.				
F	1 x 26W TC-L	3500ºK	Circular recessed fluorescent downlight luminaire c/w integral DALI ballast, manufactured from flame retardant moulded dark grey polycarbonate housing, metalised polycarbonate matt aluminium reflector, wide angle distribution, white cover ring, decorative glass attachment, tri-wing arms for fixing to ceilings with thickness 1-40mm, adjustable by screw accessed by removing cover ring.	Fagerhult Lighting Zumtobel Staff iGuzzini Riegens Concord:Marlin or approved equivalent.	Pleiad Compact Panos Sistema Concido LED 100		Toilets
F/E			As ref. F but c/w integral 3-hour battery pack and inverter (maintained).				
F1	1 x 26W TC-L	4000ºK	As ref. F but c/w wallwash optic and white glass cover ring (no decorative glass attachment).				Meeting Rooms
F2	1 x 26W TC-L	4000ºK	As ref F but c/w white glass cover ring (no glass attachment).				Meeting Rooms
F2/E	1 x 26W TC-L	4000ºK	As ref. F2 but c/w integral 3-hour battery pack and inverter (maintained).				Meeting Rooms
F3	1 x 26W TC-L	4000ºK	As ref. F3 but c/w coloured decorative glass attachment.				Reception

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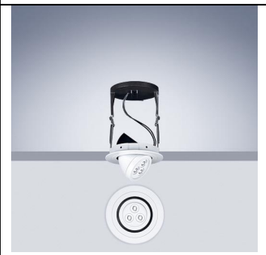
Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
F3/E	1 x 26W TC-L	4000ºK	As ref F3 but c/w integral 3-hour battery pack and inverter (maintained).				Reception
F4	1 x 26W TC-L	4000ºK	As ref. F but c/w IP54 glass cover and white cover ring.				Office/Write Up Corridor
F4/E	1 x 26W TC-L	3500ºK	As ref. F4 c/w integral 3-hour battery pack and inverter (maintained).				
F5	3 x 1W LED		Recessed directional spotlight, built-in Power LED board unit 3 x 1W, 350mA, recessed ring of die-cast aluminium, spring clips no-tool recess, tilting housing rotates through 360º and pivots through 40º/60º, radiation angle 30º c/w power supply unit.	Zumtobel Staff or approved equivalent	Panos S 100 LED		Lab corridor storage system
F6	50W QT12		Recessed circular downlight, smooth reflector made of highest grade aluminium, low glare anodised in matt satin finish, IP44 protective glass cover, white cover ring, dimmable DALI control gear.	Concord:Marlin or approved equivalent	Equinox		Electron Microscope labs. Confocal Microscope labs.
F7			As ref. F2 but c/w cross-blade louver attachment.				
F7/E			As ref. F7 c/w integral 3-hour battery pack and inverter (maintained).				
F8	2 x 26W TC-TEL	4000ºK	Recessed circular fluorescent downlight luminaire c/w integral dimmable DALI control gear, die-cast aluminium housing, direct symmetrical distribution, LOR=59%, spun aluminium specular faceted-vacuum metalised reflector, white cover-ring.	Concord:Marlin or approved equivalent	LED 150		Lecture Theatre
F8/E			As ref. F8 c/w integral 3-hour battery pack and inverter (maintained).				

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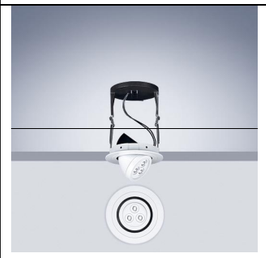
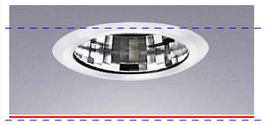
Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
F9			As ref. F2 but c/w 2 x 26W lamps.				
F9/E			As ref. F9 c/w integral 3-hour battery pack and inverter (maintained).				
F10	1 x 20W HIT-TC-CE	3500ºK	Recessed directional spotlight, tilting housing rotates through 360º and pivots through 45º/60º, separately adjustable pivot housing prevents direct view into luminaire, textured reflector made of highest grade aluminium, anodised in bright satin finish, iridescence free, structured upper part, protective glass, white mounting ring, die-cast aluminium recessed ring with spring-clips, integral dimmable DALI control gear, flood optic.	Zumtobel Staff or approved equivalent	Panos S 150		Meeting & Seminar Rooms
F11			Recessed directional spotlight, built-in Power LED board unit 3 x 1W, 350mA, recessed ring of die-cast aluminium, spring clips no-tool recess, tilting housing rotates through 360º and pivots through 40º/60º, radiation angle 30º c/w power supply unit.	Zumtobel Staff or approved equivalent	Panos S LED		Restaurant notice boards
F12			As ref. F10.				Restaurant
F13			As F4 but c/w 2x26W lamps.				
F14	1x35W HIT-CE	3500ºK	Circular recessed downlight luminaire, flush mounting, polycarbonate white cover ring, removable for relamping, anti-glare mirror reflector of highest-grade aluminium with facetted structure, post-anodised, protective glass, spring clips for fixing to plasterboard ceiling, dimmable DALI control gear, gear removable via luminaire aperture.	Zumtobel Staff Or approved equivalent	DL3000 E120 HIT		Atrium

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Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
G	2x28W T5	4000ºK	1200mm surface mounted industrial fluorescent batten luminaire with 10% uplight reflector, twist locking lamp holders integral DALI control gear, trough reflector, wireguard.	Philips Fagerhult Whitecroft Or approved equivalent	Pentura Indulux Trimpak		Plant Areas
G/E			As ref. G c/w integral 3-hour battery pack and inverter (maintained).				
G1			DELETED				
G1/E			DELETED				
G2			DELETED				
G2/E			DELETED				
G3			1200mm surface mounted industrial fluorescent batten luminaire with 10% uplight reflector, twist locking lamp holders integral DALI control gear.	Philips Fagerhult Whitecroft Or approved equivalent	Pentura Indulux Trimpak		Node Escape Stairs
G3/E			As ref. G3 c/w integral 3-hour battery pack and inverter (maintained).				
H/E	9 x 1W LED White		Ground-recessed 230V LED uplight luminaire, Teflon coated, aluminium coloured die-cast aluminium body, toughened clear glass, machined marine grade 316 stainless steel top plate, built in DALI control gear, remote 3-hour emergency battery pack and inverter (maintained), installation sleeve for recessing in raised access floor, mounting, IP67, external cable connection, stationary load withstand 1000kg, glass surface temperature <75ºC.	Louis Poulsen Concord:Marlin Simes or approved equivalent	Nimbus Power LED Micro LED		Level 3 Atrium Bridge
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2 x 35W HIPAR 111 GX1O 24º
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Direct component c/w twin 28W lamps, double parabolic louvre, satin matt, optic in aluminium MIRO 7;¶
Indirect component c/w 28W lamp, asymmetric reflector, satin matt, optic in aluminium MIRO 7;¶
1No. recessed adjustable downlight at each end of module, ± 25º pivot, 230V Britespot ES111 35W lam... [4]
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Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
K	1 x 200W A80 Frosted E27	3500ºK	Suspended IP20 pendant luminaire c/w adjustable wire suspension, 4m wire and transparent armour cable, mouth-blown white opal glass shade.	Louis Poulsen Concord:Marlin Limburg or approved equivalent	Satellite 4489		Library Atrium Reception
L	2 x 1W Power LED	3500ºK	Wall recessed luminaire, IP65 corrosion resistant die-cast aluminium alloy body and frame, built in 2 x 1W Power LED board unit, titanium coloured microstructure paint and cover made of special steel with camlock fasteners (no visible screws), integral control gear, 0.35m connecting cable.	Zumtobel Staff or approved equivalent	OriLED		Atrium
L/E			As ref. L but c/w remote 3 hour battery pack and inverter (maintained).				
L1	1 x 18W TC-L	3500ºK	Wall recessed luminaire, IP55, corrosion resistant die-cast aluminium body and frame, through wiring facility, polycarbonate UV stabilised and vandal proof diffuser, weatherproof and durable silicon gasket, integral DALI control gear.	We-ef lighting or approved equivalent	ST G259		Atrium Stairs and ramp
L1/E			As ref. L1 but c/w integral 3-hour battery pack and inverter (maintained).	.			
L2	1 x 28W T5	3500ºK	Surface mounted linear fluorescent batten luminaire vertically mounted concealed in toilet mirror detail c/w remote control gear and clips to surface fix to mirror recess.	Encapsulite or approved equivalent			Toilets, Shower rooms
M	1x70W HIT-TC-CE	3500ºK	Surface mounted spotlight luminaire, die-cast aluminium body, aluminium reflector, 11º spot, flicker-free operation, lamp focusing facility and lockable head, interchangeable safety lenses, glare shield. DALI control gear.	Concord : Marlin or approved equivalent	Torus 70 FX		Atrium Roof

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Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
M1	150W CDM-T	3000ºK	Surface mounted ellipsoidal luminaire for stage lighting.	ETC or approved equivalent	Source Four HID Zoom		Lecture Theatre
M2			DELETED.				
M3			DELETED.				
M4			DELETED.				
N			Deleted.				
N1			Deleted.				
N1/E			Deleted.				
Q			DELETED.				
P	28W 2D		Surface mounted fluorescent bulkhead luminaire, polycarbonate base and opal diffuser, integral DALI control gear.	JSB or approved equivalent	Fairlite		Stores
P/E			As ref. P/E c/w integral 3-hour battery pack and inverter (maintained).				
R1			"Room In Use" light, surface mounted, slim-line design, zinc coated sheet steel construction, gloss white polyester powder coated finish, integral DALI control gear.	Philip Payne Ltd. or approved equivalent	2000 Range		Laboratories

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Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
R2			"Laser In Use" light, surface mounted, slim-line design, zinc coated sheet steel construction, gloss white polyester powder coated finish, integral DALI control gear	Philip Payne Ltd. or approved equivalent	2000 Range		Laboratories
R3			"Procedure Taking Place light", surface mounted, slim-line design, zinc coated sheet steel construction, gloss white polyester powder coated finish, integral DALI control gear	Philip Payne Ltd. or approved equivalent	2000 Range	As above with appropriate legend.	Laboratories
R4			"Do Not Enter light", surface mounted, slim-line design, zinc coated sheet steel construction, gloss white polyester powder coated finish, integral DALI control gear.	Philip Payne Ltd. or approved equivalent	2000 Range	As above with appropriate legend.	Laboratories
R5			"X-Ray In Use" light, surface mounted, slim-line design, zinc coated sheet steel construction, gloss white polyester powder coated finish, integral DALI control gear.	Philip Payne Ltd. or approved equivalent	2000 Range	As above with appropriate legend.	Laboratories
S	1 x 150W /828 CDD-TT		Surface mounted area floodlight, asymmetric distribution, peak intensity at 60°, sharp cut-off at 80°, hinge mechanism for angle adjustment, fully opening front face for access to lamp compartment, gear tray, removable gear tray for maintenance, non-corrosive, high-pressure die-cast aluminium housing, colour TBC, high-reflectivity and purity anodised aluminium reflector, thermally hardened 4mm thick glass.` Ref.E11 emergency floodlight luminaire integrated on special mounting bracket.	Philips	OptiFlood MVP506 c/w A58.1 distributor		Atrium
T	1 x 28W T5	3500°K	Concealed fluorescent batten luminaire, 3-position rotating lampholders, through wiring facility, lamps overlapping for appearance of unbroken light along length of installation, DALI control gear.	Riegens Whitecroft Thorn or approved equivalent	Certus Trimpack Arrowslim		Atrium stairs and bridges
T/E			As ref. T but c/w 3hour battery pack and inverter (maintained).				

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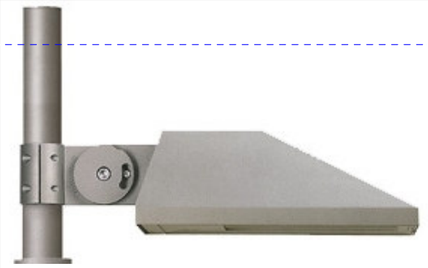
Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
EX1	1 x 70W HIT	4000ºK	Post mounted single-head luminaire, street lighting distribution, IP66, marine grade die-cast aluminium alloy, 5CE superior corrosion protection, powder coated finish (colour TBC), safety glass lens, silicone rubber gaskets, anodized aluminium reflector, integral electronic control gear on hinged and “no tool” removable gear tray, c/w tapered 6m root mounted aluminium column. Specific luminaires c/w photocell mounted on top of luminaire housing as identified on the drawings and cable link to lighting control system for external lighting control.	We-ef Lighting or approved equivalent.	PFL 240		Car Park and Access Roads
EX2			As ref. EX1 but c/w asymmetric “forward throw” distribution. Ref EX2 and EX15 to be mounted on same column and c/w appropriate mounting bracket.				
EX3			DELETED				
EX4	70W HIE-CE	4000ºK	Exterior bollard to IP55, marine grade die-cast aluminium alloy, 5CE superior corrosion protection, powder coat finish (colour TBC), shielded light source, silicone rubber gaskets, polycarbonate lens, anodised aluminium reflector, pre-wired post c/w cable connecting box and service door for mains connection, integral electronic control gear, c/w galvanised steel planted root.	We-ef Lighting or approved equivalent	CTY 150		Car Park Paths
EX5			As ref. EX1 but wall mounted version.				
EX6	LED		Inground marker light, IP67, die-cast body made from AISi aluminium alloy, stainless steel frame including PCS hardware, silicone rubber gasket, factory-sealed termination chamber c/w cable gland and 1.5m of flexible PVC-free cable, IP68 in-line connector, safety glass max load 5 tonnes, factory installed circuit board with high efficiency white LEDs, integral DMX controls.	We-ef Lighting or approved equivalent	ETR 159		Western Stack external terrace

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Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
EX7	32W TC-TEL	3500ºK	Recessed exterior downlight, medium beam symmetrical distribution, IP65, marine-grade die-cast aluminium alloy, 5CE superior corrosion protection including PCS hardware, powder coat finish, silicone rubber gasket, safety glass lens, anodised aluminium reflector, “no tool” lamp replacement, two cable entries, integral DALI control gear in thermally separated compartment.	We-ef Lighting or approved equivalent	DOC240 (M)		Restaurant terrace
EX7/E			As ref. EX7 but c/w integral 3-hour battery pack and inverter (maintained) and fitted with additional G9 lamp holder.				
EX8	28W T16	3500ºK	Recessed linear fluorescent luminaire, extruded aluminium structure, die-cast aluminium end caps, optical assembly with ultra pure reflector, symmetrical, distribution, glass safety screen, aluminium chassis with technopolymer caps, integral DALI control gear, A2 stainless steel screws.	iGuzzini or approved equivalent	Linealuce		Main entrance canopy.
EX8/E			As ref. EX8 but c/w integral 3-hour battery and inverter (maintained).				
EX9	2 x 28W T5	3500ºK	Surface mounted linear fluorescent IP54 luminaire, transparent direct/indirect diffuser, high-impact resistant polycarbonate, single-piece diffuser, translucent white reflector louvre of highly specular anodised aluminium, c/w integral DALI control gear.	Zumtobel Staff Fagerhult or approved equivalent	Chiaro Kaptor 200		External Stair at Level 4, Plant Tower bridge links
EX9/E			As ref. EX9 but c/w integral 3-hour battery packed inverter (maintained).				
EX10	28W T16	3500ºK	In-ground recessed linear fluorescent luminaire, extruded aluminium structure, die-cast aluminium end caps, optical assembly with ultra pure reflector, symmetrical, distribution, glass safety screen, aluminium chassis with technopolymer caps, integral DALI control gear, A2 stainless steel screws, installation housing.	iGuzzini or approved equivalent	Linealuce		Below benches
EX10/E			As ref. EX10 but c/w integral 3-hour battery and inverter (maintained).				

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Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
EX11	9 x 1W LED White		Ground-recessed LED uplight luminaire, Teflon coated, aluminium coloured die-cast aluminium body, toughened clear glass, machined marine grade 316 stainless steel top plate, built in DALI control gear, remote 3-hour emergency battery pack and inverter (maintained), installation sleeve for recessing in concrete flush mounting, IP67.	Louis Poulsen or approved equivalent	Nimbus Power LED		Tree uplighter
EX12	2 x 1W Power LED	3500ºK	Wall recessed luminaire, IP65 corrosion resistant die-cast aluminium alloy body and frame, built in 2 x 1W Power LED board unit, titanium coloured microstructure paint and cover made of special steel with camlock fasteners (no visible screws), integral control gear, 0.35m connecting cable.	Zumtobel Staff or approved equivalent	OriLED		External areas
EX13			As EX4 but c/w shield accessory to limit output to one side only.				
EX14	1 x 150W CDM-5		Surface mounted IP65 floodlight luminaire with asymmetric light distribution, non-corrosive, high-pressure die-cast aluminium housing, high reflectivity and purity anodised aluminium reflector, thermally hardened 4mm – thick glass, spill light control, sharp cut-off at 80º, fully opening front face for easy access to lamp compartment and gear tray.	Philips Or approved equivalent	OptiFlood MVP506		Service Yard Canopy
EX15			As ref EX1 but mounted as twin-head post-top fittings. Luminaires c/w appropriate bracket for twin-head post-top mounting.				
EX16			As ref X2 but wall mounted.				
EX17			DELETED				
EX18			As ref. EX1 but c/w 4m column.				Between South Plant Towers

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Deleted: Recessed IP68 submersible linear LED luminaire, housing and cable vault in rust-proof stainless steel, length = 910mm, height = 120mm, width = 28mm, width of base plate = 100mm, glass strip of ESG float glass, thickness = 19mm, 1.5 ton drive-over load, c/w power supply and cable connection to suit PSU location, PSU to be installed in IP68 junction box located in in-ground access chamber adjacent to pond (access chamber by others, junction box by Electrical contractor).

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Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
AA	2 x 28W T5	4000ºK	1200mm chain suspended (3500mm chain) industrial fluorescent batten luminaire with 10% uplight reflector, spring loaded lamp sockets, electronic ballast < 10% THD, trough reflector, wireguard.	Philips Riegens Whitecroft Or approved equivalent	Pentura Certus Trimpak		Energy Centre, Plant Areas
AA/E			As ref. AA but c/w integral 3-hour battery and inverter (maintained).				
BB	2 x 28W T5	4000ºK	Surface mounted linear fluorescent IP54 luminaire, transparent direct/indirect diffuser, high-impact resistant polycarbonate, single-piece diffuser, translucent white reflector louvre of highly specular anodised aluminium, c/w integral DALI control gear.	Zumtobel Staff Fagerhult or approved equivalent	Chiaro Kaptor 200		Tunnels
BB/E			As ref. BB but c/w integral 3-hour battery and inverter (maintained).				
CC1	175W Metal Halide	4000K	Wall pack luminaire, surface mounted metal halide luminaire with cast aluminium housing and gasketed prismatic glass lens.	Coughtrie Lighting Designplan Sylvannia XL or approved equivalent	Ultralux Brunel Yaren		Service Transformers, Outdoor Switchgear, Chiller Area
CC2	250W Metal Halide	4000K	Wall pack luminaire, surface mounted metal halide luminaire with cast aluminium housing and gasketed prismatic glass lens.	Coughtrie Sylvannia XL or approved equivalent	Ultralux Yaren		Chiller Area
EE1	1 x 26W TC-DE4	3500ºK	IP55 surface mounted fluorescent bulkhead luminaire c/w integral DALI ballast, corrosion resistant powder coated die cast aluminium body and frame with polycarbonate opal diffuser, integral 3 hour battery pack and inverter (maintained).	We-ef Lighting Concord:Marlin iGuzzini Lighting or approved equivalent	DL 0259 Sterling Bulkhead Grid		Externally at emergency exits.
EE2	1 x 8W T5		Surface mounted, self contained single sided emergency exit sign, IP65, high-impact polycarbonate housing, printed with suitable legend, integral 3-hour battery pack and inverter (non-maintained).	Philip Payne Ltd. or approved equivalent.	TR Range		External areas

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Type	Lamp	Colour	Description of Luminaire	Manufacturer	Product	Image	Locations
EE3			As ref. E10.				
EE4			As ref. E9				

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APPENDIX 4

Sandy Brown Associates standby generator installation acoustic criteria specification

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05282/DC
18 November 2008

LMB Project

Standby generator installation
Acoustic criteria specification (rev 01)

1 Introduction

This specification is addressed to the standby generator system installer, hereafter referred to as the "Supplier".

This specification relates to the control of noise and vibration from all parts of the standby generator installation including the generator units, cooling systems, intake air, discharge air and exhaust systems, hereafter referred to as the "Generators".

This specification should be read in conjunction with specifications and drawings issued by RMJM and KJ Tait/RMF.

2 Construction

The generator room is to be housed inside a section of the energy centre. The primary energy centre envelope including generator service access panels and roof is designed to provide a sound insulation performance of R_w 47 dB. Doorsets in this envelope which provide access to the generator enclosure are designed to give a performance of R_w 45 dB. The energy centre external envelope (walls, roof and doors) is to be provided by others.

The Supplier shall be responsible for providing all other items and shall be responsible for meeting the overall performance criteria given in this specification.

3 Noise

3.1 Maximum external levels

The total noise at the site boundary from the operation of the generators shall not exceed $L_{Aeq,5min}$ 35dB.

3.2 Characteristics

Outside of the generator room, the noise from the Generators shall not contain any distinguishable, discrete, continuous notes (whine, hiss, screech, hum, etc) or distinct impulses (bangs, clicks, clatters or thumps).

Where this is not possible, the total noise level shall be at least 5 dB lower than the criterion specified above.

3.3 Guidance noise levels for design

The following information is provided for guidance purposes only.

3.3.1 External sound pressure levels

With the ventilation inlets and outlets positioned and oriented as shown in the Stage E, the following noise apportioning should allow the criterion at the boundary (in section 3.1), to be met:

L_{Aeq} 61 dB at 1m in front of the ventilation inlet – assumes positioning within the energy centre footprint on the boundary side;

L_{Aeq} 63 dB at 1m in front of the ventilation outlet – assumes positioning within the energy centre footprint on the main building side;

L_{Aeq} 55 dB at 1m from the exhaust outlet – assumes positioning at the top of one of the main building plant towers;

L_{Aeq} 29 dB at 10 m from the enclosure;

3.3.2 Noise control measures

For guidance, the following would typically be expected:

- Box in box construction with significant spacing between inner and outer boxes on all sides (including ceiling). A high performance metal sandwich panel construction may be appropriate for the inner box construction.
- Acoustically rated doorsets will be required on the inner box of any box in box construction;
- attenuators to the air intake and discharge openings;
- attenuators in series to engine exhausts;
- sound absorbent lining to walls & soffit of generator room;
- sound absorbent lining to air intake/discharge plenum;
- sound insulating panels to external walls of generator room and to air intake plenum;
- acoustic lagging to exposed ductwork within the generator room;
- acoustically sealed services penetrations;
- sound absorbent treatment/lining in void between inner and outer generator boxes – box in box construction.

4 Vibration

4.1 Maximum vibration levels

This specification relates to the total vibration level from the Generators. Maximum permissible vibration amplitudes shall not:

- exceed Curves 8 as given in BS 6472: 1992 "Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)" at any point within the external envelope of the energy centre;
- be of a magnitude which causes the maximum noise criteria in Section 3 to be exceeded.

4.2 Vibration control measures

The Supplier shall provide all necessary flexible connections and anti-vibration hanger/support devices to ensure that the criteria given in Section 4.1 are not exceeded.

For guidance, the following would typically be expected:

- Spring type anti-vibration mounts to the generator units with flexible connections on the discharge side and to all connecting pipework;
- Spring type hangers/supports to all connecting pipework within the generator room;
- No rigid connections to the generator units via cable supports, trunking, etc - connecting electric cables to be looped to minimise vibration transmission;
- Spring type anti-vibration mounts and flexible connections to fans;
- Metal panels such as drip trays to incorporate damping elements.