



SPECIFICATION

FOR THE

ELECTRICAL SERVICES INSTALLATION

AT

RUH OPD REWIRE

LINKED PRACTICES

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ELECTRICAL SERVICES SPECIFICATION

INDEX

PREFACE

SECTION 1: GENERAL REQUIREMENTS

SECTION 2: GENERAL SPECIFICATION (6-)

SECTION 3: PARTICULAR SPECIFICATION

- PART 3.1: ELECTRICITY CENTRE & MAIN DISTRIBUTION SYSTEM (61)
- PART 3.2: POWER DISTRIBUTION SERVICES (62)
- PART 3.3: LIGHTING SERVICES (63)
- PART 3.4: COMMUNICATIONS SERVICES (64)

APPENDIX 1: RECORD DOCUMENTATION

APPENDIX 2: ELECTRICAL SUB-SYSTEM CERTIFICATION

APPENDIX 3: LOW VOLTAGE SWITCHGEAR

APPENDIX 4: LUMINAIRES

APPENDIX 5: EMERGENCY LUMINAIRES

APPENDIX 5A: BSRIA TECHNICAL NOTE TN21/97 DEFINITIONS

APPENDIX 6: UNINTERRUPTIBLE POWER SUPPLY UNITS (UPS)

APPENDIX 13: SCHEDULE OF LUMINAIRES, WIRING ACCESSOIRES & SUPPLIERS

ELECTRICAL SERVICES SPECIFICATION

PREFACE

1. DEFINITIONS:

- 1.1. The definitions ascribed to the parties and consultants to the contract in the Form of Tender shall prevail throughout this Specification.
- 1.2. 'Indicated' as used in 'as indicated', 'where indicated', 'unless otherwise indicated' and like phrases shall mean indicated in the addenda to the Specification and/or in the equipment schedules in the appendices, or on the drawings or any other relevant contract documentation. 'Specified' shall be interpreted similarly.
- 1.3. 'Approval' means approval in principle from the Engineer, and does not infer that the Contractor is in any way relieved of the consequential responsibility of adhering to the spirit of the contract documentation with regard to standard of workmanship, materials and design intent.

2. INTERPRETATION:

- 2.1. Section 1: Indicates the scope of the Contractor's responsibility to provide a complete and satisfactory working installation, complying with all necessary requirements, for hand-over to the Employer.
- 2.2. Section 2: Provides a description of the electrical services general specification for materials along with any other relevant information.
- 2.3. Section 3: The Particular Specification sets out the requirements and standards for workmanship, material, equipment and services/systems to be provided. The Contractor shall ensure that the installation conforms to the standard of workmanship called for and that materials and equipment are to the standard required.
- 2.4. Appendices: includes specifications for specialist equipment, record documentation and sub-system certification, particular to the project.
- 2.5. This Specification shall be read in conjunction with the general conditions of contract, drawings and all other contract documentation. Any discrepancy shall be referred to the Engineer in writing for clarification as soon as practicable.

SECTION 1 - GENERAL REQUIREMENTS

1. SCOPE OF MAIN CONTRACTOR'S & SPECIALIST CONTRACTOR'S RESPONSIBILITIES:

- 1.1. The Main Contractor, and where the specialist contractor acts as main contractor, shall be entirely responsible for the works set out in the contract documentation, whether under construction or during tests, and until the works have been handed over, or deemed to have been handed over in compliance with the conditions of the contract. Receiving the responsible Engineer's or Employer's Representative approval does not relieve the Main Contractor of this responsibility.
- 1.2. Unless otherwise stipulated, the works shall include the provision of electricity supply, delivery, installation, testing, commissioning, setting to work, making good any defects that occur during the defects liability period, provision of 'as-installed' drawings and maintenance and operating manuals, and all of the labour and materials necessary to form a complete installation, whether or not all the necessary (labour) components are indicated.
- 1.3. The Main Contractor shall be responsible for ensuring that any firm that is appointed on Client's instruction or otherwise, appointed by him/her/them as a specialist contractor (in this case Mechanical, Electrical & Transport Specialist Contractors) a supplier or as a supplier to the specialist complies with and fulfils all the relevant undertakings and conditions described in the contract documentation. The Main Contractor shall also be responsible for incorporating the works of his/her/their Specialist Contractors into the programme of works.
- 1.4. The Main Contractor shall conduct inspections and tests and compile reports during manufacture or fabrication on or off site, as and when required, to ensure that quality, workmanship, delivery, assembly, erection, testing, setting to work and completion by the Specialist Contractors are satisfactory.
- 1.5. The Main Contractor shall, by submitting a tender; guarantee that all materials, equipment and work carried out shall be 'Fit for the Purpose' and shall secure similar guarantees from his appointed Specialist Contractors and specialist's suppliers.
- 1.6. The design of plant, equipment, specialist installations or materials used by the Main Contractor and or Specialist's Contractors and requiring the input of the manufacturer's specialist designers shall be the responsibility of the manufacturer/supplier of the specific plant, equipment, specialist installations or materials. The Main Contractor and or Specialist's Contractors shall, when placing orders, be responsible for ensuring that all relevant information regarding every aspect of the project is passed on to the manufacturer/supplier and for ensuring that the plant, equipment, specialist installations or materials are suitable for the application and comply with the Engineer's design intent and the Specification.

- 1.7. Unless otherwise indicated, all materials and equipment to be installed shall be new. Equipment shall be installed in accordance with manufacturers' written instructions.
- 1.8. Where equipment is supplied by others as free-issue items, the Main Contractor or Specialist Contractor if so agreed, shall take delivery, erect, test and commission the equipment unless otherwise indicated.
- 1.9. The Main Contractor shall ensure before ordering that all equipment can be installed in allotted spaces and shall maintain adequate access for maintenance and repair.
- 1.10. Notice prior to cover shall be given in reasonable time by the Main Contractor to the Engineer whenever any works or materials are intended to be covered by earth, lagging, structural duct covers, walls, floors, ceilings, building in, or otherwise.
- 1.11. The Main Contractor shall ensure to include for all services expansion and flexible joints as necessary to cross building expansion joints.
- 1.12. The Main Contractor shall regard all maps, plans, drawings, sketches, etc. of the works as highly confidential, all as set out in accordance with the main contract conditions, and shall only release them to other persons on a need-to-know basis.
- 1.13. The whole of the works shall be carried out to the complete satisfaction of the Engineer and Employer's Representative who shall reserve the right to reject any workmanship and materials that, in their opinion of, do not conform to the Specification. The Main Contractor shall be obliged to carry out such alterations or replacements of materials at his own expense.
- 1.14. The Main Contractor shall not interrupt or interfere with any existing services without prior written permission from the client's representative.
- 1.15. The Main Contractor and Specialist Contractor shall note that the Engineer reserves the right to change, amend or modify the specifications, drawings, design or layout as required throughout the contract and in accordance with the contract conditions

2. STANDARDS AND CODES OF PRACTICE:

- 2.1. Unless specifically stated otherwise, or approved by the Engineer, installation, materials and equipment shall be in accordance with the relevant Irish, European and British Standards and Codes of Practice and CIBSE Guidelines, whether indicated in this Specification or not.
- 2.2. Although relevant Standards and Codes of Practice are referred to in this Specification, the Main Contractor and Specialist Contractor shall ensure that all Standards and Codes of Practice shall be current editions dated three months before the date for return of tenders.

- 2.3. Any differences between these Standards and Codes of Practice and any part of this Specification shall be brought to the attention of the Engineer for clarification.
- 2.4. Commodities conforming to Standards shall be clearly and indelibly marked with the Standard reference. Where this is impracticable, the relevant advice and delivery notes shall include the Standard reference with which they are to comply.
- 2.5. Where commodities/services are specified to be by registered/approved firms under Certification and/or Quality Assurance schemes, the proposed firm must be a current participant in the relevant scheme.
- 2.6. Certificates or compliance with Standards, Certification schemes and/or Quality Assurance schemes shall be provided to the Engineer on request.

3. NATIONAL AND LOCAL AUTHORITIES:

- 3.1. The Main Contractor and Specialist Contractor shall ensure that all materials, items of equipment, methods of installation and standards of workmanship are in compliance with the recommendations and requirements of the relevant national and local authorities and shall arrange for such authorities to witness any testing which may be required.

4. ACTS AND REGULATIONS:

- 4.1. The installation(s) shall comply with all Acts, relevant Statutory Instruments and Regulations including any special Regulations issued by the electricity, gas and/or water authorities. The tender shall be based on the Acts and Regulations current on the date for return of tenders. If these Acts and/or Regulations are amended or new Acts and/or Regulations are enacted after that date the Contractor shall inform the Engineer and Employer's Representative immediately.

5. HEALTH AND SAFETY:

- 5.1. The Main Contractor and Specialist Contractor (s) shall comply fully with the health and safety requirements as detailed in the Main Contract and all relevant Safety, Health and Welfare at Work Statutory Instruments. Of particular note are the relevant sections of the following:-
 - 5.1.1. Health and safety and welfare at work Act 2005
 - 5.1.2. S.I.299/2007 General Applications
 - 5.1.3. S.I.732/2007 General applications

5.1.4. S.I.291/2013 Construction Regulations

- 5.2. All equipment deployed in a temporary capacity (during installation works) and permanently as part of the project contract works shall comply with the current European directives in connection with safety of machinery and electrical equipment:-

5.2.1. Machinery Directive (2006/42/EC)

5.2.2. The low Voltage Directive (2014/35/EU)

5.2.3. Electro Magnetic Compatibility (2014/30/EU)

All such equipment shall carry the "CE" marking. Equipment not bearing this marking will be rejected by the Engineer and the Main / Specialist Contractor shall be required to replace it with certified (and marked) equivalents without cost penalty to the Client.

- 5.3. The hardware/software/firmware supplied shall be accompanied by documentation stating this conformity.

6. INTERIM CLAIMS:

- 6.1. Claims for interim payment shall be in accordance with the information set out in the Main Contract.
- 6.2. The specialist progress claims shall be broken down as per the form of tender.
- 6.3. Interim claims in respect of specialists' works shall be accompanied by a certificate confirming that the works executed and materials on site under the claim are in accordance with the contract documentation. Failure to provide this certificate will invalidate the claim.

7. ASBESTOS MATERIALS:

- 7.1. Asbestos materials shall not be installed. This requirement applies to major items, e.g., thermal insulation, and to sundry minor components such as gaskets, fire seals and valve packing.
- 7.1.1. Where there is asbestos in an existing installation where works are proposed, it is subject to the Chemicals (Asbestos Articles) Regulations, 2011 (S.I. 248 of 2011). Further, where installation work could interfere with said asbestos, a full risk assessment pertaining to the implications of proposed the work, and the potential affects relating to the asbestos, is required.

- 7.2. Should asbestos (historical, natural, or new) be identified by the Contractor on the site during the course of the contract the following procedural undertakings must be adhered to.
- 7.2.1. Work is to cease in the associated area and the area is to be identified as a restricted area,
 - 7.2.2. The Main Contractor Foreman and the Engineer are to be informed immediately
 - 7.2.3. Work can only continue in the restricted area once a suitable risk assessment and method statement in line with S.I. 386/2006 and S.I. 589/2010 is undertaken and approved by all affected parties.

8. CFCS AND HCFCs:

- 8.1. Products containing and/or requiring the use of CFCs in their manufacture will not be permitted. Those containing and/or requiring the use of HCFCs may only be used with the permission of the Engineer. The Main Contractor shall confirm in writing that such products are free of CFCs and/or HCFCs prior to delivery to site.

9. SITE ADMINISTRATION:

- 9.1. The Main Contractor and Specialist Contractor(s) shall provide all necessary supervision during the execution of the works. Suitably qualified engineering staff shall be employed and given charge of the site works from commencement to completion. Supervisory staff shall be on site during the whole of the time that the work is in progress and shall be authorised to receive instructions from the Engineer on the Contractor's behalf.
- 9.2. The Main Contractor and Specialist shall allow for attendance at all site meetings involving the services installations, and for attendance at site visits by the Engineer, for the duration of the Contract.
- 9.3. The Main Contractor shall provide staff of sufficient number and competence as necessary in the opinion of the Engineer and Employer's Representative for preparing programmes, records, working drawings, builder's work drawings, progress drawings and any other documentation as is required for efficient and satisfactory execution of the works.
- 9.4. The Specialist Contractor shall provide all necessary staff as and when required to liaise with the Main Contractor in the production and maintenance of the overall works programme. Such staff shall also engage in programming and the monitoring of progress within the overall programme. The programme and required updates are to be in compliance with the Main Contract Conditions, and shall be available to the Engineer on request.

- 9.5. The Main Contractor shall submit a type written report detailing the manpower and plant on site in relation to the services installations in accordance with the terms of the main contract.

10. SPECIALIST SERVICES DRAWINGS AND CO-ORDINATION:

- 10.1. The definition of drawing types applying to the works shall be as set out in BSRIA BG 6 "A Design Framework for Building Services".
- 10.2. The tender drawings associated with this contract have been brought to the stage of *detailed design drawings* as detailed in BSRIA BG 6. These drawings show the locations of plant items and services routes in such detail as to indicate the design intent and the initial co-ordination of services (design stage) with the building structure. The drawings do not indicate the precise position of services, but it should be feasible to install the services within the general routes and general locations indicated, and to produce *co-ordinated drawings* or *installation drawings* without major re-routing of services. Symbol and line conventions are in accordance with the schedule of symbols and notations issued with the tender documents.
- 10.3. Identified ATEX classified hazardous areas are to be supplied to all contracting services. The onus is on the Main Contractor to qualify that all services entering and exiting these zones are suitable and clearly identified to all affected parties at a design stage as well as the suitable marking and identification at the completion stage.
- 10.4. The Main Contractor shall have responsibility for performing the overall co-ordination process in respect to all building services with each other and with the building elements. The Main Contractor shall assign to this task staff with proven knowledge and experience of building services to ensure that the service co-ordination activities are successfully completed. The responsibilities of the staff so assigned shall include but are not limited to: -
- 10.4.1. The realistic programming of all building services works and activities and the incorporating of this programme into the main contract programme.
- 10.4.2. The timely and adequate production, by the services specialist contractors, of drawings as described below.
- 10.4.3. The timely and adequate provision of services related samples, patterns, mock-ups and setting out details for design team comments.
- 10.4.4. The interpretation of all building services drawings and specifications and the resolution of queries raised by the building services and other specialist contractors and, if necessary, obtaining clarification or instructions from the design team.
- 10.4.5. The day to day co-ordination of site setting out of building services and sequencing of installation to ensure that systems are not damaged due to premature installation.

- 10.4.6. Being present at all meetings called to discuss building services and to report on the works and progress.
 - 10.4.7. The timely and realistic programming of inspections, testing, commissioning and handover of the building services works, all in accordance with the services specification, and in sufficient detail to provide for a design team option to attend during these activities.
 - 10.4.8. The timely and realistic programming of the provision of record drawings and maintenance manuals, in accordance with the services specifications.
 - 10.4.9. Any further activities considered necessary by the Main Contractor in order to fulfil his obligations with regard to services co-ordination.
- 10.5. The specialist contractor associated with the mechanical installation shall undertake the role of Lead Services Co-ordinator. This specialist contractor shall take the lead, under the direction of the Main Contractor, in the services co-ordination activities. These activities and responsibilities include but are not limited to the following:-
- 10.5.1. Before any installation work commences and in time to meet programme dates, the Lead Services Co-ordinator shall meet with representatives of all relevant parties associated with the works to examine all drawings and all aspects of the detailed services co-ordination. Co-ordination meetings shall be of sufficient number to ensure that the co-ordination of services with each other and the building structure, together with the sequencing of installation, is successfully carried out.
 - 10.5.2. From information agreed at the co-ordination meetings, the Lead Services Co-ordinator shall develop and produce co-ordination drawings. The co-ordination drawings shall be of sufficient detail to demonstrate that all services can be installed with adequate space for access, commissioning, and ongoing maintenance. Access points for commissioning and maintenance shall be, as far as is practicable, grouped to minimise the number of points required and located in areas where they will cause the least disruption to the functioning of the building when in use.
 - 10.5.3. When the Lead Services Co-ordinator completes the co-ordination drawings and agrees the proposals with all relevant parties, the co-ordination drawings shall be forwarded to the Main Contractor for comment and then issued to the design team for comment. If necessary, the Lead Services Co-ordinator shall revise the proposals until agreement is reached with all parties.
- 10.6. The specialist contractors shall co-operate fully with the Main Contractor to ensure that the services co-ordination activity is successfully completed.
- 10.7. Based on the final agreed co-ordination drawings, the Specialist Contractor shall develop and produce installation drawings for the works included in his contract. The installation drawings shall be forwarded to the Main Contractor for comment and then issued to the design team for comment. If necessary, the Specialist Contractor shall revise these drawings until agreed by all parties.

- 10.8. When the installation drawings are agreed and completed, the Specialist Contractor shall develop and produce *builder's work drawings (installation stage definition)* for the services included in his contract. The builder's work drawings shall be forwarded to the Main Contractor for comment and then issued to the design team for comment. If necessary, the Specialist Contractor shall revise these drawings until agreed by all parties.

11. BUILDERS' WORK:

- 11.1. All builders' work such as the cutting of holes/chases in masonry/concrete walls and floors, the provision of foundations for plant and equipment, etc., will be carried out by the Main Contractor. The Specialist Contractor shall, however, be responsible for providing all information required by the Main Contractor for the correct marking-off and setting out of such work.
- 11.2. Where services pass from one fire compartment to the next, the integrity of the fire barrier shall be maintained. Unless otherwise indicated, the Main Contractor shall carry out such making good of fire compartments. The Specialist Contractor shall be responsible for ensuring that no damage is caused to services.
- 11.3. The Specialist Contractor shall include for all services expansion and flexible joints as necessary to cross building expansion joints.
- 11.4. Where applicable, details of walls and ceilings having a wet plaster finish shall be as listed in the Architect's schedules. Services in these areas shall be installed insofar as possible to alleviate the need for access. Where access is necessary, the Specialist Contractor shall be responsible for the correct indication and marking out of such access.

12. PAINTING:

- 12.1. Ferrous sheet materials shall receive a protective coating of paint at works after suitable preparation, or be treated with the manufacturer's approved corrosion-resisting metal finishing process. Any deterioration or damage to the manufacturer's protective coating during storage, installation and before hand-over shall be made good by the Specialist Contractor to the satisfaction of the Engineer.
- 12.2. The surfaces of all ferrous metalwork including conduit, hangers, supports, etc. which are not protected by galvanising, works-applied primer, or protective paint shall be suitably prepared and painted with one coat of zinc phosphate primer. All such surfaces, with the exception of pipework that is to be insulated, shall be finished with two coats of approved quality non-metallic paint to BS 5493. Where surfaces will be subjected to temperatures above 100°C, the finishing coat(s) shall be heat-resisting paint, and the primer normally omitted. The Contractor shall ensure that:-

- 12.2.1. Surfaces are cleaned in accordance with BS 7079 before they are painted.

- 12.2.2. Those parts of the installation required to be left unpainted (e.g. brasswork) are so left.
- 12.2.3. Where required services are correctly identified to ensure the use of approved paint of the correct colour to comply with BS 1710.
- 12.2.4. Exposed threads on steel conduit (running couplers) are to be treated in accordance with manufacturers guidelines.

13. MOCK-UPS, DEMONSTRATIONS AND SAMPLES:

- 13.1. The Specialist Contractor shall allow for the provision of mock-ups, samples and functional and operational demonstrations of all systems.
- 13.2. The Specialist Contractor shall submit samples of proposed materials to the Engineer for written approval as and when required.
- 13.3. All items that require a factory acceptance test are to be approved by the Engineer prior to transportation to the site.

14. RATIONALISATION OF SUPPLIES:

- 14.1. Items, fittings and accessories to be used in quantity shall, where practicable, be the product of one manufacturer and shall be used only for the purpose recommended by that manufacturer.

15. COMMISSIONING AND TESTING

- 15.1. The Main Contractor shall notify the Engineer in writing when, in their opinion, the services installation works or parts thereof are ready for testing and commissioning. The specialist contractor shall then carry out the tests. The specialist contractor shall prove to their satisfaction that all test results are in accordance with the specification and where relevant national requirements. The specialist contractor shall then functionally test all installations in the presence of the Engineer and shall make all specified tests to the satisfaction of the Engineer.
- 15.2. Should the specialist's contractor's initial tests fail to demonstrate that the plant and equipment are properly installed and functioning correctly, the cause of the failure shall be investigated and adjustments as may be necessary made. The commissioning and functional demonstrations shall then be repeated to the satisfaction of the Engineer.
- 15.3. Where it is not possible at the particular time of commissioning and testing for full load conditions to be obtained or simulated, the specialist contractor shall repeat such operations of full load or simulation thereof at a time when this can be achieved.
- 15.4. Where portions of the work are commissioned and tested separately, the Specialist Contractor shall, upon Practical Completion or Completion of Section as defined in the Main Contract Conditions, demonstrate to the Engineer that all the several portions are capable of proper simultaneous operation.
- 15.5. In cases where the construction programme is such that the Specialist Contractor will need to return to the portion of the building taken over and occupied by the client in order to undertake testing, balancing, adjustment, etc., the Specialist Contractor shall take all necessary precautions against, and shall be responsible for, any damage caused whilst working in such areas for that purpose.
- 15.6. Subsequent to the completion of all testing and commissioning to the satisfaction of the Engineer, the specialist contractor shall operate the plant and shall demonstrate that the overall systems function correctly in accordance with the requirements of the Specification. A period of at least seven days full running and operation shall be considered reasonable for this demonstration. During this period the specialist contractor shall be responsible for the operation and maintenance.

16. PRACTICAL COMPLETION

- 16.1. Practical Completion of the specialist's contractor's works, or agreed phase or part of the works, shall not be effected until the specialist contractor has fulfilled their obligations under the Main Contract conditions and in particular demonstrated to the satisfaction of the Engineer that the following aspects are complete:-
- 16.1.1. All works to be complete other than minor snags or defects which could be reasonably completed within an agreed programme without causing disruption to the client's or their Agent's use of the Building or agreed part thereof. In respect of this clause, specifically but not uniquely, the employer's representative shall be the sole arbiter of what may be considered minor, reasonably completed, an agreed programme and disruption to the Employer.
 - 16.1.2. All tests and functional demonstration have been undertaken successfully
 - 16.1.3. All final copies of the Record Drawings, Schedules, Operating and Maintenance manuals and test certificates have been supplied in a format agreed to the Engineer.
 - 16.1.4. All spares, keys, tools, oils, chemicals and other materials required by the specification for the running and maintenance of the Engineering Systems as specified are to have been supplied.
 - 16.1.5. All instruction of the client's staff to have been satisfactorily completed in accordance with the programme for handovers agreed with the employer's representative.

17. TRAINING OF CLIENT'S PERSONNEL

- 17.1. Provide experienced personnel to instruct the Employer's personnel in the operation, maintenance and servicing of all of the installations. Give instructions for an appropriate period commensurate with the scale and complexity of the installations and not less than three working days before the Specialist Works are handed over.

18. SYSTEMS USED BEFORE PRACTICAL COMPLETION

- 18.1. Systems may not, without the prior written approval of the consultant engineer be used before Practical Completion.
- 18.2. Systems to be used before practical completion for the benefit of the Main Contractor and / Specialist Contractor must have all defective consumable elements (including lamps and tubes) replaced by new elements not more than seven days prior to Practical Completion.

- 18.3. No system shall be put into use prior to handover to the client, except for testing and commissioning, unless in accordance with the following procedure:
- 18.4. Following the receipt of written instructions, the Specialist Contractor shall operate designated parts of the Works, provided that such operation is practicable and does not prejudice the Specialist Contractor's responsibilities and obligations.
- 18.5. Allow the defects liability period to commence on handover.

19. OPERATION OF SYSTEMS BEFORE THE PRODUCTION OF RECORD DRAWINGS AND/OR OPERATING AND MAINTENANCE MANUALS

- 19.1. The Contractor is required to provide attendance, at no expense to the Client, and to put into service, operate 24 hours a day and maintain the systems to the client'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 Engineer, otherwise qualify for Practical Completion.
- 19.2. In the event of the Specialist Contractor failing to provide this service satisfactorily the Employer shall be entitled to make his own arrangements and recover the full cost through the Contract.

20. OBLIGATIONS AFTER PRACTICAL COMPLETION

- 20.1. Between the issue of a Certificate of Practical Completion and the Certificate of Making Good Defects relating to the whole or part of the Specialist Works, provide the following:
 - 20.1.1. A prompt call-back service, available at all reasonable times, to attend to any faults.
 - 20.1.2. Carry out a final test at the end of the Defects Liability Period to demonstrate to the Engineer that the Specialist Works are operating efficiently and that all components are functioning correctly.
- 20.2. Carry out all work using competent, trained personnel and except where made necessary by abuse, misuse or negligence by other than the Specialist Contractor, make no charge to the Employer.
- 20.3. Notwithstanding the foregoing paragraph, charge to the Employer the net cost of replacement of life-expired disposable parts.

21. REQUESTS FOR DEVIATION FROM SPECIFICATION:

- 21.1. Any deviation from the Specification sought by the Specialist Contractor made through the Main Contractor must be in the form of a written request and must be sanctioned in writing by the Engineer and Employer's Representative to be valid.

22. BUILDING CONTROL (AMENDMENT) REGULATIONS 2014

- 22.1. The Contractor shall include for the full implementation of the Building Control Regulations 1997 - 2014 and the Building Control (Amendment) Regulations S.I. No.9 of 2014 & S.I. No. 105 of 2014. The Contractor shall include for their attendance as required to implement the inspection plan prepared by the design team and the ongoing inspections.
- 22.2. The Contractor shall notify the design team when their works are ready for inspection, during the proposed program of works. The Contractor is advised to contact the Main Contractor to establish the proposed programme of works.
- 22.3. The Contractor shall give adequate notice for the ongoing inspection prior to the completion of any individual element of the Mechanical, Electrical and Lift Installations and shall confirm that the works are in compliance with the Building Regulations and will be complete for inspection. Any defects of workmanship, materials, performance, design of equipment, maladjustments or other irregularities which become apparent during the inspections shall be rectified at the Contractor's expense.
- 22.4. The Contractor shall ensure that sufficient time is allowed in the Main Contractor's programme for each of the ongoing inspections. Throughout the execution of the works, the Contractor shall be responsible for ensuring compliance with all relevant Contract Drawings & Specifications, Building Regulations, Safety Codes and Local Authority requirements and shall notify the Engineer of any infringement which directly or indirectly detracts from the safe and satisfactory operation of the installation whether or not such infringement relates to the works covered in this Specification or to the associated works of others.
- 22.5. The Contractor shall provide all necessary Certificates of Compliance with regard to the requirements of the Building Regulations, the Building Control Regulations 1997 - 2014 and the Building Control (Amendment) Regulations S.I. No.9 of 2014 & S.I. No. 105 of 2014 and as requested by the Engineer.
- 22.6. In addition to and accompanying the Commencement Notice, there are two statutory assignments and three statutory certificates to be completed on-line using the Building Control Management System (BCMS), on-line system. The format for these are as per the Second Schedule, S.I. 9 2014.
- 22.7. At completion, a fourth statutory certificate is completed on-line using the Building Control Management System (BCMS) on-line system. The format for these are as per the Second Schedule, S.I. 9 2014.

- 22.8. The Preliminary Inspection Plan is a statutory document prepared by the Assigned Certifier that to be submitted to the Building Control Authority by the Employer with the Commencement Notice a minimum of two weeks and a maximum of four weeks in advance of the commencement of the works. At project completion the Inspection Plan as implemented is submitted to the Building Control Authority.
- 22.9. It is the responsibility of the Main Contractor to employ competent persons to supervise the works. The Inspection Plan shall not in any way diminish the duty of the Main Contractor to properly supervise, and any defective works, whether identified during or after the contract period, remain the sole responsibility of the Main Contractor.
- 22.10. The Main Contractor shall include with his tender submission a Method Statement and his own Preliminary Inspection Plan indicating his own inspection and supervision regime.
- 22.11. A copy of the Preliminary Inspection Plan will be included in the Architectural tender documents. The inspection requirements set out in this document do not in any way relieve, replace, or reduce the Main Contractor's duty to supervise the works.
- 22.12. COORDINATION OF TESTS, INSPECTIONS & RECORDS:
- 22.12.1. The Main Contractor shall meet and coordinate and update the Inspection Notification Framework and Preliminary Inspection Plan with the proposed construction programme and shall incorporate the agreed inspection milestones.
- 22.12.2. All elements identified in the Inspection Notification Framework are to be made available for inspection at each milestone:
- Complete,
 - Not concealed
 - Safely accessible.
- 22.12.3. The Main Contractor shall facilitate random inspections by the Assigned Certifier and / or Ancillary Certifiers as if such inspections were identified in the Inspection Notification Framework.
- 22.12.4. The Main Contractor shall provide in a timely manner all CE certificates, Declarations of Performance and test certificates for materials, products and assemblies.
- 22.13. ADVANCE NOTICE AND TIME FOR INSPECTIONS:
- 22.13.1. Due consideration shall be given by the Main Contractor for inspection notices. No claims for extension of time or financial claims shall be considered for delays arising out of inspection or re-inspection requirements.

- 22.13.2. The Main Contractor shall ensure advance notifications are issued with respect to works to be inspected that are identified in the Inspection Schedule. The minimum advance notice required for inspection of items of works is five working days.

22.14. RE-INSPECTIONS/FOLLOW UP INSPECTIONS:

- 22.14.1. The minimum notice required for re-inspection of items of works not complete or requiring remedial works shall be three working days.
- 22.14.2. The Assigned Certifier shall without delay notify the Main Contractor through the Contracting Authority / Employers Representative of any incomplete work at a given milestone identified in the Inspection Notification Framework.
- 22.14.3. The Main Contractor shall diligently ensure that any incomplete areas items at given milestones are completed and that such works are kept available for inspection again, or until a record of completion is furnished, as may be required by the Assigned Certifier.
- 22.14.4. The Main Contractor shall diligently ensure that any areas of non-compliance are rectified and that such works are kept available for inspection again, or until a record of rectification is furnished, as may be required by the Assigned Certifier.
- 22.14.5. The Main Contractor shall ensure all tests and certificates for materials, components and assemblies listed in the Inspection Notification Framework are undertaken in a timely way. Any test failure shall immediately be made known to the Employers Representative / Assigned Certifier; the materials/works in question shall be replaced / rectified and retested undertaken prior to proceeding with subsequent work.
- 22.14.6. It is the responsibility of the Main Contractor to coordinate and supervise the works and no claim for delay or cost shall arise from the requirement to re-inspect.

22.15. CONTRACTOR'S PROGRESS RECORDS:

- 22.15.1. The Main Contractor shall maintain progress records and inspection records prepared by him in accordance with the Method Statement submitted at tender and as set out in this document.
- 22.15.2. Contractors shall include in their tender costs for the provision of progress records as the works proceed.

22.16. METHOD OF RECORDING:

- 22.16.1. Promptly provide a copy to the Assigned and Ancillary Certifier of all progress records and inspection records prepared by the Main Contractor and the sub-contractors.

- 22.16.2. At completion stage, the Main Contractor shall issue the Ancillary Certifier a copy of the records prepared by the Main Contractor and the sub-contractors.
 - 22.16.3. The Main Contractor shall also retain in his own central office all records prepared by them and the sub-contractors for a minimum period of six years.
 - 22.16.4. One hardcopy and softcopy of all records shall be issued five days in advance of the nominated completion date.
 - 22.16.5. The record should include evidence of the successful execution of the Main Contractor's method statement on supervision including tests, check sheets, photographs and memos. All evidence shall be indexed by location and date.
 - 22.16.6. Acceptance of such records shall not constitute approval or imply that their content has been examined.
- 22.17. Main Contractors shall submit the following documentation as part of their tender. Failure to do so may invalidate the tender:
- 22.17.1. Main Contractor's Competence Assessment
 - 22.17.2. Sub-Contractor/Specialist Competence (Ancillary Certifiers) Assessment
 - 22.17.3. Main Contractors Method Statement
- 22.18. Tenderers shall note that Practical Completion for this contract is contingent upon the successful registration of the works on the Building Control Management System.
- 22.19. Tenderers shall note that this project shall require a Prior Notification of Completion to be submitted to the Building Control Authority in advance of completion.
- 22.20. The Main Contractor shall provide four to six weeks in advance of the nominated completion date all completed and/or 'prospective' documentation and confirmations for Registration. The Assigned Certifier and the Main Contractor shall co-sign the Completion Certificate.
- 22.21. The Assigned Certifier and Main Contractor shall then lodge/upload the documentation onto the Building Control Authority system.
- 22.22. Notwithstanding any statutory duty to retain same, in advance of project completion, the Main Contractor shall issue to the Assigned Certifier a copy of all inspection records retained by the Main Contractor during the course of the Project.

23. CONSTRUCTION PRODUCTS REGULATIONS:

- 23.1. Building Regulations Technical Guidance Document Part D (TGD D) provides guidance in relation to Part D of the Second Schedule to the Building Regulations. It relates to materials and workmanship as inserted by the Building Regulations Part D Amendment 2013 (S.I. No. 224 of 2013). To ensure the quality of materials used in construction, Building Regulations Technical Guidance Document Part D requires compliance with the EU Construction Products Regulation (Regulation (EU) No. 305/2011).
- 23.2. The EU Construction Products Regulation lays down harmonised conditions for the marketing of construction products and is directly applicable in Irish law. From July 1st 2013 CE markings have been mandatory for all construction products placed on the market in the European Economic area which are covered by a Harmonised European Standard (hENs). Although other forms of certification (IAB, BBA Certs etc.) may be available for a given product or material, if a Harmonised Standard is in place, then the product/material must be CE Marked and have an associated Declaration of Performance.
- 23.3. The EU Construction Products Regulations, (CPR), sets rules for placing construction products on the EU market. All Construction products placed on this market, which includes both Ireland and Northern Ireland, must comply with the CPR, irrespective of where they are manufactured. This means they must be CE marked, use harmonised standards, (hENs), to demonstrate conformity, be certified by an EU-27 notified body and have an up-to-date EU Declaration of Performance, (DoP). Reference to a BS EN on a Declaration of Performance or CE Marking is not compliant with the relevant EU Regulations.
- 23.4. To affix the CE marking to a construction product, the manufacturer is obliged to draw up a Declaration of Performance (DoP) when a construction product is covered by a harmonized standard or conforms to a European Technical Assessment. Any information about the product's performance in relation to the essential characteristics may be provided only in the form of a declaration of performance. The CE marking shall be applied to the product itself and where this should not be possible to the packaging or accompanying documents.
- 23.5. Only manufacturers or importers can place products on the market, whereas distributors, importers and manufacturers can make them available thereafter. An importer or distributor may be considered to act as a manufacturer and is thus subject to all obligations for manufacturers in cases where he places a product on the market under his name or trademark or modifies a construction product already placed on the market. Even though not expressly stated in the CPR, the DoP and all accompanying documents are considered legal documents and shall not be altered but supplied as they have been provided by the manufacturer.
- 23.6. To this end, the Contractor shall, when selecting and submitting products and equipment for use in construction works, review the manufacturer's Declaration of Performance to ensure it is suitable for their intended use and in addition shall review National Annexes and/or Standard Recommendations for guidance on appropriate minimum performance levels for specific intended uses of the proposed equipment/product.

24. ENVIRONMENTAL PRODUCT DECLARATIONS:

- 24.1. As part of the procurement and equipment submittal process the Contractor shall endeavour to select products from manufacturers who have verified environmental life cycle impacts to encourage the use of products and materials for which life-cycle information is available and that have environmentally, economically, and socially preferable life-cycle impacts.
- 24.2. Life-cycle assessment and environmental product declarations:
 - 24.2.1. Products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that at a minimum cover product stage (A1-A3) showing the impacts of manufacture and the supply chain from the “cradle to gate”.
 - 24.2.2. Product-specific Type III EPD -- Internally Reviewed. Products with an internally critically reviewed LCA in accordance with ISO 14071. Products with product specific internal EPDs which conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
 - 24.2.3. Industry-wide Type III EPD -- Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. Products with industry-wide EPDs, which conform to EN 15804 or ISO 21930, and registered and published within EPD programmes which need to meet the requirements of International Standard ISO 14025 and at a minimum cover product stage (A1-A3) showing the impacts of manufacture and the supply chain from the “cradle to gate”.
- 24.3. Environmental Product Declarations which conform to ISO 14025 and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
- 24.4. Product-specific Type III EPD -- Products with third-party certification (Type III), including external verification and external critical review and at a minimum cover product stage (A1-A3) showing the impacts of manufacture and the supply chain from the “cradle to gate”.

SECTION 2 - GENERAL SPECIFICATION (6-)

1. EQUIPMENT SAFETY:

- 1.1. The Contractor shall be responsible for the safety of all electrical equipment including that supplied by others for installation under the electrical contract.

2. FIRE COMPARTMENTS:

- 2.1. The building is divided into fire compartments as indicated on the Architect's drawings. Where services pass from one compartment to the next, the integrity of the fire barrier must be maintained. The Contractor shall install fire barriers inside trunking and busbar systems which pass through such fire compartments (section 527, I.S. 10101). The Contractor shall be responsible for ensuring that such activities do not cause any damage to services installed.

3. POSITIONS OF EQUIPMENT AND OUTLETS:

- 3.1. The positions of equipment and outlets shown on the Engineer's drawings, unless otherwise stated, are for tendering purposes only. The exact positions shall be agreed with the Engineer and Architect.
- 3.2. The Contractor shall make a careful study of the Architect's detailed drawings and furniture layouts before commencing to mark out for work in any room. Any obstruction to the proper positioning of the outlets shall be resolved by the Contractor with the services co-ordinator to the satisfaction of the Engineer.
- 3.3. Where outlets for switches, sockets, etc., are specified to be installed in tiled walls or other regularly patterned surface, care shall be taken to ensure that the outlet boxes are positioned to the satisfaction of the Architect at no extra cost to the contract. Similar care shall be taken where luminaires are installed on finished ceilings.
- 3.4. Note that due to the nature of this building, the Contractor shall include for any item of equipment or outlet shown in a room to be positioned anywhere within that room i.e., positions will not be fixed until the furniture layout is determined.

4. WET PLASTER FINISH:

- 4.1. Walls and ceiling having wet plaster finish will be as detailed in the Architect's schedules which are available to the Contractor. Services installed in these areas shall be installed to alleviate the need for access.

5. LOCATIONS FOR SURFACE INSTALLATION:

- 5.1. Surface installations shall be provided where wall finishes are bare-faced blockwork painted or attic or plant spaces - for details see Architect's schedules.

6. LOCATIONS FOR CONCEALED WORK:

- 6.1. In all other locations apart from those adverted to in the preceding clause, the installation shall be carried out as a concealed system with conduits recessed in the walls and in the spaces above the false ceilings.

7. CONDUITS IN PATENT METAL STUD PARTITIONS:

- 7.1. Patent metal stud partitions may be used in sections of the building and because of their bearing on the installation of electrical services it is extremely important that the Contractor make himself fully familiar with the details and locations of these partitions (before submitting a tender) which may be indicated on the Architect's floor plans and detail drawings.
- 7.1.1. Wiring systems within metal stud partitions shall be in accordance with clauses 522.8.14 and 52.8.14.1 of I.S. 10101.
- 7.2. Runs of conduit shall be installed in accordance with the partition manufacturers specification and the Contractor shall be deemed to be aware of all relevant details.
- 7.3. Conduits shall enter only at the top of the partition, the metal ceiling channel of the partition being cut. Notching should not be permitted unless carried out by the person responsible for installing the stud work. The preferred conduit installation method is a set down from the true ceiling.
- 7.4. Grounds shall be provided and fixed in the partitions by the Main Contractor to which the conduit and the outlet box shall be securely fixed, the box having first been aligned and levelled. The Contractor shall be responsible for marking out the position of the conduit drops and the outlet boxes.
- 7.5. In order that the soundproofing qualities of the partitions shall not be impaired by the indiscriminate cutting of holes in them, all conduits shall be kept as close as possible to the soffit of ceiling slab and shall be so arranged as to require the minimum of interference to the plasterboard linings.
- 7.6. It shall not be permissible for conduits to enter or to pass through the partitions other than close up to the soffit of the concrete slab.

8. METHODS OF FIXING:

- 8.1. All lightweight fixings to blockwork or concrete shall be made with steel wood screws, lightly greased, and approved inserts. In damp or exposed situations, lightly greased brass screws shall be used with approved non-deteriorating plugs.
- 8.2. For lightweight fixings to ceiling tiles, plasterboards, etc., which are inaccessible to the back, approved gravity toggles or spring fixings or equivalent shall be employed.
- 8.3. All heavyweight fixings to brick or concrete shall be by means of mild steel bolts of appropriate size, or by chemical fixings, or by expanding bolt fixings.
- 8.4. Generally, the size of bolts or screws shall be the largest permitted by the diameter of the hole in the apparatus to be fixed, and shall be of adequate length. When fixing any item of equipment, all bolt or screw holes provided therein shall be used and the fixing in each hole shall be secure.
- 8.5. The Contractor shall ensure that the type of fixing selected is suitable for the material being secured and for the full weight of the equipment being mounted, e.g. filled tray, luminaire complete with lamps and control gear.
- 8.6. Prior to erection on site all purpose-made mild steel brackets and rods which are not protected by galvanising shall be suitably treated to prevent rust forming and one finishing coat of grey enamel or other colour to meet the Architect's requirements at no extra cost to the contract.

9. REMOVAL OF ORIGINAL SERVICES:

- 9.1. The Contractor shall include for the making safe and careful removal of all designated redundant existing electrical services and equipment within the building.
- 9.2. Material recovered in this manner shall be presented to the Employer's representative to obtain a direction as to its disposal or retention.

10. CIRCUIT IDENTIFICATION:

- 10.1. In accordance with section 514 of I.S. 10101 labels or other suitable means of identification to identify the purpose of switchgear and control gear.

The Contractor shall include for supplying and installing permanent circuit identification tags or labels at each location where circuits are terminated i.e. socket outlets, switches, isolators, fused outlets, luminaire outlets. The positioning of the labels shall be agreed with the Engineer. The identification code shall relate to the records on the circuit charts at the switchboard or distribution board serving the circuit.

11. PVC CONTAINMENT:

- 11.1. All rigid PVC conduit shall be high impact quality to the latest IS EN 61386.
 - 11.1.1. Conduit having an outside diameter less than 20 mm shall not be used. Neither shall oval conduit be used.
 - 11.1.2. Conduit boxes shall meet the current IS EN 61386 and shall have brass inserts for fixing screws. Conduit boxes which support light fittings shall have the brass inserts riveted to external metal fixing lugs.
 - 11.1.3. Inspection tees and elbows shall not be permitted unless through prior written agreement with the responsible Engineer.
- 11.2. All PVC trunking - surface, dado and skirting - shall be of heavy duty, high impact PVC-U material to IS EN 50085.
 - 11.2.1. Trunkings may be of 1, 2 or 3 compartment type with fixed or demountable partitions.
 - 11.2.2. Only components and accessories manufactured specifically for the particular trunking system shall be used.

12. FLEXIBLE CONDUIT:

- 12.1. As per clause 521.9.4 of I.S. 10101, flexible conduit systems may be used to protect flexible insulated conductors.
- 12.2. Flexible metal and PVC conduits shall be used, by approval by the responsible Engineer, where connections are made to equipment or machinery subject to vibration.
- 12.3. Pliable three-layer Class 4 conduit to EN50086 Parts 1 & 2 may be used to serve island equipment via floor chases and to serve partition systems.
- 12.4. An internal insulated earth wire shall be provided in all instances where flexible conduit is used.
- 12.5. Flexible conduit shall not be excessive in length and shall be supported with saddles where appropriate.

13. INSTALLATION OF CONDUIT AND ACCESSORIES:

- 13.1. Surface conduit shall be installed in a neat manner with suitable supports in compliance with the manufacturer's instructions.
- 13.2. Recessed conduit shall be supported with galvanised crampets and be adequately covered with cement or plaster.
- 13.3. Vertical runs shall be supported at 1.5m intervals.
- 13.4. Horizontal runs shall be supported at 1.2 m intervals.
- 13.5. Saddles shall be installed within 0.5 m of a change in direction of conduit, or proximity of termination box.
- 13.6. Draw-in boxes shall be provided at no more than 10 m intervals on straight runs and between two right hand bends or three dog-leg sets.
- 13.7. Exposed threads of steel conduit shall be painted with aluminium based paint.
- 13.8. Conduit entries shall be protected against ingress of moisture or debris during installation.
- 13.9. In exposed or wet situations conduit connections and terminations shall be water tight.
- 13.10. Conduit runs shall be approved before installation work commences and shall be at least 150 mm clear of piping and ducting of other services.
- 13.11. Conduit and adaptable boxes shall be fixed with round head brass or steel sheradised or cadmium plated screws.

14. CONDUCTORS IN CONDUIT AND TRUNKING:

- 14.1. Only insulated cables shall be installed in conduit and trunking.
- 14.2. Cabling for different services shall be installed in separate conduits.
- 14.3. Fire alarm circuits shall not share the same compartment in trunking as other services. The same applies to circuits fed from central battery systems for emergency lighting and any other emergency service circuits, unless they are wired in MICC. This will only be allowed with written approval from the Engineer.

- 14.3.1. As per clauses 528.1 of I.S. 10101, band I and band II circuits shall not be contained in the same wiring system unless the specification prescribed in the clause are facilitated.
- 14.4. As per clause 526.3.1 of I.S. 10101, cables shall not be jointed in trunking. Cables of different circuits in trunking shall be taped or bound at intervals of 3 meters for easy identification.
- 14.5. Cables exceeding 10 sq. mm shall not be installed in trunking with smaller PVC cables.
- 14.6. MICC or SWA cables shall not be installed in trunking with PVC cables.
- 14.7. Cables shall not be packed or forced into trunking in such a manner as to damage or disfigure the insulation.
- 14.8. As part of the services co-ordination process and prior to installation, the Contractor shall advise the Engineer of trunkings which will exceed their capacity (including preserving spare capacity recommended in I.S. 10101).

15. CABLES AND FLEXIBLE CORDS:

15.1. GENERAL:

- 15.1.1. Only cables and flexible cords in accordance with section 521 of I.S. 10101 may be installed. They shall be in accordance with the latest Irish Standards and shall carry the Irish Mark of Electrical Conformity (IMEC).
- 15.1.2. In accordance with section 527 of I.S. 10101, all cables are required to have a minimum rating of class DCA, S2, D2, A2, where *D* refers to resistance to fire (*A-F*, with *A* being the most resistant, and *F* being the least) and *CA* in this context stands for Cable. *S* identifies Smoke, *D* identifies Droplets, and *A* identifies the level of resistance to Acid.
- 15.1.3. Where the appropriate Irish Standard is not yet available, cables and flexible cords complying with the latest British, VDE or CENELEC standard shall be installed.

15.2. DCA APPROVED 70 DEGREES THERMAL PLASTIC CABLES AND FINAL CIRCUITS:

- 15.2.1. These shall be high conductivity stranded copper conductors with 450/750 volt grade insulation.
- 15.2.2. Colour coding of cables shall comply with the Table 51ZC.1 of Annex 51Zc within I.S. 10101 or as already established in an existing installation.

15.2.3. Unless indicated otherwise the undernoted minimum sized cables shall be used in final sub circuits.

Lighting (1 kW max. load)	-	2.5 sq. mm PVCI
Socket outlets (4 No. max)	-	4.0 sq. mm PVCI
Cooker (Domestic type) circuit	-	16.0 sq. mm PVCI
Water heater circuit (3 kW)	-	4.0 sq. mm PVCI
Water boiler circuit (5 kW)	-	10.0 sq. mm PVCI
Boilerhouse final circuit (3 kW)	-	2.5 sq. mm PVCI

15.3. NHXMH CABLES:

15.3.1. NHXMH Cables may be installed on tray, ladder and basket.

15.3.2. Mechanical protection shall be provided when necessary.

15.3.3. They shall be clipped/fixed in position according with the manufacturer's instructions.

15.3.4. When installed externally on a wall these cables shall be provided with additional mechanical protection.

15.3.5. These cables shall not be buried directly in the ground or plaster, or concrete.

15.4. PVC/SWA/LSF CABLES:

15.4.1. These are acceptable in outside and underground locations but when used within building a DCA s2d2a2 alternative is required.

15.4.2. PVC/SWA/LSF cables shall be 600/1000 volt grade and have high conductivity stranded copper conductors. They shall comply with the latest CENELEC standard.

15.4.3. Terminations shall be made off with approved glands and earth bonding washers. Black PVC shrouds shall be installed on glands.

15.4.4. Cables installed below 300 mm shall be protected against mechanical damage by a galvanised steel piping sleeve.

15.4.5. Where single cables are installed, they shall be supported with approved saddles or cleats. The saddles shall prevent the cable from sagging. Fixing screws shall be sheradised or cadmium plated.

15.4.6. Where three or more cables are installed they shall be fixed to cable tray.

15.4.7. See Appendix 'Underground Cable Installation' for installation methods for cables buried in the ground.

15.4.8. Cables installed under made ground - roads, foot-paths etc., shall be installed in high impact ducts suitably sized to facilitate withdrawal of the cables.

15.5. XLPE/SWA/DCA APPROVED 70 DEGREES THERMOPLASTIC CABLES:

15.5.1. The same specification applies to XLPE/SWA/DCA approved 70 degrees thermoplastic cables as apply to PVC/SWA/ approved 70 degrees thermoplastic cables.

15.6. ENHANCED CABLE:

15.6.1. Enhanced cable shall be PH 120 type tested to I.S. EN 50200 including Annex E2. Cable supports and/or Fasteners shall be non-combustible and shall be such that the circuit integrity afforded by the cable is maintained. To this end enhanced cables may be installed as follows:

- 15.6.1.1. On tray or basket where the anchors/fixings are of a non-combustible construction and the cables are dressed with steel cable ties that have a 2-hour fire resistance.
- 15.6.1.2. Within a broken galvanised steel conduit system where the saddles are fixed with non-combustible screws or bolts that have a 2-hour fire resistance.
- 15.6.1.3. Direct clipping to the structure with proprietary clips to meet the PH120 integrity of the cable.

16. LOAD BALANCING:

16.1. The Contractor shall include for the testing of the completed electrical services installations to ascertain and record the loading of each circuit and of each distribution board, switchboard and control panel and to modify the circuit arrangements to ensure the loads are balanced to the satisfaction of the Engineer.

17. LABELS:

17.1. The Contractor shall include for the supply and installation of permanent labels for all terminations, switchboards, distribution panels, isolators, connection boxes and link boxes and where specified elsewhere. Samples of the labels and method of fixing proposed shall be provided for the Engineer's approval.

17.1.1. Labels shall be in accordance with section 514 of I.S. 10101.

17.2. Labels shall be traffolyte engraved black lettering on white background or red background. The labels shall be fixed by means of or superglue directly to the surface of the device so as not to compromise its use. Alternatively, the label can be permanently screwed to the local mounting material directly beside the device.

18. NOTICES:

- 18.1. The Contractor shall include for the supply and installation of all statutory notices (safety and information types) as required.

19. ACCESSORIES:

- 19.1. Accessories shall be flush, or surface mounted to suit particular requirements.
 - 19.1.1. General requirements for electrical accessories are provided in BS 5733.
- 19.2. Ferrous parts shall be adequately rust-protected.
- 19.3. Accessories mounted outside a building shall be weatherproof and boxes shall have external fixing lugs.
- 19.4. Cable ties shall be selected to conform with the type of cable being served, the weight of the cable(s), the environmental conditions, fire rating and cable manufacturers requirements.

20. TESTING AND COMMISSIONING:

- 20.1. GENERAL:
 - 20.1.1. The Contractor shall include for fully testing and setting to work all the installations, systems and equipment included within the contract and shall demonstrate the correct and specified performance of all such items in the presence of and to the satisfaction of the Engineer and Employer's Commissioning Officer prior to practical completion as set out elsewhere in this Specification.
 - 20.1.2. It will be necessary when setting up the programme to arrange for parts of the Installations to be complete and enable other sub-contractors or suppliers to carry out their testing and setting to work.
 - 20.1.3. The Contractor shall ensure that sufficient time is allowed in the Main Contractor's programme(s) to carry out the testing, pre-commissioning, commissioning and handing over of the installation. The testing and setting to work set out here shall apply to all elements of the works described in this Specification and shown on the drawings.

20.2. TESTING AND SETTING TO WORK:

- 20.2.1. On completion of works or parts of the works the Contractor shall test the various installations for polarity, earthing, insulation and protection as laid down in Chapter 6 of I.S. 10101, National Rules for Electrical Installations and any other requirements called up in the Specification.
- 20.2.2. Protective devices and ring-circuit continuity shall also be tested in accordance with the National Rules (I.S. 10101).
- 20.2.3. The various sections may not all be carried out together and the Contractor shall include for testing in stages to suit the progress of the building.
- 20.2.4. Where nominated suppliers appointments includes for testing, the Contractor shall be responsible for ensuring that all tests are properly carried out.
- 20.2.5. Test certificates shall be made available to the Contractor to enable him to record the details of the tests and upon completion of the tests systems or parts of the systems a copy shall be submitted to the Engineers.
- 20.2.6. The Contractor shall serve at least seven days' notice on the responsible Engineer before carrying out the tests, to allow the Engineer or his representative to witness the tests if he so wishes.

20.3. PRE-COMMISSIONING:

- 20.3.1. During the course of the works the Contractor shall carry out on an on-going basis the pre-commissioning of the works and shall assemble all necessary handover material which will be required at hand-over.
- 20.3.2. The pre-commissioning shall be sufficiently thorough and systematic so as to identify together with normal site inspections any obvious installation deficiencies, design errors or omissions.
- 20.3.3. The Contractor shall be responsible for the rectification of the defective work. Any problems which result from design or omissions shall be referred to the Engineer.

20.4. COMMISSIONING:

- 20.4.1. Within the time allowed in the Main Contractor's programme(s) the Contractor shall carry out the commissioning procedures.
- 20.4.2. The Contractor shall provide all instruments and equipment required to carry out the commissioning. Instruments and equipment shall be of good quality and shall be approved by the responsible Engineer.

- 20.4.3. Where necessary the Contractor shall arrange for nominated suppliers or their representatives to be present at the commissioning.
- 20.4.4. The commissioning procedures shall be thoroughly and systematically carried out by the Contractor.
- 20.4.5. The commissioning shall be carried out at a time agreed between the Contractor, the Engineer and the Main Contractor.

21. EQUIPMENT AND APPLIANCES:

- 21.1. All equipment and appliances to be supplied under the electrical services contract shall be connected in accordance with the manufacturer's instructions.

22. DESCRIPTION OF THE WORKS:

- 22.1. The following general description is intended to give an overall view of the works and does not relieve the tenderer in any way from taking account of all parts of the tender documentation.

The project is the refurbishment of existing OPD in Roscommon Hospital.

- 22.2. **The contractor shall note that the building will only be available for a 3-week period to carry out the strip out and installation works noted herein and on the drawings. The submittals, RAMS and procurement processes shall be complete and all materials shall be on site prior to commencing the 3-week works period.**

- 22.1. Electrical supply and distribution.

The 400 / 230Volt 50Hz LV electrical supply for the OPD shall be taken from the existing sub distribution under the stairs in the Hospital. There is a spare 250A MCCB at the board, the contractor shall allow for any modifications to distribution board to facilitate the termination of the new sub-main circuits.



Galvanised steel trunking will be used to distribute all sub mains power cabling around the buildings.

Steel basket will be used to distribute all power and lighting circuits throughout the OPD building. A dedicated steel basket will be used to distribute network cabling from the Communications Room to each network point. Cabling will be Cat6A type.

22.2. General Services and Small Power.

A complete General Services & Small Power installation for the OPD refurbishment works will be provided. This will provide supply to all portable and fixed appliances throughout the department. All final circuits will be fed from the sub distribution board SDB-OPD. This installation will be compliant with the IS 10101.

Final distribution sub circuits at 230/400 Volts will comprise NHXMH insulated cables installed on basket in the attic of the OPD and concealed in Dado trunking within the rooms.

A maximum of four socket outlets shall be connected to a single circuit. The No. of sockets shall include twin sockets. They will have Residual Current Device (RCBO) Protection. Switches on sockets shall be double pole, neutral to make first and break last.

Switches to have a minimum of a 3mm Contact Gap. Two gang sockets shall have outboard rocker switches.

Finish shall in general be Part M compliant.

Any item of fixed equipment rated up to 13 A shall be fed from a fused spur outlet. Any equipment rated over 13A shall have its own dedicated circuit feed and a local isolator. Spur outlets shall be from the same range as the Socket Outlets.

Cat6 compliant three compartment dado trunking will be provided throughout the OPD building for data points and sockets, as detailed herein and in the drawings.

22.3. Lighting Services.

The general lighting system for the OPD refurbishment works area has been designed with careful consideration to energy efficiency and day lighting. The installation will be compliant with IS10101.

The lighting shall also comply with colour rendering and glare limitations according to CIBSE LG2. The following lighting levels shall be achieved:

Location:		Light Level:
WC	General	200 Lux
Plant Room	General	200 Lux
Utility Room	General	200 Lux
Offices	General	300 Lux
Corridor	General	200 Lux

Given the time constraints of the construction programme the light fittings have been selected to minimise the installation time and the cabling requirements, please refer to Appendix 13 for the specification of these. The output of all general lighting luminaires can be dimmed up, down or switched off as required via wireless switches and via the App.

As a brief, the automatic lighting control for all WC's, stores, circulation areas and office etc including the utility areas to ensure lighting is switched off whenever these areas are unoccupied.

Controls used will be as follows:

- Offices/Meeting Room Dimming, Presence/Absence & Switch
- WC's / Changing Rooms / Plant Room: Presence
- Stores: Presence detectors

22.4. Emergency Lighting System.

Given the time constraints of the construction programme the light fittings have been selected to minimise the installation time and the cabling requirements, please refer to Appendix 13 for the specification of these. The emergency lighting system shall provide escape lighting as defined by current IS 3217 and the IS 10101. Emergency lighting system shall be directed towards facilitating evacuation of any occupied area of the building in event of fire coinciding with failure of normal lighting sources and towards ensuring adequate pilot lighting. The system shall be a self-test system.

22.5. Communications Services.

A complete Data & Telephone Services installation for the entire department will be provided. All data and communications cabling will extended from a centralised communications room and will be segregated from power cabling to eliminate interference.

This installation will be compliant with the current Health Technical Memorandum 06-01 Part A, ISO/IEC 11801, EN 50173-1, IS 10101 and the HSE "National Agreed Standards for Structured Cabling Systems".

A total end to end category 6A Customer Premises Cabling solution shall be installed.

22.6. Fire Alarm System.

This system is being retained and shall be protected for the duration of the works. This system is serviced and maintained by Masterfire.

22.7. Security Services.

The CCTV system is being retained and shall be protected for the duration of the works. This system is serviced and maintained by Cube.

22.8. Medical Trunking.

N/A

22.9. Nurse Call System.

N/A

22.10. Electromechanical Installations.

N/A.

22.11. Strip-out Works. Refer to Drawing 25714-VCE-ZZ-ZZ-DR-E-1000.

The Contractor shall include for the stripping out of all existing electrical services which become redundant by virtue of the Contract Works. The extent of stripping out shall be deemed to include all containment, accessories, fixings, mounting brackets, plant, equipment and the like that service the Outpatients Department (First Floor).

The contractor shall note that there are Fire Alarm and CCTV Services within the OPD that are being retained. The contractor shall carry out a full survey of the electrical services installation in the OPD prior to the disconnection and removal of any cabling, containment or plant.

The contractor shall ensure that the Fire Alarm and CCTV Services remain undamaged for the duration of the works. These services shall be retained and protected for the duration of the works.

The contractor shall allow for the existing electrical services not being retained to be isolated, decommissioned and disposed of. The contractor shall allow for the disposal costs and provide certification as proof that the waste was disposed of correctly.

Where services are buried directly into elements of the building fabric which are not being retained and the removal thereof would result in excessive damage to the building fabric and finishes, these services shall be neatly cut back into the wall or floor slab so as to allow for the making good of the finishes.

When stripping out the redundant services the Contractor shall ensure that no unnecessary damage is caused to either the equipment and/or the building fabric which is to be retained.

Prior to removing redundant materials from the site the Contractor shall advise the Employer accordingly and allow them the opportunity to retain any items should they wish to do so.

The electrical contractor shall note that all works associated with the modifications/upgrades and strip-out of the existing electrical services shall only take place once a project specific method statement has been submitted and approved by the HSE and Engineer. Any shutdown's can only be for a minimal period of time and must be agreed in advance with the HSE and Engineer. All works outside the refurbishment areas must be completed out of hours with agreement with the HSE and Engineer.

All electrical installations will be in accordance with the provisions of the Safety, Health and Welfare a Work Act.

The contractor shall note the drawings provided for the OPD are for information only and shall survey the works areas prior to engaging in the proposed works noted above.

The scheduling of the works in each area shall only take place following a review of the RAMS for each area and an agreement between the Hospital and the Contractor.

- 22.12. Note that the tender documentation includes both the Specification and the Drawings scheduled.

SECTION 3 - PARTICULAR SPECIFICATION

PART 3.1 - ELECTRICITY CENTRE & MAIN DISTRIBUTION SYSTEM (61)

1. LV SWITCHGEAR :

- 1.1. The main switchboard and sub distribution boards shall be manufactured in accordance with the Engineer's schematic drawings, the switchgear specification, Appendix 3 and the approved specialist supplier's drawings. They shall be inspected by the Contractor and the Engineer at the specialist supplier's works before delivery to site. The switchgear shall be as manufactured by Parkmore Switchgear, or equal and approved.
 - 1.1.1. Where necessary to suit site access, distribution board locations and safe handling the boards shall be constructed and delivered to site in sections.
 - 1.1.2. The contractor shall include for the supply and installation of a unistrut support framework, where the distribution boards are intended for mounting on solid walls.
 - 1.1.3. Where dedicated cableways are not built into the distribution boards, the contractor shall include for the supply and installation of trunking headers, in accordance with Clause 521.6 and Annex 52 of I.S. 10101, over the boards, are suitably sized to ensure a non-constricted delivery and distribution of individual circuits/cores to terminals.
- 1.2. All fixtures and connections shall be tightened on site before final inspection. All units shall be securely fixed before any cables are connected.
- 1.3. Before being commissioned all units shall be cleaned and damaged paintwork repaired and identification labels fixed.
- 1.4. The main switchboard shall incorporate a digital multi-meter capable of indicating kVA, kW, KVAR, kWh, Amps, Volts, power factor, etc. Where appropriate, per phase (and between phase) measurements shall be recorded and be capable for interfacing with a B.M.S. network. The metering shall incorporate an interface to display the range of recorded information and the associated BMS shall be capable of providing summary information such as energy consumption etc. Other distribution boards may also be so equipped as indicated on the drawings.
- 1.5. The Contractor shall include for on-site work by the specialist supplier of the switchgear, mounting and assembly of the modular compartments, modifications to switchgear terminals, gland plates, etc. to accommodate specified cable sizes. This inclusion shall also accommodate for on-site testing of the performance of the board.
- 1.6. The Contractor shall supply and install B.M.S. wiring systems from the main switchboard and from each local distribution board to the B.M.S. outstation in the plant room, termination at both ends to be facilitated by others.

- 1.7. The supply of cable end boxes, interconnections, fuses and appropriate designation **labelling** is deemed to be included as part of the respective switchboards.
- 1.8. All switchboards (MV & LV) and LV control panels shall have a rubber mat fitted to the front of board/panel, the mat shall be 12mm thick (approx.), 0.9m wide and extending to the full length of the board/panel front (and rear if necessary). The mat shall conform to EN 61111 and be as supplied by Technical Equipment Company, or equal and approved.

2. CIRCUIT INDEX CHARTS:

- 2.1. Circuit index charts contained in clear plastic sealed containers shall be adhesive-fixed inside the door of every distribution board.
- 2.2. The index shall fully identify and describe each circuit protected.
- 2.3. The index shall also identify the neutral connections for the outgoing circuits which must be connected in sequence to correspond with the phase conductor of the circuit.
- 2.4. The Contractor shall include for the supply and fixing of all circuit index charts and plastic envelopes.

3. CABLE DISTRIBUTION SYSTEM:

- 3.1. From the LV switchgear, the Contractor shall install a complete low voltage distribution network as specified hereafter.
- 3.2. Distribution cabling shall be protected against damage during installation.
- 3.3. All cables shall be permanently clipped and connected before being commissioned.
- 3.4. All cables shall be sized as shown on the drawings.
- 3.5. Cable insulation considerations shall comply with section 527 of I.S. 10101 wherein, all buildings shall as a minimum meet the requirements of Class DCA S2, D2, A2 or higher in accordance with I.S. EN 50575. In addition, cables shall be tested in accordance with I.S. EN 61034-2 and the smoke generated shall result in transmittance values of not less than 60%.
- 3.6. Cables shall be installed using cable tray, as indicated on the drawings.
- 3.7. Cables installed using cable tray may be secured with nylon cable ties. The size and spacing of the ties shall be in accordance with the cable manufacturers' requirements.

- 3.8. Single runs of cable shall be secured by claw type cleats single bolt or two bolt fixing as required, complete with studs and backstrap.
- 3.9. The arrangements route, size and types of LV distribution cables shall be as indicated on the drawings and shall be marked out on site by the Contractor for approval by the Engineer on site before the installation commences. The selection of wiring systems shall comply with part 52 of I.S. 10101. In respect to neutral conductors and their cross-sectional area(s), clause 524.2 must be adhered to.
- 3.10. Primary distribution routes are indicated on the drawings but the Contractor shall make due allowance for deviations from or detours to these routes arising from co-ordination activities or other parameters.
- 3.11. Each cable shall be manufactured for installation in a continuous length and shall not be jointed without written authorisation from the Engineer.
- 3.12. Glands for SWA type cables shall contain a plain brass slip-on earth tags shall be provided; above this cable size glands shall have an integrally cast earth lug. Shrouds to totally enclose the gland body and form an effective seal down onto the cable's overall sheathing shall be provided. Tags and lugs shall be made off to supplement earthing provided directly by glands.
- 3.13. All electrical circuits shall include a separate earth conductor (protective earth) with yellow/green outer sheath, of appropriate insulation (in accordance with section 527 of I.S. 10101).
- 3.14. Each distribution group shall be solidly bonded to the cable gland of each incoming and outgoing cable and to cable trunking. Special care shall be taken to ensure that effective electrical and mechanical connections are obtained.
- 3.15. For tendering purposes, it shall be assumed that all wiring shall be brought directly to the terminals of the appropriate protective device and to the corresponding connector ways on the relevant neutral and earth bar(s) where relevant.

4. METAL CABLE LADDER / TRAY AND FITTINGS:

4.1. MATERIALS:

- 4.1.1. Cable ladders shall be of the heavy duty type in accordance with IS EN 61537
- 4.1.2. Perforated cable tray shall be heavy duty type formed from galvanised sheet steel IEC 61084.
- 4.1.3. For tendering purposes the dimensions shall comply with the table below unless stated otherwise on drawing.

Nominal Width	Minimum Height of Upstand	Nominal Thickness of Steel Sheet	Application
100mm	50mm	1mm	Internal Installations
150mm	50mm	1mm	Internal Installations
225mm	50mm	1.5mm	Internal Installations
300mm	50mm	1.5mm	Internal Installations
450mm	50mm	1.5mm	Internal Installations
600mm	50mm	1.5mm	Internal Installations
100mm	50mm	2.5mm	External Installations
150mm	50mm	2.5mm	External Installations
300mm	50mm	2.5mm	External Installations

- 4.1.4. Bends, tees, sets etc., shall be of the same manufacture as the cable tray and of the same material.
- 4.1.5. Where cable tray is installed in corrosive atmospheres (Battery Rooms etc.) it shall be coated with insulation in accordance with section 522 and in particular, 522.5 of I.S. 10101.
- 4.1.6. Mushroom-head sheradised or cadmium plated bolts and nuts shall be used for fabricating cable tray and accessories.

4.2. INSTALLATION OF CABLE TRAY:

- 4.2.1. Cable tray shall be secured in a neat and tidy manner and shall be secured with adequate mushroom-head or round head sheradised or cadmium plated screws fixed at regular intervals not exceeding 1.0 m. At bends or tees tray shall be supported adjacent to the overlap point. Cable tray installations shall comply with section 521 and Annex 52A of I.S.10101.

- 4.2.2. Metal spacers - 25 mm minimum - shall be used to distance the cable tray from vertical and horizontal surfaces.
- 4.2.3. Changes of direction of cable tray shall be curved to ensure continuous support for all cables.
- 4.2.4. Cable tray runs shall be determined by the Contractor and agreed with the responsible Engineer before work is started.
- 4.2.5. Cable tray shall be spaced at least 150 mm clear of piping and ducting related to other services, and installation shall be such that the wiring system is in compliance with section 528 or I.S. 10101.
- 4.2.6. Joints on cable tray shall overlap by at least 100 mm. Alternatively manufacturer approved joiners can be used.
- 4.2.7. All cables installed on cable tray in horizontal and vertical planes shall be adequately secured with straps or clips at close intervals to prevent sagging.
- 4.2.8. Where cables pass through holes in cable tray. The holes shall have a bush and lock-ring arrangement.
- 4.2.9. Where welding has been employed in the fabrication of cable tray the joints shall be treated with two coats of zinc rich paint.
- 4.2.10. Manufacturers standard accessories shall be used throughout. However, where special non-standard accessories are required, they may be manufactured by the Contractor with the approval of the responsible engineer.
- 4.2.11. Cable tray shall not be cut through perforations if possible. All raw edges shall be filed and treated with two coats of zinc rich paint.
- 4.2.12. Where cable tray penetrates through floors and walls, fire barriers shall be provided by the Main Contractor, manufactured from insulating material, shall be so rated as to retain the integrity of the fire compartment and sealing of wiring system penetrations shall be in accordance with clause 527.2 of I.S. 10101.

5. CABLE BASKET:

- 5.1. Where required, a system of cable baskets pre-galvanised to IS EN 61537, shall be supplied and installed by the Contractor, as indicated on drawings. The cable baskets shall be used to convey ELV Services throughout the building.
- 5.2. The cable baskets shall be sized and routed as indicated on the drawings and shall be suspended from the ceiling slab by threaded rods and installed facing upwards.
- 5.3. The cable basket shall be as manufactured by MK - Cable Carrier or as manufactured by MITA, with a 50 mm upstand. Only the manufacturers accessories shall be used with the system.
- 5.4. Where cables branch from this basket in conduit (rigid or flexible type), the Contractor shall use the manufacturers accessories for that purpose.

SECTION 3 - PARTICULAR SPECIFICATION

PART 3.2 - SMALL POWER SERVICES (62)

1. GENERAL SERVICE SOCKETS:

1.1. GENERAL

- 1.1.1. The wiring system shall be in accordance with section 527 of I.S. 10101 and for general service socket outlets shall be in conformance with
- Method 1 – DCA Approved 70 degrees Thermoplastic cables in conduit or trunking (section 15 and 16 (ELEC 06, section 2)
 - Method 2 – NHXMH cables on cable tray (section 15 and 16 (ELEC 06, section 2)
 - Method 3 – XLPE/SWA/ DCA Approved 70 degrees Thermoplastic cables on cable tray (section 15 and 16 (ELEC 06, section 2)
- 1.2. The Contractor shall supply and install a complete general service socket installation as indicated.
- 1.3. The installation shall be a dedicated trunking / conduit system with DCA Approved 70 degrees Thermoplastic cables.
- 1.4. Generally, conduits shall branch from the trunking and be saddled by means of spacer bar saddles to the underside of the floor slab continuing thus in the ceiling space and dropping down to the position of the sockets which may be located in the patent partition or concealed in concrete or block walls.
- 1.5. In all areas with corridor ceiling trunking the wiring from the distribution board shall be conveyed in the trunking to a point nearest to its final destination from whence it shall continue in conduit to the outlet.
- 1.6. All socket-outlets shall have a 2.5 mm² DCA Approved 70 degrees Thermoplastic earth wire, identifiable as per Table 51ZC.1 in I.S. 10101, installed with the circuit wiring from the distribution boards. Thus, each socket circuit shall have an earth conductor connecting from the earth socket terminal of the socket outlet back to an earthing bar which shall be incorporated in the distribution group.
- 1.7. Conduits serving general service socket-outlets on benches shall drop from the ceiling void in an agreed location and manner and connect to a spine trunking or conduit running beneath the worktop. Final connections to pedestal units shall be by means of flexible conduit.

- 1.8. Final circuits for general purpose socket-outlets shall be as indicated or as approved. The wiring system used shall be DCA Approved 70 degrees Thermoplastic cables in trunking and/or conduit as specified in Section 2 of this Specification. Cables shall be 4 mm² stranded) with 20A/30mA RCBO (Type B) protection with a maximum of 4 no. outlets per circuit unless otherwise indicated.
- 1.9. Socket outlets, spur outlets, water heater outlets, cooker outlets etc., shall be as specified in the attached schedule in Appendix 13.
- 1.10. Cleaning outlets, catering outlets and isolators and other items of permanently wired equipment shall be engraved with their intended usage and labelled with the circuit reference.
- 1.11. Where metallic outlet plates are installed on plaster walls, a plastic membrane shall be inserted between plate and plaster to prevent a chemical reaction between metal and plaster and consistent with manufacturer's instructions.
- 1.12. SOCKETS:
 - 1.12.1. General service socket outlets shall be 13 amp three-pin socket and shall comply with the latest IS 411 standard. Socket outlets shall be 13A 3 pin with integral single/double pole switch and shall comply with the section 554 of I.S. 10101. Socket outlets shall have integral single pole switches unless stated otherwise. Interlocked shutters shall be incorporated in all sockets.
 - 1.12.2. In accordance with clause 554.1, socket outlets for general purposes shall be mounted at a height not lower than 400 mm and not higher than 1200 mm above floor level. Socket outlets shall be mounted at 450 mm from the floor level unless particular requirements dictate otherwise . The sockets shall be as manufactured by Lewden, Legrande, Marechal, or equal and approved.
 - 1.12.3. Weatherproof socket outlets (13A externally rated, IP54) shall be provided with spring-loaded covers or screw on metal caps as scheduled. They shall comply with the latest BSS.

2. HOSEPROOF SOCKET-OUTLETS:

- 2.1. Where indicated as being hose-proof, socket-outlets shall have an IP67 Masterseal specification. Further details as indicated on relevant drawings.

3. EXTRA-LOW VOLTAGE SERVICES:

- 3.1. Clauses mentioned elsewhere in this Specification insofar as they are applicable shall be deemed to be incorporated with and shall apply equally to the miscellaneous extra-low sources of supply/load, alarm mag-locks etc.
 - 3.1.1. Note, further details on communications and networking installations may be found in Section 3.4 (Communication Services)
- 3.2. Functional tests will be taken to prove the satisfactory operation of the extra low voltage (ELV) services in accordance with the conditions set out in the relevant sections of this Specification.
- 3.3. All internal wiring shall be enclosed in heavy gauge galvanised screwed welded conduit and sheet steel cable trunking either flush or surface as detailed under locations for concealed and surface installations.
- 3.4. The installation of the ELV conduits and wiring shall comply with the requirements detailed for the lighting and general services installations and in accordance with clause 444z1.1 where relevant.
- 3.5. Where run externally cables shall be PVC insulated steel wire armoured and sheathed overall cables with copper conductors of the sizes indicated. The insulating sheath shall be in accordance with clause 527 of I.S. 10101. When laid into trenches the cables shall be protected with warning tape.
- 3.6. Where indicated armoured cables shall terminate immediately inside the building in a heavy gauge pressed steel connector box fitted with the requisite numbers of Klippon terminals fixed on mounting rail.
- 3.7. Segregation shall be provided and maintained so that circuits for fire alarm, for ELV services, for LV services and for voice and data services shall not be grouped together. Fire alarm circuits shall not be installed with any other services wiring with the exception of emergency lighting wired in MICC or Radox cable fed from a central battery source or UPS.
- 3.8. Draw-in boxes where such are necessary shall be positioned in corridors or in store rooms providing ready means of access.

4. FURNITURE & WALL-MOUNTED TRUNKING SYSTEMS:

- 4.1. In designated locations, this shall be 3-compartments, non-metallic type complete with outlet accessories and trunking system installations shall adhere to the manufacturer's specifications and shall be as specified in the attached schedule in Appendix 13.

5. U.P.S. EQUIPMENT:

- 5.1. The socket outlets (PDU's) in the Communications Cabinet shall be fed through 2 No. 5 kW U.P.S. units with 30 minute back-up time. A specification for the UPS units is included in Appendix 6.
- 5.2. These units shall be located in the Communications Room. The Contractor shall allow for connecting this unit to the power distribution system in LSOH cable in trunking and conduit.
- 5.3. Where indicated as being served by a UPS system, socket-outlet interiors shall be coloured red or their function identified by label.

SECTION 3 - PARTICULAR SPECIFICATION

PART 3.3 - LIGHTING SERVICES (63)

1. GENERAL LIGHTING:

- 1.1. The Contractor shall install a complete lighting scheme in each area as indicated on drawings and specified hereafter.
- 1.2. The following specification covers general lighting circuits, general luminaires, emergency lighting circuits, emergency luminaires, illuminated signs and other specialised lighting.
- 1.3. The lighting installation is designed generally in accordance with the SLL Code for Lighting and is cognisant of the minimum requirements outlined in IS EN 12464 part 1 and 2 where required.
 - 1.3.1. The Contractor shall include for handling, erecting, installing, and connecting all luminaires and accessories (e.g., transformers etc.) shown on the drawings, whether they are supplied as part of this contract or not.

2. WIRING:

- 2.1. The wiring shall be in a metal trunking and/or steel conduit throughout with the trunking generally being located in the ceiling spaces, facing upwards with the lid at the top, and connected to the distribution boards in the distribution cupboards. The Contractor shall allow sufficient bends, tee sets, offsets, reducers, suitable trapeze work (where required) etc. to make the interface in a workmanlike manner to the Engineer's approval.
 - 2.1.1. Wiring systems for lighting installations shall be in accordance with section 559.5 of I.S 10101
- 2.2. Unless otherwise indicated, the branch conduits shall rise from the trunking and be secured by means of spacer bar saddles to the underside of the floor slab thence dropping where necessary to light outlet boxes in walls and ceiling spaces.
- 2.3. Final lighting sub-circuits shall be wired in 2.5 mm², stranded copper conductor LSOH insulated cables with 10A protection. The MCB/RCBO characteristic shall be selected to conform with section 533 and more specifically, clause 533.3.2.2 of IS 10101.
- 2.4. The wiring shall be so arranged that not more than two 2.5 mm² cables enter any one terminal.

- 2.5. It shall be noted that 5 amp socket outlets intended for lighting circuits only including lighting circuits within bathrooms, shall be protected by RCBOs in accordance with clause 701.415.1 of I.S. 10101.
- 2.6. The Contractor shall arrange the circuiting of the lighting systems as indicated on drawings.
- 2.7. Cables shall be installed in trunking and galvanised conduit and terminated at the Luminaire position in a 6A PCR (plug in ceiling rose) (3 or 4 pin for standard) as KLIK type or MK type or equal. Note, 5 and 7 pin DALI plug/socket arrangements must be approved through written agreement with the responsible engineer.

3. FINAL CONNECTIONS TO LUMINAIRES:

- 3.1. Where fluorescent fitting spines do not cover BESA box open blanking plates with grommets shall be installed.
- 3.2. All luminaires shall be earthed with earth leads.
- 3.3. Where luminaires are recessed into a false ceiling the conduit shall terminate adjacent to the fitting in a KLIK socket outlet with the final connection being carried out with a 3 core circular 1.5mm² flex. Any reduction in cross-sectional area must be approved (in writing) by the responsible engineer.
- 3.4. Where an emergency light is integrated into a luminaire the ceiling outlet shall have an appropriate number of pins and the high temperature LSOH cord shall have a sufficient number of cores.
- 3.5. Where luminaires are mounted on the surface of the ceiling or wall, the circuit wiring shall terminate in a PCR (klik) connector (or through a connector arrangement that facilitates similar protection against overheating and accommodation of mechanical support) in the conduit box to which the fitting is fixed and the final connection shall be made in 3 core circular 1.5mm² high temperature heat resistant cord meeting the acceptable DCA requirements.
- 3.6. Standard DCA Approved 70 degrees Thermoplastic cables insulated cables shall not in any circumstances be used for final connections to tungsten luminaires.
- 3.7. The contractor is required to ensure that all conduit outlets are sufficiently facilitated with a bonding provision. The minimum requirement is one connection per branch conduit with 2.5 mm² DCA Approved 70 degrees Thermoplastic cables (minimum) where a separate CPC for the circuit is utilised.
- 3.8. Luminaires in suspended ceilings shall be earthed by the appropriate core in the flexible cord.

4. SWITCHES:

- 4.1. Cover plates for lighting switches shall be as specified in the attached schedule in Appendix 13.
- 4.2. Switches shall comply with the I.S.EN 60669 series, BS 3676 and IEC 669-1, and shall be suitable for use on inductive or resistive loads and rated for 10 amps minimum. They shall be single-pole one-way unless otherwise indicated or approved and were located adjacent to each other they shall be grouped in a multi-gang single enclosure and share a common switch-plate.
- 4.3. The rocker shall be double insulated and have a quick positive action. Brass terminals shall be pillar screw type with terminal screws to facilitate ease of connection including looping in and out of the terminal.
- 4.4. Ease of fixing and alignment shall be provided by an adjustable grid, which shall cover the box aperture and an elongated fixing lug to facilitate correct alignment. The large grid shall allow wiring to be connected without fixing the cover plate and in turn allow decorating work to be completed before the final fix. All units, except architrave assemblies shall fit boxes to BS 4662 with a minimum depth of 25mm. The switch grid shall be complete with a flying earth lead for connection to the box lug.
- 4.5. All boxes shall be of galvanised steel and provided with earth terminals with bonding link to cover-plate/switch grid. Cover plates shall be clearly and permanently labelled (e.g., Traffolyte) with the circuit reference. Multi-phase switch assemblies shall be complete with internal red phase warning labels clearly indicating '400 volts'.
- 4.6. Complete samples shall be submitted to the responsible Engineer for approval before any switches are placed on order. All samples shall be complete with boxes.
- 4.7. Ceiling switches (pull chords) shall be provided as indicated and shall be rated 15 amp one way or two way to BS 3676 and I.S.EN 60669 with 51 mm centres suitable for installation in small circular conduit boxes to BS 4568.
- 4.8. Cord operated switches shall comply with EN 61558 and be supplied with a 1.5 m white pull cord and insulated grip.
- 4.9. Switches shall be mounted in accordance with clause 530.7 of I.S. 10101 at 1100mm centre from the full floor level unless particular requirements dictate otherwise.

5. LUMINAIRES:

- 5.1. Light fittings shall be as shown on the drawings and schedule appended at the rear of this Specification. All fittings shall be fitted with lamps. Diffusers and lamps shall not be erected until the Main Contractor has cleaned the building.
- 5.2. The Contractor shall provide for the supply and delivery to site of all luminaires specified under this Contract.
- 5.3. All details of individual luminaires shall be as specified in the attached schedule in Appendix 13.
- 5.4. All luminaires and ancillary equipment are to be installed as per manufacturers guidelines. Any deviation from this is only with the written consent of the responsible engineer.
- 5.5. Care is warranted for the adequate ventilation and support for luminaires and any associated ancillary device (drivers / transformers. Particularly in false ceilings.
- 5.6. Where modular suspended ceilings are used the final lighting arrangement is to be confirmed with the responsible engineer once the ceiling grid is in place.
- 5.7. Before placing final orders, the Contractor shall obtain approval from the Architect for each type of luminaire intended for use and shall make due allowance for submission of samples to the Architect as required. A provisional sum is included in the summary of tender for the provision of sample luminaires and demonstration of luminaires.

6. EMERGENCY LIGHTING SYSTEM:

- 6.1. The Contractor shall include for the supply, wiring, erection, and connection of a complete emergency lighting installation as indicated on the drawings, including luminaires complete with lamps and external conversion units where required.
 - 6.1.1. The Contractor or Specialist Contractor for the installation, testing, commissioning and certifying of the Emergency Lighting System shall be registered to perform those duties under the Building Emergency Safety Systems (BESS) scheme, have successfully completed a nationally approved QQI Level 6 Course for those duties.
- 6.2. The emergency lighting installation shall be provided by means of emergency lighting luminaires, to provide a system of "escape lighting" complying with I.S. 3217 and IS EN 1838. The equipment shall comply with the attached emergency luminaire specification in Appendix 5.

- 6.3. The installation shall utilise non-maintained self-contained emergency luminaires and maintained self-contained exit sign luminaires, and luminaires shall be surface and semi-recessed.
- 6.4. Wiring to the self-contained luminaires shall be taken from the adjacent lighting circuit and a local means of isolating for each luminaire shall be provided by means of a 4 pin Klik type socket and plug (coloured Red) to provide a maintained supply to all charger units.
- 6.5. The permanent supply to the battery/charger units shall be derived from the same local circuit as the general lighting in line with IS 3217.
- 6.6. The self-contained luminaire based emergency lighting system shall incorporate a testing scheme as required by IS 3217 and in this project that shall be achieved by –
 - 6.6.1. Automatic Test System built into the luminaires – Type S (as a minimum) or Type P, or Type ER or Type PER or Type PERC – as defined in EN 62034:2012.
- 6.7. In areas with suspended plaster ceilings, it may be necessary in some situations to cable from the emergency luminaire to a location where there is an access point to the ceiling void and where there is a lighting junction box or local distribution boards.
- 6.8. To facilitate regular and convenient testing of emergency luminaries, the Contractor shall supply and install multi-circuit central test unit(s) complete with interface relay unit, all located at the appropriate distribution board. Note, under no circumstances may dedicated emergency lighting circuits be used. The sources for the emergency lighting supplies for each circuit must be same as the permanent supplies to the general lighting in the same circuit via the interface relay unit to the emergency luminaires. The location for the central test unit shall be confirmed before installation.
- 6.9. On completion of the work of installation the emergency lighting system, the Contractor / Commissioning Engineer shall commission, test and certify the System. The Contractor shall provide to the Engineer an inspection and test certificate as specified in IS 3217 and I.S. EN 1838, duly completed.
- 6.10. The Engineers shall be given 1 weeks' notice of the commissioning and testing of the complete installation, so that they may witness the process.
- 6.11. EMERGENCY LUMINAIRES:
 - 6.11.1. The Contractor shall supply, erect and connect the luminaires complete with lamps, specified in the schedule attached to the rear of this Specification.

- 6.12. Where indicated, standard luminaires shall be converted to emergency luminaires in accordance with I.S.EN 60598-2-22: 2014 and as indicated in Appendix 5 at the rear of this Specification. Such conversions shall be carried out by the luminaire manufacturer and shall in no way affect the warranty or performance of such luminaires. The arrangement shall be such as to provide a self-contained sustained system with an emergency lighting duration of three hours.
- 6.13. All emergency luminaires and exit signs shall be supplied complete with Compliance Certificates to EN 60598-2-22 for the particular luminaire.
- 6.14. All relevant aspects specified in the "General Luminaires" clause above shall apply to the emergency luminaires. Final connections to emergency luminaires shall be enclosed in conduit.
- 6.15. Local isolation of exit signs shall be afforded by means of a 4-pin 'Klik' outlets.

7. EXTERNAL LIGHTING:

- 7.1. The Contractor shall supply, install, test and commission a complete external lighting installation, as indicated on drawings and specified hereafter.
 - 7.1.1. External Lighting installations shall be in accordance with section 714 of I.S. 10101.
- 7.2. The luminaires shall be circuited, as indicated on drawings and shall be routed, using cable tray, trunking and conduit and ducting as required.
- 7.3. All outgoing circuits shall use 600/1000 volt grade SWA cables meeting the current DCA requirements when routed within a building sized as indicated on drawings.
- 7.4. Cables in trenches and pipe ducts shall be installed in accordance with the Appendix to this Specification.
- 7.5. Joints in cables installed underground shall not be accepted except where such joints are sanctioned by the responsible Engineer and shall be made in an approved manner, with approved jointing accessories, to the satisfaction of the Engineer, and by a qualified cable jointer.
- 7.6. Where underground pipework enters a building the radius of the pipe bend shall be of the 'slow' type not exceeding the minimum bending radius of the cable.

7.7. WALL MOUNTED LUMINAIRES

- 7.7.1. Wall mounted luminaires shall be wired by means of 4 core PVC/SWA/PVC or XLPE/SWA/ PVC cable in sizes as detailed on the drawings.
- 7.7.2. The cables shall be wired to a splitter box, adjacent to the luminaire, within the building on the loop-in loop-out basis.
- 7.7.3. The Contractor shall wire from the splitter box to the lantern such that the wiring system is afforded both appropriate mechanical protection while also facilitating sufficient means to avoid condensation within any associated splitter boxes.
- 7.7.4. The Contractor shall provide an earth lug in the splitter box solidly bonded to the single wire armouring of the incoming cable.
- 7.7.5. One of the cores of the four-core cable to the lantern shall act as an earth lug in the splitter box.
- 7.8. Excavation and reinstatement shall be carried out by the Main Contractor; cable laying and all electrical work shall be carried out by the Contractor. The Contractor shall be responsible for supervising all activities to ensure a satisfactory installation. During back-filling of trenches and at a depth set down in the relevant Appendix to this Specification for the underground cable installation, the Contractor shall supply and install a warning tape of vividly coloured heavy-gauge polythene strip boldly printed to identify the particular service and warning slabs.
- 7.9. The Contractor shall provide record drawings. During progress of the work an accurate record of cable routes in plan and cross-section shall be made giving such particulars as will allow an accurate reference to be made in the event of a fault, modification or extension. Such records shall show, amongst other data, the exact position of every lighting column/ bollard (their dimensions and types), joint, cable box, earth electrode and connections thereto and also particulars of the depth of the trench, the quantity of duct ways, the arrangement of the cables and the position of all obstructions revealed during the excavation. The cable details to be shown are the size of the conductor, number of cores, type of insulation, protection, finish and design voltage.
- 7.10. Record drawings shall be based on Architect's setting out plans. All physical features necessary to locate electrical distribution details such as the outline of buildings, roads, paths, hedges and ditches, etc., shall be shown. The routes of sewers, water mains, heating ducts and other services shall be shown where they affect the new cable routes. The route of the ESB cables shall also be shown.

8. LIGHTING CONTROL SYSTEM:

- 8.1. The Contractor shall include for the supply, installation, testing and commissioning of the equipment and for liaising with the specialist supplier during the installation, testing and commissioning of the integrated lighting control system.

SECTION 3 - PARTICULAR SPECIFICATION

PART 3.4 - COMMUNICATIONS SERVICES (64)

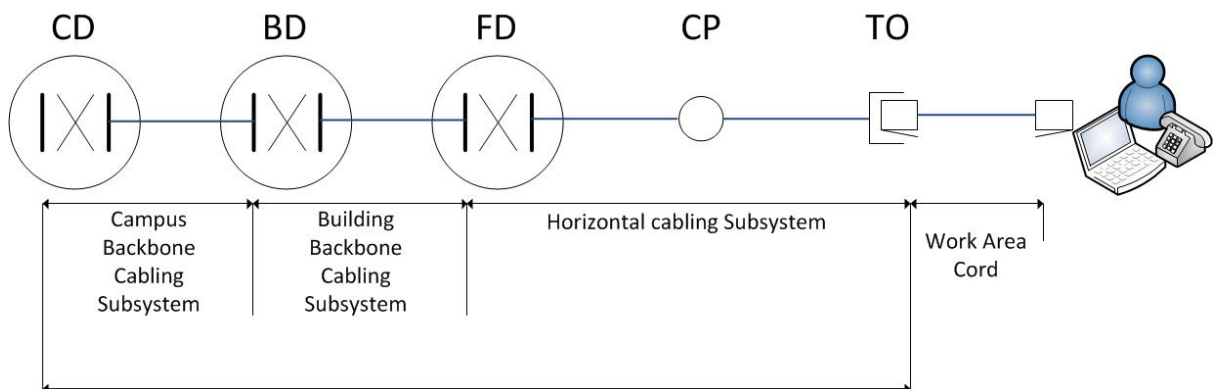
CUSTOMER PREMISES CABLING (Cat 6A) SYSTEM:

1. GENERAL:

- 1.1. The Contractor shall include for an I.T. specialist supplier to carry out the I.T. installation. The specialist supplier shall include for the supply, installation, testing and commissioning of a limited customer premises cabling (CPC) system as specified hereafter and indicated on drawings.
 - 1.1.1. The Structured Cabling System (SCS) shall be manufactured by a single source encompassing copper and fibre under a 25-year warranty, the mixing of components from multiple suppliers is not permitted.
 - 1.1.2. All copper cabling from Comms Hubs to floors will be in Cat6A U/UTP.
 - 1.1.3. All copper cabling within the Comms Hubs shall be in Cat6A U/UTP.
 - 1.1.4. A complete solution inclusive of all cabling components shall be covered by a single 25year manufactures warranty only.
 - 1.1.5. The SCS shall be Cat6a U/UTP 10GPlus system as per ISEN 50173-1 Class EA.
 - 1.1.6. The system shall Leviton, Brand-Rex or SYSTIMAX network infrastructure solutions provider shall achieve carbon neutral status for the company's operational activities in accordance with the PAS2060 standard to offer carbon neutral products. Please provide ISO 14001 and PAS 2060 Certification (or equivalent).
 - 1.1.7. The Structured Cabling system should include for some or all of the following:
 - Telecommunications links
 - Satellite backbone links
 - Internal backbone links
 - Horizontal cabling
 - Radial Cat6a cables
 - VoIP
 - DECT
 - Door Entry
 - Digital Signage

- Lighting
- IP Clock
- WiFi
- Smartphone
- Security Cameras
- Video Conference
- Environmental Control
- Access Controls
- Harness links
- Optional enclosed Hot-aisle solution
- Cabinets
- Open Racks with Vertical Managers
- Patch-panels
- Device leads and patch leads
- Labelling
- Bonding and protection

1.1.8. The horizontal cabling shall all be Cat6a U/UTP. Each horizontal run to the outlet shall not exceed a permanent link distance of 90m. Cables should be 23AWG U/UTP with an outer green jacket.



1.1.9. The AI must also as part of his works properly ground and bond all installed apparatus, equipment and components to ensure equal potential is maintained through his installation in accordance with IS EN50174 & IS EN50310.

2. STANDARDS

- **IS 10101:** Requirements for Electrical Installations. Wiring Regulations
- **IS EN 50173-1:** Information technology. Generic cabling systems. General requirements,
- **IS EN 50173-2:** Information technology. Generic cabling systems. Office premises
- **IS EN 50173-3:** Information technology. Generic cabling systems. Industrial
- **IS EN 50173-4:** Information technology. Generic cabling systems. Residential
- **IS EN 50173-5:** Information technology. Generic cabling systems. Data centres
- **IS EN 50173-6:** Information technology. Generic cabling systems. Distributed building services
- **IS EN 501741:** Information technology. Cabling installation. Installation specification and quality assurance
- **IS EN 50174-2:** Information technology. Cabling installation. Installation planning and practices inside buildings
- **IS EN 50174-3:** Information technology. Cabling installation. Installation planning and practices outside buildings
- **IS EN 50310:** Application of equipotential bonding and earthing in buildings with information technology equipment
- **IS EN 60825-1:** Safety of Laser Products. Equipment Classification, Requirements and User's Guide
- **IS EN 50600-1:** Information technology. Data centre facilities and infrastructures. General concepts
- **ISO/IEC 11801:2002 +amendments 1 & 2:** For Class EA channel and permanent link performance respectively
- **IS EN 50600-2-4:** Information technology. Data centre facilities and infrastructures. Telecommunications cabling infrastructure.
- **ISO / IEC 14763-3:** Information technology. Implementation and operation of customer premises cabling. Testing of optical fibre cabling

3. PRODUCTS

- 3.1. The manufacturer shall have locally (Ireland) based Pre-sales, post-sales, technical, design, warranty and engineering team.
- 3.2. Manufacturer should have a minimum of 5 Authorised Installers in Ireland.
- 3.3. Conductors must be 23 AWG as a minimum. 24 AWG will not be accepted.
- 3.4. Manufacturer must have five similar reference site in the last year to be visited by the client before approval.

- 3.5. Full labour and applications warranty.
- 3.6. Mandatory face to face training; online training not accepted. Must be validated within 2 year period.
- 3.7. Site audits of products >500 pts by manufacturer.
- 3.8. The product must be independently tested for full connectivity and cable, as well as certification for link and channel.
- 3.9. Toolbox talks for installers on site.
- 3.10. Tool-less jacks should be mandatory.
- 3.11. All cables should have CE classification compliant with national guidelines on Construction Products Regulation.

4. INSTALLERS

- 4.1. The AI shall be in the Structured Cabling business for a period of at least 5 years and have experience with Category 6 and 6A products.
- 4.2. The AI must be an official partner of the specified product manufacturer for at least the last 3 years and must produce evidence that they have the continuous training with that manufacturer for those 3 years.
- 4.3. Official documents will be requested to support AI's credentials with manufacturer.
- 4.4. The AI shall have a minimum of 10 field staff and 4 office staff for back up.
- 4.5. The AI shall be able to demonstrate that they have carried out at least 3 similar size installations with his proposed product within the last 2 years.
- 4.6. Face to Face training certificates must be provided, online training will not be accepted.
- 4.7. Copper and Fibre training must be verified.
- 4.8. Training must be recognised by Industry Body.
- 4.9. The Manufacturer should clarify date the AI joined the program together with current Installer certificate.
- 4.10. The AI should display proof of ownership of test equipment.

- 4.11. The AI should provide full details of test equipment together with up-to-date calibration certificates. A guide to company policy on testing on copper and fibre would be preferred.

5. HORIZONTAL CABLING

- 5.1. Valid Certification shall be provided with all bids and prior to any works commencing. The Horizontal structured cabling system shall provide in strict accordance with tender drawings. The system will be used to connect voice and data services, WLAN, CCTV, and Access Control devices to the network. The drawings showing telecommunications outlets shall be used to identify the precise quantity of MER/SERs to which each outlet must be connected to maintain cable length restrictions in the use of Category 6a cabling. The performance of the SCS Contractors Horizontal structured system being provided shall meet IS EN 50173-1, IS EN50310 standards operating at frequencies up to 500Mhz, supporting Voice, Data & Video applications at data rates of up to 10Gbit/s to full 100m channel requirements.

6. CABLE

- 6.1. The cabling must be four-pair 100 Ohm Category 6a U/UTP Cca GREEN outer jacket (AC6U). The cable must have current independent third-party approval status at component level and include specification references. Category 6A/Class EA, cable shall be constructed of 23 AWG copper conductors with a Cca Green Jacket. The copper conductors shall be twisted in pairs and separated by a cross-divider. Maximum OD 8.0mm.

7. PATCH PANELS

- 7.1. As a minimum the Patch Panels must Be 19" rack mountable, in exact multiples of 1U in height.
- 7.2. Angled all metal 24 port modular patch panel (MMCPNLX24SIJ2MAN).
- 7.3. Shall accept all Cat6a UTP Modules (6AUJK-RE6).
- 7.4. Cat6a modules shall be tool-less.
- 7.5. Front connectors to be RJ45 style.
- 7.6. Label System.
- 7.7. Lifetime Product Warranty.

- 7.8. Black finish.
- 7.9. Front connectors to be RJ45 style.
- 7.10. Rear cable presentation to be 180 degrees.

8. OUTLETS

- 8.1. Category 6A/Class EA, 8-position, UTP jack module shall terminate 4-pair, 22 – 26 AWG, 100 ohm UTP (6AUJK-RE6).
- 8.2. Patented Retention Force Technology® (RFT).
- 8.3. Modules shall be tool-less.
- 8.4. Connector style to be RJ45.
- 8.5. 100W POE Rated.
- 8.6. Coloured Options (13).
- 8.7. Lifetime Product Warranty.
- 8.8. Must have current independent third party approval status at component level to a minimum of ISO/IEC 11801.
- 8.9. HORIZONTAL CATEGORY 6A U/UTP PATCH LEADS
 - 8.9.1. The AI shall allow for the supply only of the following Leviton/Brand-Rex-Category 6a Component Compliant Patch leads. Category 6A/Class EA, small diameter patch cords shall be constructed of 26 AWG, , twisted pair, stranded copper cable with high performance modular plugs (AC6PCFaaa-bCCHB aaa=L b=Colour).
 - 8.9.2. The patch cord will incorporate a moulded boot that provides for a short-installed bend radius and ease of use in higher-density applications.
 - 8.9.3. These items shall be available from stock within 1,2,3,5 and 10 metre lengths. Bespoke lengths and colours should be available, but it is understood they will be subject to a longer lead time for delivery.

- 8.9.4. The AI will allow for patch leads to be available for the Patching Fields, these are supplied in standard lengths.

1000 no Leviton/Brand-rex Class Ea 1 metre leads

1000 no Leviton/Brand-rex Class Ea 3 metre leads

- 8.9.5. The Client's standards shall be confirmed prior to tender response and shall include up to eight different colours.

9. CONSTRUCTION PRODUCTS REGULATION

- 9.1. This regulation (EU) No 305/2011 of the European Parliament was passed by council on 9 March 2011 and extended to indoor cables on 12th June 2016.
- 9.2. All cable supplied shall conform to the EU Construction Product Regulation, EN 13501-6:2014 and shall be CE marked to the appropriate EU Classification as detailed below. The manufacturer shall supply a Declaration of Performance as part of the response.
- 9.3. The EU Classifications range through several increasing levels of performance with A_{CA} being the highest through B1_{CA}, B2_{CA}, C_{CA}, D_{CA}, E_{CA} and F_{CA} with A being outside the scope of data cables and F being outside buildings only. There are also performance levels for Smoke production, S1, 1a, 1b, 2 & 3, Flaming Droplets D0, 1 & 2, and Acid gas A1, 2 & 3.
- 9.4. The cables shall be a minimum of is C_{CA} s1a d1 a1.

10. SEPARATION OF DATA/VOICE AND POWER CABLES

- 10.1. The following instructions should be followed when installing data, voice and power as per IS EN50174 for cabling installation.
- 10.2. The final separation distance (A) shall be calculated by the product of basic cabling distance (S) and power cabling factor (P).

$$A = S \times P$$

Basic Separation Table (S)

Type of installation	Without divider or non-metallic divider	Open Metallic divider	Perforated metallic divide
Screened Cat7/7a	10 mm	8 mm	5 mm
Screened Cat6/6a	50 mm	38 mm	25 mm
Unscreened Cat6/6a	100 mm	75 mm	50 mm
RG co-axial	300 mm	225 mm	150 mm

The upper surface of installed cables shall be at least 10mm below the top of barrier

Power Cabling Factor (P)

Electrical circuit type	Quantity of circuits	Power cabling factor P
20A 230V 1-phase	1 to 3	.2
	4 to 6	.4
	7 to 9	.6
	10 to 12	.8
	13 to 15	1.0
	16 to 30	2
	31 to 45	3
	46 to 60	4
	61 to 75	5
	>75	6
3-phase shall be treated as 3 off 1-phase cables More than 20A shall be treated as multiples of 20A		

11. WIRELESS DATA POINTS

11.1. Twin Cat6a outlets at high level (or ceiling level) will service a wireless access point. The power for the access point will be delivered via POE on the Cat6a U/UTP Cca cable.

11.1.1. General Network - When the primary network connection is wired, and a wireless connection is required to support additional applications.

11.1.2. High density environment- When wireless access is required to serve a number of users located in close proximity.

11.2. GENERAL REQUIREMENTS:

11.2.1. A double high-level data point every 12-metre radius to ensure no gaps in coverage exist.

11.2.2. At least one double high-level data point is required for every meeting room.

11.2.3. In a higher density environment, data points must be distributed directly above the user group in the ceiling and must be easily accessible.

11.2.4. Access points can be mounted on suspended ceilings, walls, and plasterboard.

11.2.5. The electrical contractor is to include for 2no. Multimode OM4 48 core Fibre cables from each floor comms hub to the 3rd floor Micro Data Centre/Core Switch Stack for the proposed Wifi System.

12. FIBRE CABLING

- 12.1. Performance objectives of backbone fibre optic infrastructure shall be to support error free signal transmission between MER and SERs throughout the campus. The performance of the installed fibre optic cable plant shall support bandwidth-intensive applications including 1Gbit/s through 10Gbit/s and beyond as defined in IEEE 802.3z, 802.3ae, 802.3aq and 802.3ak Standards. All fibre shall be OM4 48 core (GFOM4UNI28B2CA).
- 12.2. Designated media shall consist of multi core Multi-Mode/Single-mode cabling compliant with ISO 11801 standards.
- 12.3. ALL CONNECTOR END FACES SHALL BE INSPECTED FOR DAMAGE AND DEBRIS USING A VIDEO MICROSCOPE AND IF NECESSARY CLEANED BEFORE INSERTION INTO COUPLERS IN ACCORDANCE BS/ISO 14763-3
- 12.4. OS2, Optical Cable Performance levels:

Wave Length (nm)	Max. Fibre Attenuation (dB/Km)	Typical Cabled Attenuation (dB/KM)
1310	0.4	0.38
1550	0.4	0.25

- 12.5. OM4, Optical Cable Performance levels:

Wave Length (nm)	Max. Fibre Attenuation (dB/Km)	Typical Cabled Attenuation (dB/KM)
850	3.0	2.8
1300	1.0	0.8

12.6. FIBRE PATCH PANELS

- 12.6.1. Fibre panels shall be Duplex LEVITON LC SDX 2U panel allowing future expansion capacity.
- 12.6.2. Suitable for mounting in 19" frames within termination closets. Fixed using securing bolts and captive nuts at either side.

12.7. CONNECTORS & FIBRE PATCH LEADS

- 12.7.1. Optical fibre cables shall be terminated LC-Duplex connectors that conform to EN 186000 Part 1, by means of fusion splicing using factory terminated pigtails.
- 12.7.2. The average loss for all connector pairs shall be less than 0.3dB, including the loss due to splicing.

- 12.7.3. The fibre leads shall be OM4 (VPC-M4D1LCLCxxxx) and violet in colour.
- 12.7.4. Fibre optic pigtails shall be made from the same fibre type as the fixed cabling.
- 12.7.5. Pigtails shall be kept slack when the cable is terminated.
- 12.7.6. Pigtails shall be supplied in a 12-pack kit following the TIA colour scheme OM4 (RWL-VPK-M49LC1200-01).
- 12.7.7. Splices shall be retained within a protective sleeve by either friction or adhesive bonds to the optical fibre and additional strain relief for the completed joint shall be provided. All splice, joints and their strain relief shall be fixed within the optical fibre management system of the enclosure. The insertion loss through any splice shall not be greater than 0.15dB.

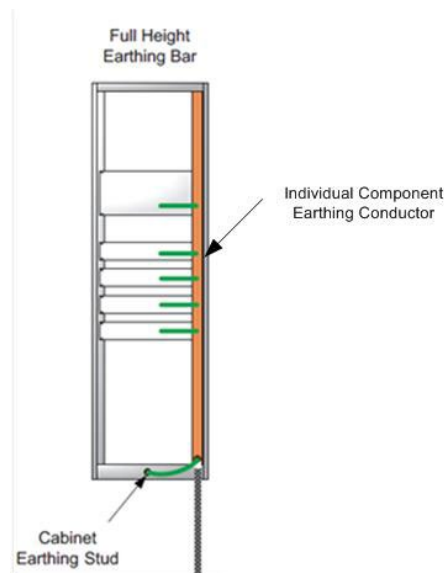
13. TELECOMMUNICATION ROOMS

- 13.1. Each room housing Cabinets and frames shall be sized in accordance with the requirements of IS EN 50174.
- 13.2. The room shall be large enough to provide 1.2m of clearance on all faces of cabinets and frames where access is required. There must be a minimum of 2.6m unobstructed height from the finished floor to any fixtures such as tray, sprinklers, lighting etc.
- 13.3. Doors shall be 1m wide and 2.13m High and fitted with a locking system.

14. SERVER RACK

- 14.1. Server Cabinet shall be from the **APC 3150** or equivalent and conform to the following specification:
 - 14.1.1. Comply with ANSI/EIA-310-E, IEC60297-2, DIN41494 Part 1&7.
 - 14.1.2. Fabricated from steel.
 - 14.1.3. Colour scheme: Grey RAL9002, White RAL9003, Black RAL9005.
 - 14.1.4. Overall height less than 2300mm.
 - 14.1.5. Footprint of 800x1000mm.
 - 14.1.6. Capacity 42U.
 - 14.1.7. 4No. 19" Vertical mounting angles, each fully adjustable.
 - 14.1.8. Internal equipment mounting depth minimum of 895mm front to rear.

- 14.1.9. Lockable Quick release front and rear doors and metal side panels.
- 14.1.10. 'Wave Style' ventilated metal front door with 2 point swing handle CAM lock.
- 14.1.11. Ventilated metal split rear doors with 3 point swing handle CAM lock.
- 14.1.12. 2NO.



- 14.1.13. Static Load = 1360kg, Rolling Load = 1136kg.
- 14.1.14. Levelling legs that have ability to tune cabinet.

15. OPEN RACK

- 15.1. The Two Post Patching frames (R2P) shall be Panduit and conform as a minimum with the following:
 - 15.1.1. DIN414 compliant.
 - 15.1.2. 2 post aluminium construction.
 - 15.1.3. 42,48 or 52U height.
 - 15.1.4. 19" profiles marked with U height positions.
 - 15.1.5. 1500lbs static load bearing.
 - 15.1.6. High Density Cable Management.
 - 15.1.7. Patchrunner 12" vertical cable management as required (PRV12).

16. CONTAINMENT

- 16.1. Horizontal cabling must be fully supported, contained, and managed along its entire length. Cabling must be routed and secured, fixed, or positioned upon designated 'Communication Containment' provided by the Electrical subcontractor.
- 16.2. The SCS Contractor shall ensure the containment system is suitable and adequate under the standards of this specification and against those set by the manufacturer of the structured cabling system.

17. TESTING

17.1. COPPER

- 17.1.1. The AI shall test 100% of the Category 6a horizontal cabling over the permanent link to confirm cable plant performance characteristics as stated in the current editions of IS EN50173 Class EA.
- 17.1.2. In all high-performance data transmission environments (such as 10GB/s Ethernet) and in environments where Power Over Ethernet (POE) may be deployed, the Test Limit selection shall include 'PLUS ALL' for example, EN50173 PL x (+All). This selection adds essential balance measurements which confirm the cable's suitability for these applications:
- DC Resistance Unbalance within a pair,
 - DC Resistance between pairs,
 - TCL (Transverse Convergence Loss),
 - ELTCTL (Equal Level Transverse Conversion Transfer Loss)
 - CDNEXT (Common Mode to Differential Mode Near-End CrossTalk)
 - CMRL (Common Mode Return Loss)
- 17.1.3. Sample testing for Alien NEXT will not be required.
- 17.1.4. Calibration: The AI must use a level IV Cable tester, which shall have a current calibration certificate issued by the manufacturer, and within the manufacturer's (Fluke Networks) recommended calibration periodicity.
- 17.1.5. Computed test results that indicate that some part of the result is closer to the limit than the tolerance of the test equipment may be noted as 'PASS*' or 'FAIL*'. A 'PASS*' test result shall not be accepted and shall be treated in the same way as a 'FAIL'.

17.2. FIBRE

- 17.2.1. Fibre Loss Certification (Tier 1 or 'Basic' Certification):

Single and Multi-mode backbone links shall be tested at both cardinal wavelengths and in both directions in accordance with BS/ISO/IEC 14763-3. Testing of the fibre optic cabling using the One Jumper Reference Method using Light Source and Power Meter with reference grade test cords and couplers. All Multimode links shall be tested using the “Encircled Flux” methodology with the relevant Test Reference Cords (TRCs).

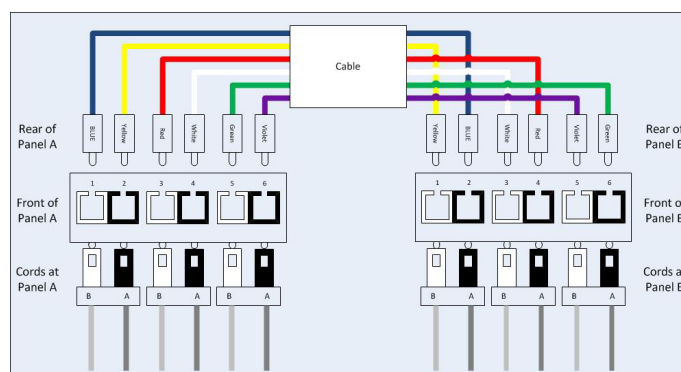
The one-jumper reference shall be supported within the test results by AT LEAST one Test Reference Cord (TRC) verification result per session. TRC Verification is part of the reference process and is supported in Certifier Pro by the Reference wizard.

All results should be capable of being stored within the test equipment for future submission electronically as part of the warranty application.

The length of each fibre shall be recorded.

Paired duplex fibres in multi-fibre cables shall be tested to verify polarity.

The polarity of the paired duplex fibres shall be verified using a Power source and light meter in accordance with IS/EN 50174-1.



The following information would be recorded from all tests:

- Name of personnel conducting the test.
- Project Name
- Date test is being performed.
- Optical source wavelength, spectral width, and CPR (for multimode tests only).
- Type of test equipment used (manufacturer, model, and serial number).
- Fibre identification.
- End point locations.
- Test direction.

- Reference power measurement (when not using a power meter with a Relative Power Measurement Mode).
- Measured attenuation of the link segment.
- Acceptable link attenuation.
- Reference cord identification.

18. END-FACE INSPECTION

- 18.1. All installed fibre end-faces shall be inspected for cleanliness and condition prior to commencement of testing. Any end-faces found to be contaminated shall be cleaned prior to either Loss testing or OTDR testing commences. AT LEAST a sample equivalent to 10% of the total number of installed end-faces shall be imaged and the images stored for future reference, as part of the test record.

Fiber Type	Core/ Cladding	Wavelength (nm)	Max Loss (dB/km)	Minimum EMBc (Mhz*km)	Max Reach @ 1G (m)	Max Reach @ 10G (m)	Max Reach @40/100G
OM1	62.5/125	850	3.5	200	270	33	n/a
		1300	1.5	-----	550	300	n/a
OM2	50/125	850	3.5	500	550	82	n/a
		1300	1.5	-----	550	300	
OM3		850	3.5	2000	1000	300	100
		1300	1.5	-----	600	300	100
OM4		850	3	5000	1040	500	150
		1300	1.5	-----	600	300	150
OS2	9/125	1310 - 1625	0.35	n/a	n/a	n/a	n/a

19. WITNESS TESTING

- 19.1. The Engineer reserves the right to attend site to witness cable plant tests and complete random sample testing upon completion of test. Witness testing and random sample testing will be agreed with the PCI prior to commencement of site testing and will be no more than 10% of the total number of outlets. Any further testing will be chargeable at an agreed hourly rate prior to the testing.

20. ACCEPTANCE

20.1. For acceptance of the SCS Physical Infrastructure the AI shall complete the following:

- All labelling.
- All installation of SCS Physical Infrastructure (to the correct standards).
- All cabling test results showing positive results (to the correct standards).
- All documentation.

21. SITE AUDITS

21.1. Site audits should be made available by both the manufacturer and local distributor. The individual's responsible for audits should be identified together with their qualifications.

21.2. The Installer should demonstrate qualifications from Industry Certifications such as BICSI RCDD or CNET CNIDP.

22. LABELLING

22.1. The AI shall draw up full details of the cable plant labelling scheme for every cable, patch panel, wiring closets, termination frames, and telecommunication outlets and agree the format with the Main Contractor prior to installation.

22.1.1. Typeface Labels shall have an agreed typeface size and font. Hand-written labels will not be accepted, except on a temporary basis during installation and will not be acceptable for cable plant testing purposes.

22.1.2. All labels shall be permanently fixed. Legible, durable and robust.

22.1.3. All labels shall be fixed horizontally on fixed equipment and longitudinally at each end along the line of cables.

22.1.4. Positions The following positions at which labels are fixed shall apply as a minimum:

Cable terminations shall be labelled at patch panel outlets.

Cable shall be labelled at telecommunication outlets.

Cables shall be labelled at the entry/exit points of rooms and buildings.

Cables shall be labelled at all access chamber, cable turning chambers and draw pits.

23. WARRANTY:

- 23.1. Results shall be documented as per labelling.
- 23.2. The AI shall provide all results.
- 23.3. This should be forwarded to the supplier, who will issue a 25-year warranty upon correct installation and application package.
- 23.4. The warranty shall cover:
 - 23.4.1. Guarantee from manufacturer to end-used for defined time period.
 - 23.4.2. Lifetime applications.
 - 23.4.3. Covers copper and fibre.
 - 23.4.4. IEC fire ratings.
 - 23.4.5. Full cost of replacement (labour and parts).
 - 23.4.6. Transferable warranty.
 - 23.4.7. Extended distance.
 - 23.4.8. Fully compliant with latest International and European standards.
 - 23.4.9. CPR Cca as a minimum.

24. T.V. / RADIO DISTRIBUTION SYSTEM:

- 24.1. The Contractor shall include for the supply, installation, testing and commissioning of a complete television/radio distribution system and its integration to the AV system as noted in design drawings and as specified hereafter and indicated on drawings.
- 24.2. The TV system shall provide RTE 1 & 2, TV3, BBC 1& 2, ITV, Sky News, Sky One, Sky Sports etc. The radio system shall provide RTE 1 & 2, Local Radio, BBC Radio 4.
- 24.3. The system shall consist of supplying and installing a twin FM/TV outlets at each of the locations as indicated on the drawings. A double screened 75 ohm coaxial RG59 cable shall be supplied and installed on ELV tray/trunking & via conduit from each outlet to amplifier splitter units located as indicated.

- 24.4. A double screened 75 ohm coaxial cable shall be supplied and installed by the Contractor in the service riser from the main distribution equipment located as indicated on the drawings. This cable shall interconnect to amplifiers and splitter units on each level.
- 24.5. The Contractor shall include for the supply & installation of all conduits/trunking and outlets and the installation, testing and commissioning of all the amplifier splitter units and any other distribution equipment required to complete the system. The system shall be designed, tested and commissioned by the TV Specialist.
- 24.6. The Contractor shall include for the supply and installation of a system of cable tray/trunking/cables to link roof-mounted satellite dishes for the UTELSAT and ASTRA to the central TV distribution equipment, as indicated on the drawings.

25. INTERCOM SYSTEM:

- 25.1. The Contractor shall include for the supply, installation, testing and commissioning of a complete intercom system as indicated on drawings and specified hereafter.
- 25.2. The system shall consist of a central base station and a quantity of outstations linked to the central station, as indicated on the drawings.
- 25.3. The base station shall be a desk-mounted unit and the outstations shall be flush mounted, stainless steel finish and weatherproof standard.
- 25.4. The system shall be audio-only system, but with the facility to release an electric lock remotely at the location of each outstation unit.

26. PTN PROVIDER:

- 26.1. The Contractor shall include for the supply and installation of a dedicated system of trunking/conduit to link the incoming PTN provider's circuits to the Micro Data Centre PABX location, as indicated on drawings.

27. AUDIO-FREQUENCY INDUCTION LOOP SYSTEMS:

- 27.1. Sound reinforcement for the hard of hearing:
 - 27.1.1. This part of the system comprises the supply and installation of an induction loop amplifier and a copper loop as indicated on the design drawings.
 - 27.1.2. The loop can be situated around the perimeter of the rooms indicated above ceiling or below floor.

- 27.1.3. The induction loop amplifier will be located within the electrical cupboard or stores as indicated on the design drawings.
- 27.1.4. This signal is fed through the loop, which surrounds the room and induces a magnetic field within the loop area, which can be picked up by conventional hearing aids.
- 27.1.5. An induction loop tester is to be provided as part of the induction loop installation, for issue to the client.
- 27.1.6. The Hearing Loop system shall comply with IEC 60118-4:2006.
- 27.1.7. The Contractor shall:

At the earliest opportunity in the project, (When all electrical devices and circuits in the room can be turned on) provide evidence that the background magnetic noise in the areas designated for loop coverage is within the limits defined in the standard, IEC 60118-4:2006. Where the background magnetic noise exceeds -32dB re: 400mA/m -1 [-22dB for short-term use/localized applications], the contractor shall not proceed without client approval. This approval will require a realistic demonstration of what the finished loop system will sound like.
- 27.1.8. Prior to installation, show that cross-talk between adjacent looped areas (whether part of this contract or not), and that magnetic spill from any Hearing Loop System where the signal is defined as 'confidential' will, by design, be less than -32dB peak with normal signal levels.
- 27.1.9. Prior to installation, provide evidence that the effect of metal within the structure of the building has been adequately assessed and compensated for by loop design and / or appropriate loop driver selection. Where necessary, the effect of metal shall be assessed by site survey and using test loops on relevant construction, carried out by a competent test specialist.
- 27.1.10. Prior to installation, provide a pre install test data sheet to demonstrate that the field strength of the proposed systems will meet the requirements of the standard IEC 60118-4:2006.
- 27.1.11. Prior to installation demonstrate that all seating areas will be covered by the hearing loop.
- 27.2. The induction loop specialist supplier shall include for the design of the loop arrangement to remove all cross contamination between rooms above, below or beside the loop. All special loop patterns shall be designed by the AFIL supplier and included within the O&M manuals.
 - 27.2.1. It shall be the responsibility of the Electrical Contractor and his specialist supplier to provide a fully working system. The tender drawings are issued for tender purposes only. All design by specialist must be completed by competent person and certified to all relevant standards.

- 27.2.2. It shall be the responsibility of the Electrical Contractor and his specialist supplier to provide all necessary loop location signage in relation to the hard of hearing induction loop system and install. All locations to be agreed with architect prior to installation.
- 27.3. The induction loop specialist supplier, the electrical contractor and the audio visual specialist shall liaise at an early stage to ensure full integration of the audio visual system and the hard of hearing induction loop system.
- 27.4. COMMISSIONING
- 27.4.1. The contractor shall:
- Include commissioning of the complete system(s) in accordance with IEC 60118-4:2006.
 - Provide a procedure for testing and commissioning. Provide all necessary test equipment to complete the process, all test results to be fully recorded and copies included in the Operation and Maintenance manuals.
 - Provide a minimum of 14 days notice of all testing in order that a Client's representative may have reasonable option to attend and witness tests.
 - Provide operating instructions for all items of equipment and installed systems. Demonstrate all systems and methods of use to the end user.
 - Provide "As Installed" drawings and Operation and Maintenance manuals for all Hearing Loop Systems.
 - When carrying out commissioning tests, use a Field Strength measurement tool with a minimum specification.
 - Issue Certificates of Conformity to IEC 60118-4:2006 that clearly state the results of testing and whether the system performance meets the relevant requirements of the standard.
 - Commissioning shall not be complete until adequate signage has been both approved by the facility and installed where users will note the systems has been installed before taking their seats.
 - Demonstrate that all seats within the facility meet the IEC 60118-4 standard and any exceptions are appropriately covered by the signage.
 - Where the induction loops are to be installed prior to the driver/amplifier equipment, the loops shall be tested for continuity and for isolation from electrical ground and metal structures/containment. The Client shall have the opportunity to witness these tests which shall be recorded and documented.
 - The specialist supplier and electrical contractor shall demonstrate the integration with the audio visual system.

27.5. TRAINING AND MAINTENANCE

- 27.5.1. Training and instruction documentation shall be provided that enables operational staff to understand the proper use of the hearing loop system and how to ensure that people with MT or, T-Coil equipped hearing aids can make use of the system effectively.
- 27.5.2. A test and maintenance schedule shall be provided.
- 27.5.3. Training and instruction documentation shall be provided for operational staff such that they can use and perform regular functional tests on the system(s). This training shall include, but not be limited to, demonstrating the correct use of the test equipment and hearing loop drivers provided.
- 27.5.4. The specialist supplier and electrical contractor shall demonstrate the integration with the audio visual system.

APPENDIX 1

RECORD DOCUMENTATION

1. GENERAL:

- 1.1. The following specification covers the preparation and supply to the Engineer of a comprehensive Hardcopy and Digital Project Safety File (DPSF) incorporating the following:-
 - 1.1.1. Operating and maintenance manual(s).
 - 1.1.2. Record drawings.
 - 1.1.3. Testing, commissioning and proving reports.
- 1.2. Of the four sets, three complete sets of documentation shall be provided to the Client on practical completion and one complete set shall be supplied by the Contractor to the Project Safety Officer.
 - 1.2.1. The tenderer shall agree at an early stage with the client and engineer as to the form (Hardcopy or digital) of the O&M manual.
- 1.3. The documentation shall be written, assembled and completed in accordance with the requirements of EN 82079-1 : 2020, "Technical manuals", and BSRIA BG 79, "Handover Information and O&M Manuals".
- 1.4. The Contractor shall be required to demonstrate during the course of the works that adequate and accurate records are being maintained and that record documentation is being progressively compiled.
- 1.5. Where information is required from material or plant suppliers/manufacturers the Contractor shall request such details from the relevant company. The Contractor shall allow for any charges that may be required by manufacturers or suppliers for the provision of information and literature.
- 1.6. The Contractor shall issue a draft copy of the record documentation to the Engineer for approval 6 weeks before the planned practical completion of the project.
- 1.7. The final documentation shall be capable of being used without other supporting information.

2. PRESENTATION:

- 2.1. The manual(s) shall be presented in a format which allows for three levels of reader ability:-
 - 2.1.1. Non-technical (those who use or occupy the building).
 - 2.1.2. General technical (those responsible for managing the operation and maintenance of the building).
 - 2.1.3. Specialists (those who maintain the building).
- 2.2. The manual(s) shall be A4 size, hard bound, and shall comprise a loose leaf system.
- 2.3. Manual details, logos, addresses and other relevant information shall be provided on the front cover and on the spine if space permits.
- 2.4. An information sheet shall be provided at the front of the manual(s) listing the names and addresses of the principals (main contractor's engineers and mechanical and electrical sub-contractors) involved on the contract.
- 2.5. The manual(s) shall be arranged with an index and referencing system, with numbered card dividers between sections.
- 2.1. In respect to hard-copy submissions, the paper used in the final issue shall be good quality, white, 120 g/m², and the reproduction method shall be dry photocopy.
- 2.2. All documentation shall be written in English. The text of descriptive sections shall be kept concise while at the same time ensuring completeness.
- 2.3. Jargon shall be avoided. New terms shall be defined when first introduced. Abbreviations shall only be used if they have been defined or their meaning is clear from the text.
- 2.4. Illustrations, drawings and diagrams incorporated into the manual(s) shall be easily read in conjunction with the relevant text.
- 2.5. The instructions applicable to the project shall be highlighted by the Contractor on the initial copy for the Engineer's approval, and on all four final copies.

3. CONTENT AND LAYOUT:

- 3.1. The manual(s) shall follow the framework set out in BSRIA BG 79 and shall include purpose and planning information, technical documentation including record drawings, full operating instructions for each system, detailed maintenance instructions and schedules, emergency information, parts lists, modification instructions, disposal instructions, manufacturers' literature, together with procedures and results of all tests undertaken during the testing and commissioning process.

4. RECORD DRAWINGS:

- 4.1. The drawings shall be issued in CAD and PDF format A0 or A1 size and each drawing shall be clearly marked "record drawing".
- 4.2. Record drawings shall be executed by a competent draughtsman and shall contain sufficient detail to enable the Employer to maintain, dismantle, reassemble and adjust all parts of the works.
- 4.3. Lettering on drawings shall be to an approved lettering system and the title block shall be to the Engineer's approval.
- 4.4. The title block shall not contain any revision notes or references, nor shall the drawings contain any references to existing services or similar notes.
- 4.5. The drawings shall clearly show all systems, plant, terminal points such as luminaires, sockets, isolators, etc. and distribution, circuit orientation and references. All sizes of tray, trunking and their routes shall be indicated. All plant shall be clearly referenced and shall be readily identifiable.
- 4.6. The Contractor shall ensure that any services which are buried within the structure, or underground, are precisely located on the drawings, along with the precise positions of entry of services to the building, giving their depth and the locations of the relevant pits, etc.
- 4.7. The drawings shall incorporate all building changes which may have occurred during the course of the contract.
- 4.8. The Contractor shall provide the following for inclusion in the manual(s):-
 - 4.8.1. A schedule of record drawings, including those issued by manufacturers or suppliers during the course of the works, e.g. switchgear layout and control panel wiring diagrams.
 - 4.8.2. A complete set of drawings, in numerical order, reduced to A3 size and printed on good quality paper identical to that used for the remainder of the manual(s).

- 4.8.3. Any isometric or diagrammatic drawings.
- 4.8.4. Copies of distribution board identification charts.
- 4.9. The Contractor shall provide digital record drawings to the AutoCAD Release version requested by the Engineer / Client.
- 4.10. The Contractor shall provide one copy of each of the warning signs and safety charts, which shall be heat sealed or fixed in glazed hardwood frames, for installation in locations to be agreed on site.

5. COMPLETION CERTIFICATES:

- 5.1. The Contractor shall submit the following certificates when the installation is completed and include copies in the manual(s):-
 - 5.1.1. Safe Electric certificate of entire installation.
 - 5.1.2. 4 part certificates for fire alarm and emergency lighting (Design, Installation, Commissioning and Handover).
 - 5.1.3. Lightning protection certificates (Design, Installation, Commissioning and Handover).
 - 5.1.4. Certificates from suppliers or manufacturers stating that equipment has been installed and commissioned satisfactorily and is operating in accordance with the design requirements.
 - 5.1.5. Safe Electric or appropriate governing body sub-system certificates.
 - 5.1.6. All system testing and commissioning certificates and results.
 - 5.1.7. An IOU (incomplete, outstanding or unsatisfactory work) shall be attached to a certificate in the event of any work not required at hand-over stage, and a programme agreed for the completion of works.

APPENDIX 2

ELECTRICAL SUB-SYSTEM CERTIFICATION

In accordance with the Safety, Health & Welfare at Work (General Application) Regulations, 2007 – 2012 every new electrical installation and every major alteration or extension to an existing installation shall after completion be inspected and tested by a competent person in an approved manner, and a certificate of test shall be completed verifying that the relevant requirements of these Regulations have been complied with.

After the installation has been tested and found to comply, the contractor or other person responsible for the construction of the installation, or a person duly authorised to act on his behalf, must sign a statement to that effect. The statement must be in the form of an approved certificate. Certification in accordance with the requirements of CRU and Safe Electric will be deemed to meet this requirement. In addition to the certificate, the test record sheets containing the results of tests carried out must be retained. The certificate must be completed by an authorised person having adequate technical knowledge and experience.

In accordance with the above the proposed electrical installation specified herein shall be certified as having been installed, inspected and tested in full in accordance with the CRU and Safe electric rules pertaining to an electrical installation as prescribed by NSAI IS 10101 National Rules for Electrical Installations. In this respect ALL electrical works relating to the project shall be tested and certified.

Where a new or amended ESB service is required, the completed works shall be required to have a Safe Electric completion certificate.

For electrical sub-systems, which are defined as being “any system that will be connected to the low voltage network of any installation, with the exception of portable appliances that are designed for such use” and examples of which are:

- Lift installations
- Electrical works not requiring an ESB connection
- A/C or ventilation systems
- UPS
- Datacoms works
- Specialist electrical equipment installations
- Standby generation
- Fire protection systems
- Etc.

Such sub-system contractors shall ensure that:

- a All electrical works are carried out by a qualified electrician or by an apprentice electrician under the supervision of a qualified electrician.

- b A sub-systems certificate in the form attached must be completed by the sub-systems contractor for each sub-system within his contract, where applicable. This will include sub-system works carried out by another party but forming part of the contractor's scope of work or contract. An example of this would be a fit-out electrical contractor who has a number of specialist systems suppliers, e.g., fire suppression, A/C, audio visual, under his fit-out contract but where he is linking to an existing main or sub main switchboard that has been installed and has had an Safe Electric completion certificate certified by others.
- c In addition to receiving one or more sub-systems certificates from the specialist suppliers working under his contract, the main sub-systems contractor must also complete a sub-systems certificate in respect of his work.
- d Prior to any electrical contractor making a power supply available to a sub-systems contractor, he must obtain a completed sub-systems certificate from that sub-systems contractor.

The contractor supplying a sub-systems certificate must be a registered Electrical Contractor.

APPENDIX 3

LOW VOLTAGE SWITCHGEAR

1. PROCEDURAL PROCESS:

- 1.1. The Contractor is provided with the following:
 - 1.1.1. Schematics and or Circuit schedules.
 - 1.1.2. An individual Panel (distribution board) Specification Sheet for each panel required.
- 1.2. The panel manufacturer shall provide a draft layout drawing including all relevant dimensions of the proposed panels and any amendments identified on the panel specification sheet.
- 1.3. The iterative draft processes outlined in subsections 1.1 and 1.2 are continued until agreement is achieved between the responsible engineer and the nominated panel assembler.
- 1.4. Once formal written agreement is received by the assembler including the agreed panel layout drawing and final specification sheet, the panel assembly shall commence. It is only at this stage that an order is confirmed.
- 1.5. **PANEL TESTING:**
 - 1.5.1. On completion of panel assembly, it shall be subjected to an insulation resistance test, and a suitable declaration certificate will be provided.
 - 1.5.2. A declaration that terminal torque requirements have been adhered to shall be provided.
 - 1.5.3. The agreed panel assembly is subject to passing a factory acceptance test (FAT) witnessed by the responsible engineer prior to its transportation to site. 2 weeks' notice will normally be required prior to panel assembly by the responsible engineer.
- 1.6. Installation criteria shall be agreed between the contractor, the panel assembler and the responsible engineer prior to its installation. This shall include the following consideration in a formal written format.
 - 1.6.1. Glanding arrangements (types and positions).
 - 1.6.2. Termination arrangements (use of ferrules, bolts, lugs etc).

- 1.6.3. Mounting arrangements.
- 1.6.4. Cable entries and routing within the panel.

1.7. INFORMATION ON HAND OVER:

- 1.7.1. Two copies of detailed general arrangement, single line and control wiring drawings. These drawings shall identify all components by manufacturer and type. Operating characteristics of all protective devices shall be submitted. The switchgear manufacturer shall submit full fault level analysis to the Engineer with the drawings for comment.
- 1.7.2. Copies of "as-built" general arrangement, single line and control wiring drawings.
- 1.7.3. 4 copies of completed signed and witnessed test certificates.
- 1.7.4. 4 copies of list of spares and accessories supplied (if required).
- 1.7.5. 4 copies of short circuit test certificates from an independent test house if applicable or if custom built assembly.
- 1.7.6. 4 copies of design calculations verifying short circuit strength of assembly.
- 1.7.7. Any information required in this Specification and related documents and standards.

2. STANDARDS:

- 2.1. All switchgear shall comply with the requirements set out in current editions of IS EN 60439-1 and any relevant codes of practice relating to switchgear assemblies. In addition, the switchgear shall comply with the particular requirements of the Electricity Supply Authority and with the particular requirements of this Specification.
- 2.2. Only LV switchgear approved by (NSAI) IS 10101 and the appropriate standards as applicable to all internal components within the assembly shall be utilised.

PANEL (DISTRIBUTION BOARD) SPECIFICATION SHEET

	Specification Required	Proposed by Assembler	Agreed (Varmings use only) (Yes/No)
Panel Details			
Unique Panel name/identifier	SDB-OPD		
Intended location on site	OPD		
Panel use (Main Board, Sub- Board, MCC, etc.)	Sub-Board		
Physical Specifics			
Nominal Physical Size (mm)	1500H, 1000W, 400D		
Is the panel construction plastic or metallic?	Metalic		
Wall thickness mm	2mm		
Paint or surface coating	Powder coated		
Finished colour	Manufacturer's standard colour		
Doors required (Yes/No)	Yes		
Interlocking Incomer Door Isolation (Yes/No/NA)	No		
External design:	Multi cubicle		
Service conditions:	Standard indoor		
Degree of protection:	IP 42		
Separation Classification	Form 4-Type 6		
Protection against indirect contact:	Class 1		
Type of mounting:	Free standing		
Component mounting:	Fixed/Withdrawable		
Incomer cable Entry	Bottom Left via trench		

	Specification Required	Proposed by Assembler	Agreed (Varmings use only) (Yes/No)
Cables Exiting:	Top via dedicated cable way and gland plate minimum 600 x 400		
Labelling	Traffolyte 10mm White on Red background		
Future extension:	N/A		
Operating access:	Front only		
Working access:	Front only		
Working access:	Front only		
Labelling	Traffolyte 10mm White on Red background		
Electrical Parameters			
160	160A		
Supply characteristics:	400V 50Hz TP & N		
Incoming Device	160A MCCB LSI (fully settable for overcurrent and short circuit)		
Residual current monitoring of incomer (Yes/No)	No		
Residual current protection of incomer (Yes/No)	No		
Overvoltage class of incomer	IV		
Incomer Remote arm (Yes/No)	No		
Incomer shunt trip (Yes/No)	No		
Incomer Undervoltage trip (Yes/No)	No		
Supply Healthy indication lamp (via phase monitoring relay (Yes/No?))	No		
Neutralising required (Yes/No?)	No		
Separate Neutralising compartment (Yes/No?)	No		

	Specification Required	Proposed by Assembler	Agreed (Varmings use only) (Yes/No)
Prospective symmetrical short circuit current	Switchgear to be able to withstand the max. fault current which could be delivered by the ESB 1000kVA transformer		
Peak asymmetrical short circuit current	50kA		
Manual Interlocking Required (Yes/No?) Details:	No		
Digital Metering	Yes		
Mechanical Interlocking Required (Yes/No?) Details:	No		

25714

DISTRIBUTION BOARD SCHEDULE							PROJECT:		RUH OPD		DATE	APP	DESCRIPTION
							PROJECT No:		25714				
							CLIENT:		HSE				
							DATE:		Aug. '26				
DISTRIBUTION BOARD REF: SDB-OPD LIGHTING SERVICES			NUMBER OF WAYS: AS INDICATED FAULT LEVEL: 10 kA			SUPPLIED FROM: Main Switchboard LOCATION OPD				ISOLATOR: MCCB 63A			
CIRCUIT No.	SERVICE		LOAD A			MCB SIZE	CCT	CABLE SIZE	DESCRIPTION	REV			
	LIGHT	OTHER	R	S	T								
R1						10	1	2.5	Room 4, 5 & 6	0			
S1						10	1	2.5	Room 7 & 8	0			
T1						10	1	2.5	Store, Toilets & Sluoe Room	0			
R2						10	1	2.5	Admin Reception & Lobby	0			
S2						10	1	2.5	Corridor & Waiting	0			
T2						10	1	2.5	Corridor	0			
R3						10	1	2.5	Room 9, 10 & 11	0			
S3						10	1	2.5	ENT & X-Ray	0			
T3						10	1	2.5	Dental Reception & Surgery 1	0			
R4						10	1	2.5	Dental Surgert 2 & Kitchenette	0			
S4						10	1	2.5	Corridor	0			
T4						10	1	2.5	Corridor	0			
R5						10	1	2.5	Wating Area 2	0			
S5						10	1	2.5	Spare	0			
T5						10	1	2.5	Spare	0			
R6						10	1	2.5	Spare	0			
S6						10	1	2.5	Spare	0			
T6						10	1	2.5	Spare	0			
R7						10	1	2.5	Spare	0			
S7						10	1	2.5	Spare	0			
T7						10	1	2.5	Spare	0			
R8						10	0	2.5	XXX	0			
S8						10	0	2.5	XXX	0			
T8						10	0	2.5	XXX	0			
							21 Cct						

DISTRIBUTION BOARD SCHEDULE						PROJECT:		RUH OPD		DATE	APP	DESCRIPTION	
						PROJECT No:		25714					
						CLIENT:		RUH					
						DATE:		Thursday 27 August 2026					
DISTRIBUTION BOARD REF: SDB-OPD			NUMBER OF WAYS: AS INDICATED			SUPPLIED FROM:				ISOLATOR: MCCB			
EXTERNAL LIGHTING			FAULT LEVEL:			LOCATION OPD							
CIRCUIT No.	SERVICE		LOAD A			MCB		CCT	CABLE SIZE	DESCRIPTION			REV
	EX LTG	OTHER	R	S	T	SIZE							
R1						10	1		6	Car Park			0
S1						10	1		6	Car Park			0
T1						10	1		6	Spare			0
R2						10	1		6	Spare			0
S2						10	1		6	Spare			0
T2						10	1		6	Spare			0
R3						10	0		6	XXX			0
S3						10	0		6	XXX			0
T3						10	0		6	XXX			0
								6 Cct					

25714

DISTRIBUTION BOARD SCHEDULE						PROJECT: RUH OPD		DATE		APP		DESCRIPTION	
						PROJECT No:		25714					
						CLIENT:		RUH					
						DATE:		27 August 2026					
DISTRIBUTION BOARD REF: 1 Ph SDB-OPD GENERAL SERVICES			NUMBER OF WAYS: AS INDICATED FAULT LEVEL: 10 kA			SUPPLIED FROM: Main Switchboard							
			LOCATION			OPD						ISOLATOR: MCCB 100A	
CIRCUIT No.	SERVICE		LOAD A			MCB SIZE	CCT	CABLE SIZE	DESCRIPTION	REV			
	OUTLET	OTHER	R	S	T								
R1						20	1	4	Room 4	0			
S1						20	1	4	Room 4	0			
T1						20	1	4	Room 5	0			
R2						20	1	4	Room 5	0			
S2						20	1	4	Room 6	0			
T2						20	1	4	Room 6	0			
R3						20	1	4	Room 7	0			
S3						20	1	4	Room 8	0			
T3						20	1	4	Room 8	0			
R4						20	1	4	Waiting Area 01	0			
S4						20	1	4	Room 9	0			
T4						20	1	4	Room 9	0			
R5						20	1	4	Room 10	0			
S5						20	1	4	Room 10	0			
T5						20	1	4	Room 11	0			
R6						20	1	4	Room 11	0			
S6						20	1	4	ENT Specialist	0			
T6						20	1	4	ENT Specialist	0			
R7						20	1	4	ENT Specialist	0			
S7						20	1	4	X-Ray	0			
T7						20	1	4	X-Ray	0			
R8						20	1	4	Canteen	0			
S8						20	1	4	Canteen	0			
T8						20	1	4	Canteen Fridge	0			
R9						20	1	4	Dental Surgery 02	0			
S9						20	1	4	Dental Surgery 02	0			
T9						20	1	4	Dental Reception	0			
R10						20	1	4	Dental Reception	0			
S10						20	1	4	Dental Surgery 01	0			
T10						20	1	4	Dental Surgery 01	0			
R11						20	1	4	Print Room	0			
S11						20	1	4	Print Room	0			
T11						20	1	4	Reception	0			
R12						20	1	4	Reception	0			
S12						20	1	4	Admin 01	0			
T12						20	1	4	Admin 01	0			
R13						20	1	4	Sluice	0			
S13						20	1	4	Waiting Area 02	0			
T13						20	1	4	Spare	0			
R14						20	1	4	Spare	0			
S14						20	1	4	Spare	0			
T14						20	1	4	Spare	0			
R15						20	1	4	Spare	0			
S15						20	1	4	Spare	0			
T15						20	1	4	Spare	0			
R16						20	1	4	Spare	0			
S16						20	1	4	Spare	0			
T16						20	1	4	Spare	0			
R17						20	0	4	XXX	0			
S17						20	0	4	XXX	0			
T17						20	0	4	XXX	0			
						48 Cct							

25714



DISTRIBUTION BOARD SCHEDULE						PROJECT: RUH OPD		DATE	APP	DESCRIPTION
						PROJECT No: 25714				
						CLIENT: RUH				
						DATE: 27 August 2026				
DISTRIBUTION BOARD REF: SDB-OPD		1 Ph	NUMBER OF WAYS: AS INDICATED			SUPPLIED FROM: Main Switchboard				
POWER SERVICES			FAULT LEVEL: 10 kA			LOCATION: OPD			ISOLATOR: MCCB	63A
CIRCUIT No.	SERVICE		LOAD A			MCB SIZE	CCT	CABLE SIZE	DESCRIPTION	REV
	OUTLET	OTHER	R	S	T					
R1						20	1	4	Fire Alarm Panel	0
S1						20	1	4	Automatic Door	0
T1						20	1	4	CCTV Cabinet	0
R2						20	1	4	Pneumatic Tube	0
S2						20	1	4	Spare	0
T2						20	1	4	Spare	0
R3						20	0	4	XXX	0
S3						20	0	4	XXX	0
T3						20	0	4	XXX	0
						6 Cct				

APPENDIX 4

LUMINAIRES

1. GENERAL

- 1.1. The specified luminaires must be utilised unless prior (written) agreement with the responsible engineer has been secured.
- 1.2. The party that is proposing a change to the specified luminaires shall do so at entirely their own cost.
- 1.3. The pre-approval process is outlined below (Section 2).
- 1.4. **Notwithstanding the criteria detailed in Section 2, Varming Consulting Engineers Ltd. is under no obligation to agree to any proposed change(s).**

2. PRE-APPROVAL PROCESS

- 2.1. Luminaires and equipment offered shall comply with all relevant Standards and Codes of Practice insofar as they apply.
- 2.2. Luminaires shall be supplied complete with lamps.
- 2.3. The general criteria associated with a change to the specified luminaires shall comprise of the following considerations.
 - 2.3.1. Luminaire data sheets
 - Conformance certificates from manufacturer within Europe or via an independent test-house (for a non-European jurisdiction)
 - Lamp efficacy
 - Luminaire power factor
 - Life span
 - Warranty on fittings
 - IP rating
 - IK rating (mechanical impact)
 - Luminaire suitability for the environment in which it will be installed
 - All (luminaire control) drivers shall be independently tested and shall display the ENEC European Safety Mark.

- Electrical Supply arrangements (including earthing, class I and class II (and class III where relevant))
 - Lamp colour
 - Colour rendering
 - Luminaire reflector/diffuser arrangements
 - Luminaire mounting arrangement (incorporating removable covers for maintenance where required)
- 2.3.2. Lighting design file that meets the design specification as provided by Varming Consulting Engineers Ltd. which include specifics concerning the following on the stated working plane.
- Power consumption (W/m²)
 - Illuminance (average, minimum and maximum)
 - Glare
 - Uniformity
 - Maintenance factors
 - D.L.O.R / U.L.O.R values
- 2.3.3. Lamps/luminaire availability (within the project timeline)
- 2.4. All (luminaire control) drivers shall be independently tested and shall display the ENEC European Safety Mark.
- 2.5. Contractor to confirm the ceiling type to be installed on the project prior to approval.
- 2.6. Contractor provide a working sample for review by Architect & Engineer prior to approval.

3. COMPLIANCE WITH STANDARDS:

3.1. GENERAL:

- 3.1.1. The luminaires and equipment offered shall comply with all relevant Irish and British Standards and Codes of Practice and in particular with the following insofar as they apply.

3.2. LUMINAIRES:

EN 13032-1	Light and lighting. Measurement and presentation of photometric data of lamps and luminaires. Measurement and file format
EN 13032-2	Light and Lighting- Measurement and Presentation of Photometric Data of Lamps and Luminaires- Part 2: Presentation of Data for Indoor and Outdoor Work Places
EN 60601-2-41	Medical electrical equipment - Part 2-41: Particular requirements for the basic safety and essential performance of surgical luminaires and luminaires for diagnosis
EN 60529	Degrees of Protection Provided by Enclosures (IP code)
EN 60598	Luminaires - Part 1: General requirements and tests
EN 60598-2-1	Fixed general purpose luminaires
EN 60598-2-3	Luminaires for road and street lighting
EN 60598-2-5	Floodlights
EN 60598-2-11	Aquarium luminaires
EN 60598-2-13	Ground recessed luminaires
EN 60598-2-18	Luminaires for swimming pools and similar applications
EN 60598-2-19	Air-handling luminaires (safety requirements)
EN 60598-2-21	Rope lights
EN 60598-2-22	Luminaires for emergency lighting
EN 60598-2-23	Extra low voltage lighting systems for filament lamps
EN 60598-2-24	Luminaires with limited surface temperatures
EN 60570	Electrical supply track systems for luminaires
EN 60598-2-25	Luminaires for use in clinical areas of hospitals and health care buildings
EN 60838-2-2	Miscellaneous lampholders - Part 2-2: Particular requirements - Connectors for LED-modules
EN 62031	LED modules for general lighting - Safety specifications
EN 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
EN 62471	Photo biological safety of lamps and lamp systems
EN 62560	Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specifications
EN 62612	Self-ballasted LED lamps for general lighting services with supply voltages > 50 V - Performance requirements
EN 62717	LED modules for general lighting - Performance requirements
EN 62722-1	Luminaires Performance- Part 1: General Requirements
EN 62722-2-1	Luminaire performance - Part 2-1: Particular requirements for LED luminaires

3.3. CONTROL UNITS, OTHER AUXILIARIES AND ACCESSORIES:

All drivers shall be independently tested and shall display the ENEC European Safety Mark.

EN 61000-3-2	Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
EN 61000-3-3	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
EN 61347-1	Lamp controlgear - Part 1: General and safety requirements
EN 61347-2-13	Lamp controlgear - Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules
EN 62384	DC or AC supplied electronic control gear for LED modules - Performance requirements
EN 61547	Equipment for general lighting purposes - EMC immunity requirements
EN 62386-101	Digital addressable lighting interface - Part 101: General requirements - System components
EN 62386-102	Digital addressable lighting interface - Part 102: General requirements – Control gear
EN 62386-207	Digital addressable lighting interface - Part 207: Particular requirements for control gear - LED modules (device type 6)

3.4. MISCELLANEOUS:

EN 55015	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
2006/42/EC	Machinery directive (Standard updated)
2014/35/EU	Low voltage directive (Standard updated)
2014/30/EU	Electromagnetic compatibility directive (Standard updated)
2002/95/EC	EC Directives on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

4. ELECTRICITY:

- 4.1. Unless otherwise indicated, all luminaires shall be suitable for use with a 1-phase 2-wire 230 volt 50 Hz earthed neutral system. The luminaires shall be designed to operate at all voltages encountered due to the fluctuations in nominal supply voltage, as stated by the Electricity Supply Board (+6 -10%).

5. ANCILLARY EQUIPMENT AND LAMPS:

- 5.1. Heat-resisting type lampholders shall be used with enclosed type luminaires, regardless of the lamp cap position, i.e. cap-up or cap-down.
- 5.2. Lampholders incorporated in weatherproof luminaires shall be of porcelain or brass.
- 5.3. Luminaires shall be supplied complete with lamps.
- 5.4. All internal wiring shall be carried out in "high temperature" flexible cables insulated with butyl silicone rubber (BS 6007) with copper conductors. The colour code shall be in accordance with I.S. 10101.
- 5.5. Lampholders for use with tubular fluorescent lamps shall be gripping type with skirt covering lamp cap and protecting earth clip, complying with IS EN 60061.
- 5.6. Tubular fluorescent lamps shall be "Warm White" type to BS EN 60081, tungsten filament lamps shall be coiled coil type complying with BS EN 60064.

6. LUMINAIRES - ALL TYPES:

- 6.1. All luminaires shall have an ingress protection (IP) rating as dictated in the lighting schedule and shall be tested in accordance with the standards outlined in this section.
- 6.2. All luminaires shall have an protection provided against external mechanical impacts (IK) rating as dictated in the lighting schedule and shall be tested in accordance with the standards outlined in this section.
- 6.3. All luminaires shall have a lamp lumen per circuit watt (LL/CW) as dictated in the lighting schedule, typical values as follows;
 - 6.3.1. 110 LL/CW minimum for toilets ,circulation areas, etc.
 - 6.3.2. 130 LL/CW minimum for offices ,administration areas, etc.
- 6.4. All luminaires shall have a unified glare rating (UGR) as dictated in the lighting schedule, typical values as follows;
 - 6.4.1. Technical drawing/paper based work UGR <16.
 - 6.4.2. Reading, writing, training, meetings, computer-based work UGR <19.
 - 6.4.3. Craft and light industries UGR <22.

- 6.4.4. Heavy industry UGR <25.
- 6.4.5. Railway platforms, foyers UGR <28.
- 6.5. All luminaires shall comply with relevant safety and environmental standards outlined in this section.
- 6.6. All luminaires and the associated control gear (i.e. the driver) are to comply with the EN 55015. The LED lighting and control gear should also comply with the relevant electromagnetic compatibility standards.
- 6.7. Luminaires shall have a colour temperature as dictated in the lighting schedule, typical values as follows;
 - 6.7.1. Domestic, communal living Warm 2000K
 - 6.7.2. Circulation areas, toilets, etc. Warm White 3000K
 - 6.7.3. Office, administration etc. Cool White 4000K
 - 6.7.4. Surgical theatres, etc. Daylight White 6000K
- 6.8. Luminaires shall have a colour rendering value as dictated in the lighting schedule, typical values as follows;
 - 6.8.1. Circulation areas, toilets, etc. >80Ra
 - 6.8.2. Food prep/display, surgical >90Ra
- 6.9. The minimum McAdam Ellipse value shall be 3 at a minimum. SDCM<3.
- 6.10. Luminaires shall have a Power Factor >0.9.
- 6.11. LED PCBs / modules shall be replaceable should a failure occur.
- 6.12. LED PCBs shall be protected with LED PROTECT (PLEDs), the failure of one LED shall not cause others in the group to extinguish. If there is a failure of a single LED other LEDs in close proximity shall brighten slightly to compensate.
- 6.13. All drivers shall be independently tested and shall display the ENEC European Safety Mark.
- 6.14. All luminaires shall have an approved type earth terminal (5 mm diameter stud) mounted on the gear tray adjacent to the mains terminal block which shall give effective earthing to the complete luminaire when connected to the system earth busbar.

- 6.15. Each luminaire shall be supplied and delivered as a complete unit including reflector/diffuser, mounting brackets and suspension kits where applicable.
- 6.16. Each luminaire shall be fully tested in accordance with the standards outlined in this section following assembly and shall be guaranteed for a minimum period of twelve months against faulty workmanship, materials and design. In such circumstances, the Contractor shall make good the defect either by repair or replacement and shall bear all associated costs including the cost of carriage on the return of the defective goods or parts and shall deliver any repaired goods to the site.
- 6.17. Full technical details of luminaires shall be made available at the time of submission of tender. The specialist supplier shall make one sample luminaire of each type available for inspection by the Engineer within one week of being requested to do so following submission of the tender.
- 6.18. The design of diffuser type luminaires shall ensure even flashing of the diffuser.
- 6.19. Recessed luminaires shall be supplied suitable for fixing to the ceiling grid and also with four standard conduit support outlets before ordering. Prior to providing a technical submittal the Contractor shall confirm the specific ceiling system being procured and installed by the Main Contractor and confirm the suitability of luminaires in conjunction with the ceiling system with the supplier.
- 6.20. Surface/suspended type luminaires shall have two standard conduit support outlets spaced at 600 mm centres, unless determined otherwise by the Contractor. Conduit boxes for suspended fluorescent type luminaires shall be provided with ball-and-socket covers spring-loaded with captive screws and earth link. Pendant conduits shall be 20 mm dia. 900 mm long and terminate in screwed dome covers affixed to the luminaire.
- 6.21. All luminaires shall be so designed that after installation, subsequent maintenance can be carried out from the underside of the luminaire following removal of the diffuser land/or coverplate.
- 6.22. Through-wiring facilities shall be available by means of knockout conduit entries in the ends of the gear housing or spine.
- 6.23. Diffusers shall be one piece, injection moulded, acrylic prismatic or opal type as specified. Polycarbonate diffusers shall be fitted in all plant areas and any areas likely to be subjected to vandalism. They shall be elastic light in weight and highly resistant to breakage. Each diffuser shall bear the manufacturer's catalogue number and trade mark or other means of positive identification.
- 6.24. Luminaires for general office and commercial use shall have a D.L.O.R. of at least 0.65.
- 6.25. The specialist supplier shall provide information to prove that luminance values shall not exceed 1000 cd/m² above 65° or 55° in special applications.

7. 4000K COLOURED NEUTRAL WHITE LIGHT LED SPECIFICATION:

- 7.1. Minimum 100 lumens per Circuit Watt
- 7.2. 50K hours lifetime and lumen depreciation of L80B50 minimum.
- 7.3. CRI>80. Colour Rendering should be 80 or above.
- 7.4. UGR<19. Glare to be less than 19
- 7.5. SDCM<3. The minimum McAdam Ellipse value is 3
- 7.6. This represents a value of 4000K +/- 75K so it can be as much as 4075K or as little as 3925K.

8. 3000K COLOURED WARM WHITE LIGHT LED SPECIFICATION:

- 8.1. Minimum 75 lumens per Circuit Watt.
- 8.2. 50K hours lifetime and lumen depreciation of L80B50 minimum target.
- 8.3. CRI>90. Colour Rendering should be 90 or above for warmer coloured light
- 8.4. UGR<19. Glare to be less than 19
- 8.5. SDCM<3. The minimum McAdam Ellipse value is 3.
- 8.6. This represents a value of 4000K +/- 75K so it can be as much as 4075K or as little as 3925K.

9. EMERGENCY LIGHTING:

- 9.1. As scheduled a number of the fluorescent luminaires shall be fitted with a self-contained, non-maintained battery and inverter pack to operate one lamp within the luminaire. The standards and characteristics of the emergency battery/inverter pack and the composite luminaire shall be as described in the Appendix attached to the rear of this Specification.

- 9.2. Where possible the emergency pack shall be mounted within the luminaire provided this can be achieved without detrimental effects to the luminaire or emergency pack and that the composite fitting can fit in the void. Where this is not possible the emergency pack shall be placed in a suitable enclosure and mounted to the body of the luminaire, or, in the case of very limited ceiling void (90 mm), adjacent to the luminaire with the appropriate connecting leads installed.
- 9.3. The specialist supplier of the composite luminaire will be required to assume complete responsibility for its compliance with the required standards and characteristics.

APPENDIX 5

EMERGENCY LUMINAIRES

1. GENERAL

- 1.1. The specified emergency luminaires must be utilised unless prior (written) agreement with the responsible engineer has been secured.
- 1.2. The party that is proposing a change to the specified emergency luminaires shall do so at entirely their own cost.
- 1.3. The pre-approval process is outlined below (Section 2).
- 1.4. **Notwithstanding the criteria detailed in Section 2, Varming Consulting Engineers Ltd. is under no obligation to agree to any proposed change(s).**

2. PRE-APPROVAL PROCESS

- 2.1. Emergency luminaires and equipment offered shall comply with all relevant Standards and Codes of Practice insofar as they apply.
- 2.2. Emergency luminaires shall be supplied complete with lamps.
- 2.3. The general criteria associated with a change to the specified emergency luminaires shall comprise of the following considerations.
 - 2.3.1. Emergency Luminaire data sheets
 - Conformance certificates from manufacturer within Europe or via an independent test-house (for a non-European jurisdiction)
 - Battery pack requirements (discharge duration, self-contained (integral), external/remote mounting requirements (if necessary))
 - Self-test communications requirements (if any)
 - Lamp efficacy
 - Luminaire power factor
 - Life span
 - Warranty on fittings
 - IP rating

- IK rating (mechanical impact)
- Luminaire suitability for the environment in which it will be installed
- All (luminaire control) drivers shall be independently tested and shall display the ENEC European Safety Mark.
- Electrical Supply arrangements (including earthing, class I and class II (and class III where relevant))
- Lamp colour
- Colour rendering
- Luminaire reflector/diffuser arrangements
- Luminaire mounting arrangement (incorporating removable covers for maintenance where required)

2.3.2. Emergency Lighting design file that meets the design specification as provided by Varming Consulting Engineers Ltd., which include specifics concerning the following on the stated working plane.

- Power consumption (W/m²)
- Illuminance (average, minimum and maximum)
- Glare
- Uniformity
- Maintenance factors
- D.L.O.R / U.L.O.R values

2.3.3. Lamps/luminaire availability (within the project timeline).

2.4. All (luminaire control) drivers shall be independently tested and shall display the ENEC European Safety Mark.

2.5. All batteries shall be manufactured the same year as the luminaire submittal is made.

3. COMPLIANCE WITH STANDARDS:

3.1. The luminaires shall comply with all relevant Irish and British Standards and Codes of Practice and in particular with the following:-

- I.S. 3217:2013, Code of Practise for Emergency Lighting
- BS. EN 1838:2013, Lighting Appliances - Emergency Lighting
- I.S. EN 13032-1:2004 / AI:2012 Light and Lighting - Measurement and Presentation of Photometric Data of Lamps and Luminaires. Part 1:Measurement and File Format

- I.S. EN 13032-2:2004 / A8:2007, Light and Lighting - Measurement and Presentation of Photometric Data of Lamps and Luminaires. Part 2: Presentation of Data for Indoor and Outdoor Work Places
- I.S. EN 50171:2001, Central Power Supply Systems
- I.S. EN 50172:2004, Emergency Escape Lighting Systems
- I.S. EN 60529:1993/A2:2013, Degrees of Protection Provided by Enclosures(IP Code)
- I.S. EN 60598-2-22:2014, Luminaires Part 2-22: Particular Requirements - Luminaires for Emergency Lighting
- I.S. EN 62034:2012, Automatic Test Systems for Battery Powered Emergency Escape Lighting
- 2006 / 42 / EU Machinery Directive
- 2014 / 35 / EU Low Voltage Directive
- 2014 / 30 / EU Electromagnetic Compatibility Directive

4. ELECTRICITY SUPPLY:

- 4.1. Unless otherwise indicated, all luminaires shall be suitable for use with a 1-phase 2-wire 230 volt 50 Hz earthed neutral system (+6 -10%).

5. DESIGN:

5.1. GENERAL:

- 5.1.1. The emergency luminaires shall be completely self-contained and suitable for operation of 230V 50Hz supply.
- 5.1.2. The batteries shall be fully-sealed nickel cadmium alkaline cells capable after 24-hours charge of 3-hour emergency duration of rated output.
- 5.1.3. Each luminaire shall comprise an automatic battery charger, mains failure relay, battery, mains healthy indicator and inverter.
- 5.1.4. All components shall be adequately rated and of rugged construction to ensure reliable and fast-switching to battery supply when a mains failure occurs and to ensure that the components or charge require no maintenance during the life of the luminaire.
- 5.1.5. All emergency luminaires shall be installed in rigidly - framed steel enclosures, suitable for wall and bracket-mounting and fitted with one 20 mm entry (unless otherwise stated).

- 5.1.5.1. Battery and inverter packs provided for mounting external to the luminaires they serve shall be supplied complete within metal enclosures, or fire resisting/self-extinguishing sleeving, depending on access space available for installation and maintenance.
- 5.1.5.2. Cables from the luminaire to the enclosure greater than 1m in length shall be rated to classification PH120 as defined by I.S EN 50200:2006.
- 5.1.6. Each luminaire shall have a 10A 2-way mains connection block and M4 brass earthing stud fitted internally local to the conduit entry to facilitate connection to the supply system.
- 5.1.7. All luminaires shall be fully tested and the guarantee period (12 months minimum, 4 years for batteries) shall be stated at the time of tender.
- 5.1.8. The luminaire manufacturer shall provide documentation to confirm that the particular lamp and inverter / battery pack unit are compatible and have been fully tested in combination and that they conform to the standards stated.
- 5.1.9. The following types of emergency luminaires shall be utilised:-
 - 5.1.9.1. Battery and inverter packs installed in luminaires to operate fluorescent lamps or LEDs.
 - 5.1.9.2. Self-contained maintained emergency exit luminaires using fluorescent lamps or LEDs.
 - 5.1.9.3. Tungsten halogen (50W max.) ELV lamps in luminaires.
 - 5.1.9.4. Self-contained tungsten halogen (20W) twinlight luminaire with sealed lead acid battery.
 - 5.1.9.5. Battery and inverter packs installed adjacent to luminaires to operate Tungsten, Tungsten halogen, LED or fluorescent luminaires.

5.2. WIRING

- 5.2.1. Each emergency lighting point shall be connected to the feed, neutral and switch wire of the local lighting circuit. The feeds shall be taken from the distribution board through normally closed contacts of relays operated by the central test unit and extended to each emergency point on that circuit. Wiring shall be as used for the normal sub-circuit.

5.3. BATTERIES

- 5.3.1. All batteries utilised in emergency light fittings shall be high temperature Sintered Plate Nickel-Cadmium (NiCD) or Nickel-Metal Hydride (NiMH), Secondary Cell type, Rechargeable.

- 5.3.2. All batteries shall be high temperature (55deg) and shall have the rated temperature indicated on the battery casing. All batteries shall be mounted within fittings and remote packs using battery holders to ensure that no part of the battery casing is in contact with the fitting or remote pack casing.
- 5.3.3. All battery packs used in emergency lighting luminaires shall be fully encapsulated and come complete with battery disconnect male/female connector(s) to aid isolation and service. All chargers and changeover controls shall be fully automatic and failsafe upon power failure or resumption of supply
- 5.3.4. Sealed Lead Acid (SLA) Batteries:
 - 5.3.4.1. All rechargeable Sealed Lead Acid (SLA) batteries used in emergency light fittings shall be maintenance free and of a sealed leak proof construction. All batteries shall be valve regulated to prevent excess build up of gas. Valves shall automatically reseal upon venting. All batteries shall be capable of operating in any orientation and meeting the required duration of 3 hours for emergency lighting at the end of five years of usage.
 - 5.3.4.2. The Operating Temperatures for SLA batteries used in emergency lighting shall be as follows:

Charge – 15°C to 50°C

Discharge – 20°C to 60°C

All batteries used in emergency lighting (NiCD, NiMH, SLA etc.) shall be dated with the date of installation
- 5.4. Light Emitting Diode (LED) Fittings – (Fittings Supplied By The Emergency Lighting Supplier Excluding Exit Signs)
 - 5.4.1. All LED's used, unless otherwise stated, shall be based on a full cone distribution of between 100 and 70 degrees.
 - 5.4.2. All LED fittings shall utilise LED's that provide the following minimum efficacy: **45 lumens/Watt – Usable into the Room.**
 - 5.4.3. All LED's shall be rated for operating at 25°C ambient room temperature and a Tc(max) 75°C.
 - 5.4.4. All LED's used, unless otherwise stated, shall be Warm or Neutral White.

5.5. LABELLING OF EMERGENCY LIGHTING FITTINGS

5.5.1. Each emergency light/luminaire and exit sign shall be labelled. The label shall be clearly visible from floor level so that a fitting can be clearly identified. The printed text on the label shall be as follows: **floor number / emergency luminaire number**.

5.5.1.1. e.g. **02 / 17** would indicate emergency luminaire number 17 on the second floor.

5.5.2. The electrical specialist shall supply upon completion of the project a logbook for the emergency lighting system for inclusion with the O&M manuals. The logbook shall contain a list of all emergency lighting luminaires for the project by location, label number and type, included also shall be A3 NTS drawings of the building showing the location of the as installed emergency luminaires complete with label numbers.

5.6. METALS AND PLASTICS

5.6.1. All metals and plastics utilised as part of the emergency lighting luminaires shall be suitable for the required purpose.

5.7. OVERLOAD AND SHORT CIRCUIT PROTECTION:

5.7.1. All emergency luminaires shall incorporate separate protection for each incoming supply line, to include the un-switched and switched supplies, integrally, within the luminaire by means of suitable fused terminal block(s) to aid safety, isolation and discrimination functions. All fused terminal blocks for the purpose of connection to the supply network shall be suitable sized for the connection in each terminal of at least 2 No. 1.5mm² cables or 1 No. 4.0mm² cable.

5.8. EXIT SIGNS

5.8.1. Decorative Blade Type: All exit signs of the decorative hanging blade variety which use top lit illumination shall have the running man, arrow and door symbols. The background colour of the blade shall be green and the running man, arrow and door symbols shall be white. All diffuser material either blade type or normal is to be made from polycarbonate.

5.8.2. All lamps operating whilst supplies are available shall be at a ballast of unity. No under-running of lamps is allowable by combination mains/emergency ballasts in normal operation.

5.8.3. Wiring within the exit sign shall not be loose or hanging and shall not be visible when the exit sign is illuminated.

5.9. INVERTER MODULES – ALL EMERGENCY LIGHTING LUMINAIRES

- 5.9.1. All inverter modules used in emergency lighting luminaires shall be fully encapsulated and provide for overload and short circuit protection via fused terminal block(s).
- 5.9.2. All inverter modules shall be continuously rated and suitable and/or specific to the emergency lamp in question. The BLF shall be clearly indicated for the specific lamp used. All invertors shall have reverse polarity protection to protect against damage to the inverter if batteries are connected incorrectly (i.e. reverse polarity).
- 5.9.3. All inverter modules used in emergency lighting luminaires shall be fully encapsulated by metal or plastic can such that no components or conductive surfaces at L.V. or higher tension are accessible upon removal of louver, diffuser and/or gear tray for preventive or remedial maintenance purposes. All chargers and changeover controls shall be fully automatic and failsafe upon power failure or resumption of supply.

5.10. DEEP DISCHARGE PROTECTION:

- 5.10.1. Protection shall be provided to prevent emergency duration longer than that for which the unit is designed with consequent reduction of battery life.

5.11. HIGH CHARGING CURRENT:

- 5.11.1. Protection shall be provided to prevent continuous high charging current with consequent gassing and loss of electrolyte.

6. TESTING AND INSPECTING

- 6.1. The Specialist Contractor shall include for the complete testing, pre-commissioning, commissioning, certification and handover of the emergency lighting system in accordance with I.S. 3217 (current edition).

APPENDIX 5A

BSRIA TECHNICAL NOTE TN21/97 DEFINITIONS

1. DRAWINGS:

The following suggested definitions may be used to clarify the design responsibilities incumbent on those required to produce each drawing or document. These definitions are supported by drawn examples included in TN22/97 "The Allocation of Design Responsibilities Example Drawings".

1.1. SKETCH DRAWINGS

- 1.1.1. Line diagrams and layout indicating basic proposals, location of main items of plant, routes of main pipes, air ducts and cable runs in such details as to illustrate the incorporation of the engineering services within the project as a whole.

1.2. SCHEMATIC DRAWINGS

- 1.2.1. A line diagram describing the interconnection of components in a complex system. The main features of a schematic drawing should be as follows:
 - 1.2.1.1. The drawing may be a two dimensional layout with divisions to show the distribution of the system between building levels. It may also be an isometric style layout indicating the distribution of systems across individual floor levels. The drawing would not necessarily be constructed to scale.
 - 1.2.1.2. The drawing should include all functional components which make up the system i.e. plant items, pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components.
 - 1.2.1.3. Symbols and line conventions should be in accordance with a recognised source of standard symbols, such as BS1199:Part3:1987 "Recommendations for symbols and other graphic conventions".
 - 1.2.1.4. The drawing should indicate components which have a sensing and control function and should indicate the links between them e.g. building management systems, fire alarms and HV controls.
 - 1.2.1.5. The drawing should be labelled with appropriate pipe, duct and cable sizes where these are not shown elsewhere.
 - 1.2.1.6. The major components indicated on the schematic drawing should be identified so that their whereabouts in specifications and on other drawings can be easily determined.

- 1.2.1.7. If required to form part of a **commissioning specification**, the drawing should include all data essential to testing and commissioning including volumetric flow rates, design total pressure losses at equipment, locations of dampers, valves and flow measuring stations, electrical faults, levels, current ratings, short circuits capacities and tripping times.

NB: Where a design consultant is appointed to produce a scheme design for completion by a design and build contractor, only the first three of these requirements are likely to be appropriate.

1.3. DETAILED DESIGN DRAWINGS

- 1.3.1. 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:
 - 1.3.1.1. Plan layouts should be to a scale of at least 1:100. Plant areas should be to a scale of 1:50 and should be accompanied by cross sections.
 - 1.3.1.2. The drawing will not include 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-ordination drawings** or **installation drawings** without major re-routing of the services.
 - 1.3.1.3. Main wireways should be represented by single line layouts, different containment types should be represented by differing line types. Symbols and line conventions should be in accordance with a recognised source of standard symbols such as BS1192:Part3:1987 'Recommendations for symbols and other graphic conventions'.
 - 1.3.1.4. The drawing should indicate the space available for major service routing in both horizontal and vertical planes.

1.4. CO-ORDINATION DRAWINGS

- 1.4.1. A drawing showing the inter-relationship of two or more engineering services and their relation to the structure and building fabric. The main features of a co-ordination drawing should be as follows:
 - 1.4.1.1. Plan layouts should be to a scale of at least 1:50 and accompanied by cross sections to a scale of at least 1:20 for all congested areas.
 - 1.4.1.2. The drawing should be spatially co-ordinated i.e., there should be no physical clashes between the system components when installed at the scaled-off positions shown on the drawing. In areas where tolerances are minimal, dimensions should be provided.

- 1.4.1.3. The spaces between pipe and duct runs shown on the drawing should make allowances for the service at its widest point. Insulation, standard fitting dimensions and joint widths should therefore have been allowed for on the drawing.
- 1.4.1.4. The drawing should be make allowance for those plant items specified by the designer and identified in the design specification.
- 1.4.1.5. The drawing should make allowances for installation working space and space to facilitate commissioning and maintenance.
- 1.4.1.6. The drawing should indicate positions of main fixing points and supports where they have significance to the structural design.
- 1.4.1.7. The services should be arranged in such a way that it is possible to demonstrate a feasible sequence of installation.
- 1.4.1.8. The drawing should be supported by "individual services drawings" where these are desirable for clarity.
- 1.4.1.9. Plant room layouts should be to a scale of at least 1:20 and be accompanied by cross sections and elevations to a scale of at least 1:20.

1.5. INSTALLATION DRAWINGS

- 1.5.1. A drawing based on the **detailed design drawing** or **co-ordination drawing** with the primary purpose of defining that information needed by the tradesmen on site to install the works

NB Where co-ordination drawings have not been prepared in advance, responsibility for spatial co-ordination should be allocated to the "lead" installing contractor who should be named in the tender documents. All installation requirements should then be produced taking into account the needs of co-ordination.

- 1.5.2. Main features of installation drawings should be as follows:

- 1.5.2.1. Plan layouts should be to a scale of at least 1:50 and should be accompanied by cross sections to a scale of at least 1:20 for all congested areas.
- 1.5.2.2. The drawing should be spatially co-ordinated, i.e. there should be no physical clashes between the system components when installed at the scaled-off positions shown on the drawing.
- 1.5.2.3. Allowances should be made for inclusion of all supports and fixings necessary to install the works.
- 1.5.2.4. The spaces between pipe and duct runs shown on the drawing should make allowance for the services at its widest point. Insulation, standard fitting dimensions and joint widths should therefore have been allowed for on the drawing.
- 1.5.2.5. The drawing should make allowances for installation details provided from *shop drawings*.

- 1.5.2.6. The drawing should make allowances for installation working spaces, space to facilitate commissioning and space to allow on-going operation and maintenance in accordance with the relevant health and safety requirements.
- 1.5.2.7. Allowances should be made for plant and equipment including those which are chosen as alternatives to the designer's specified option.
- 1.5.2.8. Dimensions should be provided where the positioning of the services is considered to be important enough not to leave to the tradesmen on site.
- 1.5.2.9. Plant room layouts should be to a scale at least 1:20 and be accompanied by cross sections and elevations to a scale of at least 1:20.

1.6. INSTALLATION WIRING DIAGRAM

- 1.6.1. Drawing showing the interconnection of electric components, panels etc. in accordance with the design intent indicated on the **schematic drawings** and incorporating the details provided on **manufacturer's certified drawings**.

1.7. SHOP DRAWINGS

- 1.7.1. Drawing prepared by a fabricator or supplier for a particular project, and which is unique to that project. examples include supplier's drawings for ductwork, pre-fabricated pipework, sprinkler systems, control and switchgear panels and associated internal wiring.

1.8. MANUFACTURER'S DRAWING

- 1.8.1. Drawing provided by a manufacturer or supplier to indicate a typical representation of the product, components or plant items to be supplied for a particular project.

1.9. MANUFACTURER'S CERTIFIED DRAWING

- 1.9.1. Drawing provided by a manufacturer or supplied to indicate details of the product, components or plant items and which the manufacturer or supplier guarantees the supplied equipment will comply with.

1.10. RECORD DRAWING

- 1.10.1. 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:
- 1.10.2. The drawings should provide a record of the locations of all the systems and components installed including pumps, fans, valves, strainers, terminals, electrical switchgear, distribution and components.
 - 1.10.2.1. The drawings should be to a scale not less than that of the installation drawings.
 - 1.10.2.2. The drawings should have marked on them positions of access points for operating and maintenance purposes.
 - 1.10.2.3. The drawings should not be dimensioned unless the inclusion of a dimension is considered necessary for location.

1.11. BUILDER'S WORK DRAWING

- 1.11.1. Design State Definition:
 - 1.11.1.1. A drawing to show the provisions required to accommodate the services which significantly affect the design of the building structure, fabric and external works. Most drawings (and schedules) of work to be carried out by building trade, and require to be costed at the design stage e.g. plant bases.
- 1.11.2. Installation stage definition:
 - 1.11.2.1. Drawing to show requirements for building works necessary to facilitate the installation of the engineering services (other than where it is appropriate to mark out on site).

1.12. SPECIALIST DRAWING

- 1.12.1. A generic term for those drawings which may be supplied by a specialist supplier or sub-contractor appointed to undertake design duties in relation to a specific aspect of the project.

1.13. TENDER DRAWING

- 1.13.1. Drawing produced for the purpose of obtaining competitive tenders. The tender drawings will comprise an agreed set of drawings to suit the complexity of the project, and which comply with the specific drawing definitions included in this section.

APPENDIX 6

UNINTERRUPTIBLE POWER SUPPLY UNITS (UPS)

1. GENERAL:

- 1.1. This specification covers the supply, delivery to site, off-loading and placing in position, assembly and installation, connection, testing and commissioning of all the equipment as indicated and all work necessary for the complete uninterruptible power supply units (UPS) as detailed hereafter.
- 1.2. The specialist supplier shall note that the UPS equipment and installation is intended for multi-vendor equipment largely single phase P.Cs and communications equipment.
- 1.3. UPS shall be on-line with maintenance bypass.

2. PROCEDURAL PROCESS:

- 2.1. The Contractor is provided with the following:
 - 2.1.1. Schematics and or Circuit schedules including loading
 - 2.1.2. An initial outline specification of the UPS requirements
- 2.2. The UPS manufacturer will provide a draft layout drawing including all relevant dimensions of the proposed UPS system and any amendments identified on the UPS specification sheet
- 2.3. The iterative draft processes outlined in sub section 2.1 and 2.2 are continued until agreement is achieved between the responsible engineer and the nominated UPS assembler.
- 2.4. Once formal written agreement is received by the assembler including the agreed panel layout drawing and final specification sheet, the UPS assembly/installation shall commence. It is only at this stage that an order is confirmed.
- 2.5. Installation criteria shall be agreed between the contractor, the UPS assembler and the responsible engineer prior to its installation. This shall include the following consideration in a formal written format.
 - 2.5.1. Glanding arrangements (types and positions)
 - 2.5.2. Termination arrangements (use of ferrules, bolts, lugs etc.)

- 2.5.3. Mounting arrangements.
- 2.5.4. Cable entries and routing within the panel.
- 2.5.5. Maintenance contract arrangements.
- 2.5.6. Routine testing regime.
- 2.5.7. Check list/instructions for auto/manual/test, start-up and shutdown procedures.
- 2.5.8. Operator Training
 - 2.5.8.1. The specialist supplier shall also include in his tender for providing clear instruction notices near the following points:
 - Remote Alarm Panel (if specified/supplied)
 - Power Distribution Panel
 - EPO Button
 - Manual By-pass

2.6. FACTORY ACCEPTANCE TESTING (FAT):

- 2.6.1. The agreed panel assembly is subject to passing a factory acceptance test (FAT) witnessed by the responsible engineer prior to its transportation to site. 2 weeks' notice will normally be required prior to panel assembly by the responsible engineer.
- 2.6.2. Dummy load shall be provided to demonstrate load tests at various loads, to be chosen by the Engineer. The dummy load, cables, etc. shall be provided by the Supplier.
- 2.6.3. Upon completion of suitable FAT and the provision of agreed relevant (per section 2.5), the UPS may be shipped to site.

2.7. SITE (UPS) TESTING:

- 2.7.1. Provide test certificates for the following:
 - 2.7.1.1. Operation of the UPS at fully rated load and measure battery voltage to ensure it does not drop below battery design voltage limit.
 - 2.7.1.2. Operation of the UPS within all power quality limits specified within the UPS specification sheet.
 - 2.7.1.3. Operation of controls and alarms as per UPS specification sheet.
 - 2.7.1.4. Demonstrate compliance with applicable Codes and Standards.

2.8. INFORMATION ON HAND OVER:

- 2.8.1. 2 copies of detailed general arrangement, single line and control wiring drawings. These drawings shall identify all components by manufacturer and type.
- 2.8.2. 4 Copies of "as-built" general arrangement, single line and control wiring drawings.
- 2.8.3. 4 copies of completed signed and witnessed test certificates.
- 2.8.4. 4 copies of list of spares and accessories supplied (if required).
- 2.8.5. 4 copies of short circuit test certificates from an independent test house if applicable or if custom built assembly.
- 2.8.6. 4 copies of design calculations verifying short circuit strength of assembly.
- 2.8.7. Any information required in this Specification and related documents and standards.
- 2.8.8. The specialist supplier shall provide a logbook for the UPS for recording all services, repairs and any unusual occurrence concerning the UPS equipment.
- 2.8.9. The specialist supplier shall provide a logbook identifying the typical maintenance requirements of the UPS system.

3. STANDARDS:

- 3.1. All items of equipment within the UPS assembly shall comply and conform to all current issues of the relevant standards.

4. MAINTENANCE CONTRACT:

- 4.1. The specialist supplier shall include and indicate separately, in addition to the 12 months guarantee, a 12-month preventative maintenance contract starting from date of written acceptance of the installation by the Employer. This shall comprise:
 - 4.1.1. A service call to carry out all preventative maintenance work recommended by the manufacturers every six months (a total of two calls).
 - 4.1.2. Breakdown "call-out" service for 12 months. Response time for call-out shall not exceed 60 minutes.

- 4.2. The specialist supplier shall include a standard form maintenance contract available to the Employer subsequent to the expiration of the guarantee period.
 - 4.2.1. The maintenance contracts specifics are to be noted and agree in the UPS specification sheet.

UNINTERRUPTIBLE POWER SUPPLY UNITS (UPS)

	Specification Required	Proposed by Assembler	Agreed (Varmings use only) (Yes/No)
Panel Details			
Rating	2.7kW		
No. Off.	2		
kVA (p.f. 0.8)	3kVA		
Volts	230		
Frequency	50		
Autonomy (Mins. Per battery string)	30		
System configuration	On-line		
Load Type	Communications Cabinets		
Enclosure Specifics			
Bolting to the floor (yes/no)	No		
Doors on panels (yes./no)	Yes		
Ventilation fans (yes/no)	Yes		
Free/standing or wall mounted	Rack Mounted		
Physical size (L x W x H)mm	450x380x87 (19"x380x2U) UPS 450x380x87 (19"x380x2U) Battery		
Separate battery Room (yes/no)	No		

APPENDIX 13

SCHEDULE OF LUMINAIRES, WIRING ACCESSOIRES & SUPPLIERS

for the

OPD REWIRE

at

ROSCOMMON UNIVERSITY HOSPITAL

NOTES:

1. Alternative products/ systems to the Benchmark products/systems may be proposed but must be accepted by Varming in writing before proceeding. For such alternative products, provide full technical literature to demonstrate that the alternative proposals are of a standard at least equal to that identified and demonstrate compatibility with the design intent. This schedule must be read in conjunction with the relevant part of the Specification.
2. In these specifications trade names and or suppliers are sometimes used for the purpose of brevity and clarity of technical, aesthetic, functional, maintainability, after sales service, energy and life cycle cost intent. Such references are for the conveniences of the tenderer in clearly indicating the standard of technical, aesthetic, functional, maintainability, after sales service, energy and life cycle cost requirements sought by the specifier. The intention is not to favour one product over another or to eliminate other products or suppliers.
3. Other materials / products may be put forward for consideration as equivalent materials / products to those stated in the specification once they meet the minimum criteria are set out within the tender documents and drawings.
4. Approval for substitution of equivalent materials / products shall be given where the alternative material / product are demonstrable by the electrical specialist contractor to be equal and in full accord with the original specification and drawings and once it is demonstrated that all substitution products have equivalent technical, aesthetic, functional, maintainability, after sales service, energy and life cycle costs.
5. Equivalence of an offered substitution shall be judged on the basis of objective, clear and verifiable criteria and independent proof of similar compliance with equal standards to those specified.
6. Where appropriate the electrical specialist contractor shall be required to issue verification by means of providing a detailed technical submittal, after sales commitment dossier, drawings, data sheets, energy and life cycle costs, test reports from a recognised body, samples of the material / product substitution to the client's representative and to the consulting Mechanical and Electrical Consulting Engineers. The electrical specialist shall implement an electronic system for managing and tracking all plant and equipment submittals. Any increased costs arising whatsoever from such any substitution in terms of redesign, time required for the employer's representative and consulting Mechanical and Electrical Engineers to review and evaluate substantial quantities or substantial detailed technical proposals for alternatives, rescheduling, health and safety issues etc. shall be borne by the Electrical Specialist Contractor.

7. Alternative suppliers / installers shall be required to prove their ability to perform their sub element part of the contract through the submission of proof of their technical and or professional capacity (education, experience, equipment, personnel etc.), including their ability to manage in an environmentally sound manner.
8. The contracting authority, through its architect who is the employer's representative in conjunction with the consulting Mechanical and Electrical engineers shall determine on a case by case basis, from a technical, aesthetic, functional, technical, aesthetic, functional, maintainability, after sales service, energy and life cycle cost perspective what constitutes an equal and equivalent standard / product. Verification shall take place only after the award of the contract, as part of the contract management regime. Sufficient time shall be allowed to check submissions and provide samples as indicated within the specification documents.
9. Fittings denoted by an E after the luminaire schedule symbol on the drawing are to be fitted with an addressable 3 hour emergency inverter pack for integration into the addressable emergency lighting system. All luminaire that require a 3 hour emergency back must be converted by the same supplier, such as Lighting Solutions, Ventilux, Profile, NEL, Em Com, PlusLite or equal and approved 3 hour emergency inverter pack.
10. The Contractor shall confirm all reference number correspond to the description of the items on this schedule.
11. The Contractor shall provide samples for all elements detailed herein.

INTERNAL LUMINAIRE SCHEDULE

REF	DESCRIPTION	IMAGE
A	Surface mounted fitting as manufactured by Fagerhult. 33291-553 AllFive Direct, Organic Response. Passive infrared sensor (PIR) with presence and daylight responsive control. All luminaires function as master/slave with IR communication. Detection type: Presence/Absence. Radio communication, protocol/frequency Wirepas/2.4 GHz. Radio communication, standard/security /AES-128 IP44. Opal Prism. Ra 80+ L80/B50 100K. Life expectancy of the LED 100,000 hours, when the light output has reduced to 80% of its initial level and when 50% of the LEDs have failed to meet operational expectations 4375 lm LL/CW 146 Luminaire lumens per circuit watt, the luminaire efficiency including ALL optical and gear losses.	
A1	Surface mounted fitting as manufactured by Fagerhult. 33290-553 AllFive Direct, Organic Response. Passive infrared sensor (PIR) with presence and daylight responsive control. All luminaires function as master/slave with IR communication. Detection type: Presence/Absence. Radio communication, protocol/frequency Wirepas/2.4 GHz. Radio communication, standard/security /AES-128 IP44. Opal Prism. Ra 80+ L80/B50 100K. Life expectancy of the LED 100,000 hours, when the light output has reduced to 80% of its initial level and when 50% of the LEDs have failed to meet operational expectations 3000 lm LL/CW 138 Luminaire lumens per circuit watt, the luminaire efficiency including ALL optical and gear losses.	

REF	DESCRIPTION	IMAGE
B	Surface mounted fitting as manufactured by Whitecroft. K4RPY4354KS Kolo Surface Direct, Organic Response. Passive infrared sensor (PIR) with presence and daylight responsive control. All luminaires function as master/slave with IR communication. Detection type: Presence/Absence. Radio communication, protocol/frequency Wirepas/2.4 GHz. Radio communication, standard/security /AES-128 IP44. Microprism louvre in acrylic. Ra 80+ L80/B50 100K. Life expectancy of the LED 100,000 hours, when the light output has reduced to 80% of its initial level and when 50% of the LEDs have failed to meet operational expectations 3549 lm LL/CW 128 Luminaire lumens per circuit watt, the luminaire efficiency including ALL optical and gear losses.	

LIGHTING CONTROL SCHEDULE

REF.	DESCRIPTION	
P	Surface mounted switch as manufactured by Fagerhult. 86416 EnOcean Battery-free EnOcean Push buttons, which communicate wirelessly, with the Organic Response nodes in the installation. The push button panels can be configured to check the selected zone, etc., all parameters are set using the Organic Response app for Android or iOS devices with NFC & iOS 13 or later.	

EMERGENCY LUMINAIRE SCHEDULE

REF.	DESCRIPTION	MANUFACTURER	
EA	IP65 surface mounted LED fitting as manufactured by Ventilux. Open Plan, 120 lm LED self-contained, non-maintained, self-test emergency ceiling mounted down lighter.	Ventilux: Radiance Open Plan Ref: RADNM3/L3W/WH/ST	
EXIT	Surface mounted LED Exit sign. IP40 single sided self-contained, maintained, emergency EXIT sign, complete with ISO 7010 single sided legend kit.	Ventilux: Atlantic SP Gen 2 Ref: ATSP2M3/LED/ST DIRECTIONAL PANELS TO BE AS PER EN7010	
ED	IP65 surface mounted LED fitting as manufactured by Ventilux. IP67 External wall mounted fitting, 1400 lm LED self-contained, non-maintained, self-test emergency bulkhead.	Ventilux: Radiance Open Plan Ref: ZSKNM3L10WIP67ST	

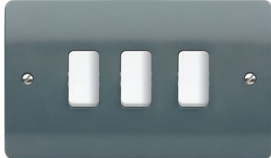
EXTERNAL LUMINAIRE SCHEDULE

REF.	DESCRIPTION	
D-D	Surface mounted IP66 fitting as manufactured by Whitecroft. ELMY74KW EUROFLOOD SL Direct, Organic Response. L90/B50 130K. Life expectancy of the LED 130,000 hours, when the light output has reduced to 90% of its initial level and when 50% of the LEDs have failed to meet operational expectations 32,576 lm LL/CW 133 Luminaire lumens per circuit watt, the luminaire efficiency including ALL optical and gear losses.	

POWER SUPPLY UNITS SCHEDULE

DESCRIPTION	MANUFACTURER	
ELECTROMAGNETIC DOOR SWING HOLD OPEN 24V, 2A, Monitored Linear DC Power Supplies for use in the Security, Fire and Associated Industries, compliant with EN 50131 Part 6	MT Range as manufactured by Power Plex	
FIRE DOOR HOLD OPEN 24V, 1A, Monitored Linear DC Power Supplies for use in the Security, Fire and Associated Industries, compliant with EN 50131 Part 6	MT Range as manufactured by Power Plex	

WIRING ACCESSORIES SCHEDULE

DESCRIPTION	MANUFACTURER	
Internal wiring accessories. Part M compliant products including socket outlets with outboard rockers with graphite coloured frontplates.	MK Logic Plus Part M Sockets shall be 2 gang double pole with outboard rockers, dual earth and neon indicators. Fuse Connection Units shall be double pole with neon indicators, outlet to be in the base with thick front plate. Euro Frontplates shall be graphite in colour with white inserts for data modules, TV modules, etc.	 
Switch Plates. Part M compliant. Bedrooms & Dayrooms	MK Grid Plus Part M Switches shall be adequately separated to allow selection of one at a time and avoid the unintended selection of adjacent switches. Switches shall be retractive and shall dim the lighting as required.	 

WIRING ACCESSORIES SCHEDULE DADO TRUNKING

Cat6 Compliant Dado Trunking	Marshall Tufflex Odyssey	
Cat6 Compliant Dado Trunking accessories. Flat Angles, Internal Bends (Adjustable where required), External Bends (Adjustable where required), Wiring Accessory Boxes, Couplers, End Caps, Flat Tees, Accessory Adapters	Marshall Tufflex Odyssey	

WIRING ACCESSORIES SCHEDULE PLANT AREAS

REF.	DESCRIPTION	MANUFACTURER	
1PH	IP67 rated lockable single phase isolator	ABB	
3PH	IP67 rated lockable three phase isolator	ABB	

All items are to be supplied complete with accessories and fixings as appropriate.

IT COMPONENT SCHEDULE

REF.	DESCRIPTION	MANUFACTURER	
	42U, Communications Cabinet 2070 mm (h), 600 mm (w), 600 mm (d). Colour: Black. Number of doors: 2. Front door material: Glass. Front door locking system: Single-point. Rear door material: Steel. Rear door locking system: Single-point. Profile spacing: 19 inch . Mounting Profile: Front and rear. Type of profile rail: L-shaped. Roof: 4 Way brush entry. Earthing studs included. Material: Steel. Type of surface: Powder coated	Environ CR600 as manufactured by Excel Networking. REF; 542-4266-GSBN-BK	
	To be supplied with proprietary horizontal cable management. 20 No per cab/rack	REF; 100-586	
	To be supplied with proprietary telescopic cabinet shelf (80kg capacity). 2 No per cab/rack.	REF; 542-029-GE	
	To be supplied with proprietary fixed 720mm cabinet shelf (80kg capacity). 1 No per cab/rack.	REF; 542-024-BK	
	To be supplied with 10 Way Vert PDU 10x UK Socket 16A IEC 60309 Plug Switched. 2 No per cab/rack. 1 No. Mains & 1 No. UPS.	REF; D16-10-EXL	

UPS EQUIPMENT SCHEDULE

REF.	DESCRIPTION	MANUFACTURER	
UPS	Rack mounted on-line 3kVA UPS, 30 minutes Autonomy. 1 No. per communications cabinet. INPUT: Rated power.3000 VA. Voltage220 / 230 / 240 Vac. Voltage tolerance 230 V $\pm$20%. Frequency 50 Hz / 60 Hz $\pm$5. Power factor >0.98. Current distortion $\leq$2% BY PASS: Voltage tolerance 180 / 264. (SMART ACTIVE Mode). Frequency tolerance $\pm$5% OUTPUT and INVERTER OUTPUT Rated power 3000 VA. Active power 2700 W. Crest factor (I_{peak}/I_{rms}) 3 : 1. Waveform Sinusoidal. Frequency 50 / 60 Hz selectable. Voltage distortion with non-linear load <3%. Voltage distortion with linear load <1%. BATTERIES Type VRLA AGM maintenance-free lead based. Typical recharge time 4-6 h. ENVIRONMENTAL Color Black RAL 9005. Communication USB / RS232 and contacts / slot for communication interface / REPO + Input contact. Accessories provided USB cable; handles kit. Protections Overcurrent - short circuit – overvoltage - undervoltage - temperature - excessive low battery. Noise (at 1 m) <48 [bBA] (ECO Mode). Operating temperature 0 °C - +40 °C. Relative humidity 5-95% non-condensing. Output sockets Terminal block + 2 IEC 320 C13 + 1 IEC 320 C19. Standards European directives: L V 2014/35/EU low voltage; EMC 2014/30/EU electromagnetic compatibility -- Standards: Safety IEC EN 62040-1; EMC IEC EN 62040-2; RoHS compliant -- Classification in accordance with IEC 62040-3 VFI - SS - 111	Sentinel as manufactured by Riello. Ref: SDU4000	