JV TIERNEY & CO
MECHANICAL ELECTRICAL & SUSTAINABLE ENGINEERS



ELECTRICAL SERVICES - SPECIFICATION

CCT-JVT-PH1-XX-XX-SP-E-0001

TIPPERARY COURTHOUSE & BRIDEWELL
PHASE 2

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TIPPERARY COURTHOUSE & BRIDEWELL
PHASE 2

CCT-JVT-PH2-XX-XX-ST-E-0001
ELECTRICAL SERVICES SPECIFICATION

ELECTRICAL SERVICES TENDER DOCUMENTS	
CCT-JVT-PH2-XX-XX-SP-E-0001	**Electrical Services - Specification**
CCT-JVT-PH2-XX-XX-SH-E-0001	Electrical Services - Luminaire Schedule
CCT-JVT-PH2-XX-XX-PS-E-0001	Electrical Services - Pricing Schedule

Description	Date	Prepared By:	Reviewed by:
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1 Introduction

This document is the Electrical Services Specification detailing the requirements for the proposed Clonmel Courthouse refurbishment at Tipperary.

1.1 Project Team

PROJECT/SITE	Electrical Services Installation Tipperary Courthouse &Bridewell
CLIENT	Tipperary County Council Civic Offices Rosanna Road Tipperary E34 WD51
SERVICES ENGINEERS	J.V Tierney & Co., Consulting Engineers, The Tannery, 53-56 Cork Street, Dublin 8
PROJECT ARCHITECTS	OC+C architects, 16 Merrion Row Dublin 2 D02 CF90

2 General

2.1 General Requirements

2.1.1 The Electrical Contractor shall obtain a copy of the Main Contract Preliminary Clauses and include all costs necessary associated with the Main Contract Preliminary Clauses within their Tender Submission. – No further monies shall be forthcoming for any errors or omissions due to the failure of the Electrical Contractor to not have included for any costs associated with their clauses.

2.2 Introduction and Interpretation

2.2.1 The Electrical Contractor shall supply, install, test and commission the Electrical Installations as detailed on the Tender Drawings and within this Specification, employing skilled Personnel and Specialist Contractors as necessary to achieve the Standards described.

2.2.2 If a conflict of information occurs between any Contract Documents then the onus shall be with the Electrical Contractor to confer and clarify the conflicts during the tendering process.

2.2.3 Where an Item is included in the Specification but not shown on the Drawings, it shall be included in the Works and deemed to be included in the Contract Price.

2.2.4 Where an item is shown on the Drawings but not included in the Specification, it shall be included in the Works and deemed to be included in the Contract Price.

2.2.5 The Architectural Room Layouts (Room Data Sheets) shall be available to the Electrical Contractor for setting out of Services within Rooms. It shall be noted that the onus shall be on the Electrical Contractor to review all Architectural Room Layouts and Mechanical and Electrical Services Layout Drawings, Schematics and Specifications, and highlight in a timely manner, any items where clarification is required.

2.2.6 In all cases, the Mechanical and Electrical Specifications and Drawings shall take precedence with regards to quantities of Equipment, Outlets etc.

2.2.7 The Architectural Room Layouts (Room Data Sheets) shall take precedence in relation to setting out of services. (It should be noted that Mechanical and Electrical Outlets that are shown on the Services Drawings, located in ceiling voids, shall not appear on Architectural Room Layouts).

2.2.8 All Queries relating to Room Layouts and setting out dimensions must be issued to the Project Architect at least 6 weeks in advance of the proposed installation date.

2.3 Definitions

2.3.1 **Contractor** – Where this term is used within the Specification it shall be taken as the Electrical Contractor.

2.3.2 **Mechanical Contractor** – Where this term is used within the Specification it shall be taken as the Contractor completing the Mechanical Installation Works as detailed in this Specification and associated Drawings etc. Depending upon the type of Contract the term Mechanical Contractor shall equally refer to the Mechanical Sub-Contractor or Building Services Sub-Contractor.

2.3.3 **Electrical Contractor** – Where this term is used within the Specification it shall be taken as the Contractor completing the Electrical Installation Works as detailed in this Specification and associated Drawing etc. Depending upon the type of Contract the term Electrical Contractor shall equally refer to the Electrical Sub-Contractor or Building Services Sub-Contractor.

2.3.4 **Specialist** – Refers to a Specialist Contractor employed by the Building Services Contractor, Mechanical Contractor or the Electrical Contractor to complete a part of the Works on their behalf, the Building Services Contractor, Mechanical Contractor or the Electrical Contractor shall be fully responsible for all Works undertaken by the Specialist.

2.3.5 **Services Contractor** – Where this term is used it shall refer equally to the Mechanical Contractor and Electrical Contractor completing the Mechanical and/or Electrical Installation Works as detailed in this Specification and associated Drawings etc. Depending upon the type of Contract the term Services Contractor shall equally refer to the Building Services Sub-Contractor, Mechanical Contractor and Electrical Contractor.

2.3.6 **Main Contractor** – Where this term is used within the Specification it shall be taken as the Contractor completing the overall Contract for the Client as detailed in the Main Contract Specification and associated Drawings etc. Depending upon the type of Contract this shall equally refer to the Builder, Principle Contractor or the Mechanical or Electrical Contractor if they are the Main Contractor for the Project.

2.3.7 **Engineer** – Refers to a representative of J.V Tierney & Co.

2.3.8 Unless the clauses in this Specification stipulate “supply only” or “installation only” the words “Supply”, “Provide” or “Install”, shall mean “Supply and Installation”.

2.3.9 **Manufacturer’s Recommendations -** shall mean the Handling, Storage, Preparation, Installation, Testing and Commissioning of Products in accordance with Manufacturer’s printed or written recommendations/instructions. The Contractor shall inform the Engineer if these instructions conflict with any other specified requirement.

2.4 General Codes & Standards Applicable

CODES & STANDARDS	
Current Building Regulations	**Relevant EN, IS, and BS Codes and Standards.**
5th Edition National Rules for Electrical Installations, IS 10101: 2020.	**Health and Safety at Work Act**
COSHH Regulations Electricity at Work Regulations	**HSA Regulations Electricity at Work Regulations**
ErP (Energy-related products)/EuP (Energy using Products) Directive 2018 efficiency requirements.	**All Equipment shall conform to the Specification of the SEAI Triple E Register Performance Criteria as a minimum.**

2.4.1 All Works described shall comply with:-

i. Safety, Health and Welfare at Work Act, 2015.
ii. Safety, Health and Welfare at Work (Construction) Regulations 2013.
iii. Local Authority/County Council By-laws.
iv. Fire Office direction or recommendations.
v. National Building Regulations – Technical Guidance Documents Particular reference is made to Part B and Part M.
vi. 5th Edition National Rules for Electrical Installations, IS 10101: 2020.
vii. I.S.3217:2023 Emergency lighting standard (.
viii. I.S.3218:2013 Fire detection and alarm standard (latest edition and addendums).
ix. I.S.EN 62305 Protection against Lightning.
x. The ESB Requirements.
xi. British Standards (where referenced in this document and in Fire Safety Report).
xii. BS9999: Code of practice for fire safety in the design, management and use of buildings.
xiii. BS8519: 2020 Selection and installation of fire-resistant power and control cable system for life safety and fire-fighting applications.
xiv. CIBESE Guides, Codes and Technical Memoranda.
xv. Factories Act/Statutory Instruments.
xvi. Project Safety Protocol.
xvii. Project Specifications.
xviii. Project Drawings.
xix. Contract Preliminaries.
xx. Materials and Workmanship Clauses.
xxi. All relevant Irish, British and European Standards and Codes of Practice.

2.4.2 The Electrical Contractor shall familiarise themselves with the above and the obligations therein.

2.4.3 Any Standard, Guide, Technical Memorandum, Application Manual, Code, Handbook, Publication, European Directive, National Rule, Statutory Requirement referenced in this Specification Document for compliance purposes shall be deemed to be the latest version of the Document including any associated annexes, amendments, addenda & corrigenda published on or before the issue date of this Specification Document.

2.4.4 The Standards listed shall not be regarded as an exhaustive list.

2.4.5 All Standards referred to within the Specification shall apply where relevant.

2.4.6 Where the Electrical Contractor or their Specialists feel there is a conflict between the specified Standards and or the requirements of the Specification, they shall notify the Engineers in writing and seek clarification on the matter.

2.5 Tender Clarifications

2.5.1 If the Electrical Contractor tendering for this Project is in any doubt as to the intent detailed within the Works Requirements and the Scope of Works involved in the successful Project completion they shall submit clarifications in the appropriate manner within the timeframes outlined in the Contract. If no clarifications are sought during this process then it is deemed the Electrical Contractor is fully aware of the works involved in completing the Project.

2.6 Tender Submission

2.6.1 The Tender Submission shall comprise the following documents in a sealed envelope, labelled as explained in the covering tender e-mail/letter.

- Covering Letter;
- Site Specific Methodology and Programme for the Works;
- Portfolio of Previous Experience on Similar Projects;
- Proposed Project Management Team;
- Proposed Specialists;
- CV of proposed Contracts Manager;
- Schedule of Rates.

2.6.2 If the Electrical Contractor fails to present any of the information listed above it will mandatorily invalidate their Tender.

2.7 Omissions Made Post Tender Submission

2.7.1 No compensation for loss of profit or otherwise shall be allowed to the Contractor for omissions made to the Contract after Tenders are received. The Client reserves the right to omit any portion of the work and any claim for loss of profits due to such omissions shall not be entertained.

2.8 Scope of Contract

2.8.1 The Electrical Contractor is to provide all Materials and Labour necessary, except any as are specially excluded by the Specification, for the proposed Electrical Services Installation.

2.8.2 The Contract Price shall cover the Supply, Installation, Erection, Testing and Maintenance of the Installation as outlined hereafter and as shown on the Drawings which shall be taken as forming part of the Specification.

2.8.3 The Electrical Contractor shall include all Labour, Materials, Import Charges and Transport which may be required for and in the construction of the Works detailed in the Specification and Drawings and for the use of all necessary scaffolding, ladders, plant, tackles, machinery, tools and other appliances for the work persons together with the carriage thereof to the spot where they are required to be used and their subsequent removal.

2.9 Tax Clearance

2.9.1 It is a condition of a Contract Award that the successful Tenderer shall, for the term of such Contract, comply with all EU and Domestic Tax Laws. Prior to the award of a Contract, the Successful Tenderer is required to provide their Tax Clearance Certificate in addition to providing its Tax Clearance Access Number and Tax Reference Number to facilitate online verification of its tax status by the Client. By supplying these numbers the successful Tenderer acknowledges and agrees that the Client has the permission of the successful Tenderer to verify its tax cleared position online. Failure to provide evidence of tax cleared status will mandatorily invalidate the Tender.

2.10 Maintainability

2.10.1 The Electrical Contractor shall demonstrate that all Plant and Equipment incorporated into the Works can be safely accessed and maintained in compliance with Health and Safety Legislation and can also be safely removed for replacement.

2.10.2 All new Installations shall comply with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020 M&E Spatial Requirements. All Electrical Plant shall be installed in compliance with the Maintenance Requirements as set out in CIBSE Guide M 2008.

2.11 Technical Submittals

2.11.1 The Electrical Contactor shall issue detailed Technical Submittals for all items of Plant and Systems prior to commencing installation work on Site. The Technical Submittals shall be accompanied by a letter from the Contractor confirming the proposed Submittal is in full compliance with the Specifications and Drawings (Contract Documents). The Design Team will endeavour to assist with the Technical Submittal Process; however the sole responsibility of complying with the Contract Documents shall be with the Electrical Contractor.

2.11.2 If in any instance it is found that an item of Plant or Equipment has been installed that is not in compliance with the Contract Documents, the Electrical Contractor shall be required to rectify/replace the item of Plant and or Equipment in question at no expense to the Client.

2.11.3 The Electrical Contactor must provide Technical Submissions for all Systems and Equipment that are proposed for comment (Status A, B, C) by the Engineer. These shall be presented a minimum of **eight weeks** in advance of the respective Equipment, Services being required for services co-ordination purposes.

2.11.4 These Submissions shall cover all aspects of the Works. Details of Specialist Installations should be included in the Tender Submission Documents. The purpose of the Submissions is to allow the Electrical Contractor to demonstrate compliance with the Works Requirements.

2.11.5 A review of the Submissions by the Engineer does not constitute any approval of the Systems and Equipment being proposed. It is the responsibility of the Electrical Contractor to comply in full with the Works Requirements and whether Submissions are reviewed, or not, or commented on, or not, does not relieve the Electrical Contractor of their responsibility to comply with the Works Requirements. Where Items or Installations are subsequently found at any stage to be not in compliance with the Works Requirements, the Electrical Contractor shall rectify the Works at their own expense.

2.11.6 In addition to the above, the Submissions shall be provided in a timely manner to suit the Programme of Works. A maximum of two Technical Submissions shall be presented in any one working week to allow review by the Engineer. The Electrical Contractor is required to submit a Programme in their Tender Submission of when each Technical Submittal shall be presented for review by the Engineers. The Engineers shall endeavour to comment on each Technical Submission within 10 working days of receipt of the Submissions; however failure to present this Programme in the Tender Submission or to adhere to the Programme may result in delays in any comments presented by the Engineers. The Engineers shall not be held responsible for any delays in the Contractor's Works due to late receipt/untimely issue of Technical Submissions for review.

2.11.7 The Submissions shall be structured to the respective Systems within the Building. The Electrical Contractor shall provide Samples for all required Submissions to the agreement of the Engineers. The cost for such provision of Samples shall be included in the Electrical Contractor's Tender/Costings at Tender Stage.

2.11.8 The below is a non-exhaustive list of separate Submissions required to be presented:-

- LV Sub-Distribution Board;
- Each component of the Switchgear e.g. Circuit Breakers, Meters, Surge Protection, Sheet Steel etc.
- Containment;
- Cables;
- Systems Control Cables;
- General Services Accessories;
- Lighting Installations;
- Emergency Lighting;
- Lighting Presence/Daylight/Absence Sensors;
- ICT Installation;
- Fire Detection and Alarm System;
- Intruder Alarm System;

- Camera Surveillance System;
- Commissioning Programme;
- Co-ordinated Services Drawings;
- Builders Works Drawings.

2.12 Freedom of Information Act 2014

2.12.1 As a result of the Freedom of Information Act 2014, and subsequent Amendments, Public Bodies will not be able to give guarantees of confidentiality which have previously featured in Public Procurement.

2.12.2 Information in relation to this Tender may be made available on demand in accordance with the Freedom of Information Act 2014.

2.12.3 The Electrical Contractor is asked to consider if any of the information supplied by you in this (Tender) should not be disclosed because of its sensitivity. If this is the case, you should, when providing information, identify the same and specify the reasons for its sensitivity. The Client will consult with you about sensitive information before making a decision on any Freedom of Information request received.

2.12.4 If you consider none of the information supplied by you is sensitive, please make a statement to that effect. Such information may be released in response to a Freedom of Information request.

2.13 Copyright

2.13.1 The ownership of copyright in all Drawings, Reports, Specifications, Bill of Quantities and other Documents provided by the Engineers in connection with the Works shall remain vested in the Engineer, but the Client shall have license to copy and use such Drawings, Reports, Specifications, Bills of Quantities and other Documents for any purpose related to the construction, letting or maintenance of or extension to the Works, provided that the Engineer has been fully remunerated in accordance with The Institution of Engineers of Ireland, Conditions of Engagement, Agreement ME 2020. Notwithstanding the aforesaid, the Client shall not make copies of such Drawings or other Documents nor shall they use the same in connection with any other Works without prior written approval of the Engineers and upon such terms as may be agreed between the Client and Engineers'.

2.14 Compliance with EU Directives and Regulations

2.14.1 The Electrical Contractor shall ensure that all Equipment supplied on the Project shall comply with the Machinery Directive (2006/42/EC), the Low Voltage Directive (2014/35/EU), the Electro Magnetic Compatibility Directive (2014/30/EU) and all other Directives as outlined in the National Standards Authority of Ireland's Information Sheet entitled "New Approach Directives & CE Marking".

2.1.2 Where required under these Directives, all Machinery and Equipment installed by the Electrical Contractor shall carry the CE Marking which shall comply in every detail with the EU Directives as outlined above.

2.14.2 Equipment supplied to Site not carrying the relevant CE Marking shall be removed by the Electrical Contractor and replaced with properly marked equipment, at no additional cost to the Client.

2.15 Waste Electrical & Electronic Equipment

2.15.1 The Electrical Contractor shall ensure that the supply, delivery and installation of Electrical Equipment installed under the Contract with EU Waste Electrical and Electronic Equipment (WEEE) Regulations.

2.15.2 Equipment shall only be purchased from Suppliers complying with Regulations, and Suppliers' Names and Addresses are required to be furnished with the Record Documents to ensure that the Client can comply with the Regulations by returning Equipment for recycling to the Supplier at a later date.

2.15.3 All WEEE charges should be included in the priced items in the Summary of Tender.

2.16 Sub-System Completion Certificate

2.16.1 Where the Electrical Contractor employs or has an Electrical Sub-System under their control, they shall provide RECI/ECSSA Sub-System Completion Certificates prior to the connection of the System to the Electrical Mains, which shall warrant that the Electrical Fixed Wiring Content of the Works has been carried out and has been installed and tested in accordance with 5th Edition National Rules for Electrical Installations, IS 10101: 2020. The RECI Sub-System Certificate must comply with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

2.16.2 The Project Supervisor (Construction Process) shall be the recipient of the Electrical Sub-System Certificate which shall be retained in the Project Safety File.

2.17 Design Intent Drawings

2.17.1 The Design Intent Drawings issued are provided to show primary routes, design intent, component order etc. They shall not be used as Working or Fabrication Drawings.

2.17.2 Dimensions shown on the Drawings forming part of the Contract are believed to be correct, but no responsibility for same is accepted. The Electrical Contractor must satisfy themselves as to their correctness. The markings on the Drawings showing the positions of points, outlets, etc. must not be taken as absolute but only as a general guide to the positions where they shall be erected.

2.17.3 The Electrical Contractor shall be solely responsible for the setting out of the Works and shall rectify any errors made either in setting out the Work or during its progress.

2.17.4 The Electrical Contractor shall develop the Design Intent Drawings in order to provide a complete set of Working and Fabrication Drawings for the Installation Works. The Drawings and Installed Systems shall:-

- Include all Fittings etc. in order to comply with this Specification;

- Be based upon measured Site Dimensions;
- Include minimum spacing as specified;
- Be fully co-ordinated as detailed elsewhere in this Specification.

2.17.5 The Electrical Contractor shall keep a record of all alterations, variations, additions and extras to the Installation as the work proceeds and shall hand over to the Engineers four copies of "AS INSTALLED" Drawings showing the correct layout of the Installation at the time of handing over.

2.18 Builders Work/Drawings

2.18.1 All Builders Work, cutting of opes, site trenching etc. shall be carried out by the Main Contractor. The Electrical Contractor shall, however, be cognisant when planning of services runs, etc. to keep the amount of cutting away and making good to a minimum and shall exercise extreme care to avoid damage to the Building and its Contents during the course of the Contract.

2.18.2 The Electrical Contractor shall also be responsible for producing accurate Builder's Work Drawings for all Services. These shall be handed over to the Builder within four weeks of commencement of contract, together with a copy to the Engineers.

2.19 Co-Ordination of Services

2.19.1 All Drawings and Sections shall be jointly produced by the Electrical and Mechanical Contractors. The Drawings shall be issued to the Architects and the Consulting Engineers for approval prior to commencement of Work in any section of the Installation.

2.19.2 The Mechanical and Electrical Contractors shall jointly produce fully Co-Ordinated Working Drawings for the entire Installation. These Drawings shall be produced on a phased basis to co-ordinate with the Main Contractor's Programme. The Mechanical Contractor shall act as lead co-ordinator in the co-ordination process and in the production of the finalised Co-Ordination Drawings. The co-ordination process shall also include the co-ordination of the complete Mechanical and Electrical Services. The Lead Co-Ordinator shall be responsible for setting up and conducting Co-Ordination Meetings to co-ordinate the Electrical, Mechanical and Builder's Services.

2.19.3 The Co-Ordinated Drawings shall include detailed plan layouts and detail cross sectional drawings of all Services including invert levels of all Services. Separate Co-Ordinated Drawings shall be produced for each Floor of the Building in the Project.

2.19.4 The Drawings shall be issued to the Architects and the Consulting Engineers for approval prior to commencement of Work in any Section of the Installation.

2.19.5 The Mechanical Contractor shall be responsible for issuing Co-Ordinated Mechanical and Electrical Layouts to the Design Team and Main Contractor.

2.19.6 The Electrical Contractor shall employ full time on site person as a competent M&E Services Co-Ordinator.

2.20 Fire Protection

2.20.1 During the course of the Contract, the Electrical Contractor shall ensure that the proper fire precautions are taken and their Operatives shall be provided with a fire blanket and extinguisher at all Stages of the Works.

2.21 Quality

2.21.1 The whole of the Works under this Contract shall be of the best quality material and workmanship and shall be completed to the entire satisfaction of the Engineers.

2.21.2 All Materials used in this Contract shall be new, of finest quality, purchased from reputable Manufacturers.

2.21.3 All Works carried out under this Contract shall be in accordance with good practice and finest quality workmanship.

2.21.4 All Items of Equipment and Components installed under this Contract shall be installed in strict accordance with the Manufacturer's Recommendations which shall form part of this Specification.

2.21.5 For Items of Equipment supplied under this Contract by others, the Electrical Contractor shall pass on the Manufacturer's Installation instructions and recommendations to the Installer and also ensure that these are understood and complied with.

2.21.6 Any Item of Equipment or Component supplied or installed under this Contract which is not of a standard or quality consistent with good practice shall, at the request of the Owner, be replaced at no additional cost to the Client.

2.22 Installation Guidelines & Quality Control

2.22.1 The Electrical Contractor must provide Installation Guidelines and As-Built Documentation for all Equipment to be installed, on an on-going basis throughout the duration of the Contract. It will not be accepted for Installation Guidelines to be produced only at the end of construction.

2.22.2 The Electrical Contractor is responsible for carrying out internal quality control checks, ensuring all Systems and Equipment are installed in line with the Manufactures Requirements prior to inspections on Site by the Design Team/Client.

2.23 Workmanship

2.23.1 The entire work shall be carried out by competent tradesmen and Trades Union Labour shall be employed throughout the Contract. Workmanship must be of the highest class.

2.24 Energy Related Products

2.24.1 The Electrical Contractor shall note that all Electrical Equipment supplied shall comply with the latest EU ErP Directive.

2.24.2 All Electric Motors and Light Fittings supplied under the Contract shall conform to the latest EU ErP (Energy related Products)/EuP (Energy using Products) Directive 2017 efficiency requirements and to the latest EU ErP (Energy related Products)/EuP (Energy using Products) Directive 2018 efficiency requirements.

2.24.3 All Luminaires installed shall meet the base criteria of the SEAI ACA program, Sustainable Energy Authority of Ireland Accelerated Capital Allowance Program/Triple E.

2.25 Tests on Completion

2.25.1 When the work has been completed the Electrical Contractor must carry out such tests and provide such apparatus, instruments and materials as the Engineers may consider necessary and as may be reasonably demanded to prove compliance with the Contract.

2.26 Record Drawings & Manuals

2.26.1 On completion of the Contract, the Electrical Contractor shall hand over to the PSDP three sets of completed Drawings of the System as installed for record purpose, two in hard copy and one in soft, together with two copies of Operating Manuals and Maintenance Instructions, again two in hard copy and one in soft copy format.

2.26.2 The Electrical Contractor shall also refer to the EIR Document for further details on the PDMS/Digital Safety File System which is also to be provided.

2.26.3 The Electrical Contractor shall include for the provision of all As-Built Drawings, As-Installed Plant/Equipment Information in digital format in line with the PDMS/Digital Safety File System Specification.

2.26.4 The Drawings and Manuals shall be bound in durable covers and shall include:-

1 **Clear instructions for correct Operation of the System.**

The Electrical Contractor shall allow in this Tender for instructing a nominated person on the Staff of the Client or an Agent thereof in the operation of the entire Plant. These instructions shall be typed out and bound together and handed over to the Engineers for approval.

2 **Names and Address of Suppliers of components for which Spare Parts may be required.**

3 **Testing and Commissioning records including Statutory Test Certificate.**

When the Work has been completed the Electrical Contractor must carry out such tests and provide such Apparatus, Instruments and Materials as the Engineers may consider necessary and as may be reasonably demanded to prove compliance with the Contract.

2.26.5 One copy of the Documents shall be submitted to the Engineers for review and comment at least two weeks before Substantial Completion, and two complete sets (incorporating the Engineer's comments) shall be submitted to the Client within 2 weeks of Substantial Completion.

2.26.6 It is to be understood that the Substantial Completion Certificate cannot be issued without the Record Drawings and Manuals being accepted by the Design Team.

2.27 Client Demonstrations

2.27.1 The Electrical Contractor shall allow in their Tender to demonstrate the operations of the entire Electrical Services Installation of Plant and Systems included within this Document to Tipperary Courthouse & Bridewell Maintenance Team.

2.27.2 These demonstrations shall be video recorded onto DVD together with a typed-out and bound Systems Operation Maintenance Document and handed over to the Engineers for approval. The Demonstrations will take place on a daily basis only after the Systems are fully commissioned.

2.27.3 The Electrical Contractor shall allow 1 man week of Controls and site Technician's time for comprehensive Hand-Over Demonstrations to the Engineer and Tipperary Courthouse & Bridewell Maintenance Team.

2.27.4 The Electrical Contractor shall allow in this Tender to instruct Tipperary Courthouse & Bridewell Staff in the operation of the entire Plant and Installations. This shall include a full plant demonstration from the Electrical Contractor and their Specialists. These Instructions shall be typed out and bound together and handed over to the Engineers for approval.

2.27.5 The Electrical Contractor shall include for a full programme of Client Training in accordance with the requirements herein.

2.27.6 The Electrical Contractor shall allow for operating the completed Works under full working conditions and for instructing Tipperary Courthouse & Bridewell Representative in the correct and most efficient operation of the Works.

2.27.7 The Electrical Contractor shall be expected to demonstrate a working understanding of the Installed Systems to a level that can be conveyed to the Tipperary Courthouse & Bridewell Maintenance Team, enabling them to operate the Electrical Systems and Installations to their full potential with confidence.

2.27.8 The Electrical Contractor shall include for a simple DVD recording to be made of the Contractor's formal handover talks including the training and demonstration of the Electrical Services and handed over to Tipperary Courthouse & Bridewell together with a fully completed and signed Completion Record Sheet. The intention is that this shall act as a future aid memoir for the Tipperary Courthouse & Bridewell Maintenance Team. This shall form part of the Safety File and shall be added to the online Safety File in the Maintenance Section.

2.28 Proprietary Product or Manufacturer's Name

2.28.1 Where a Proprietary Product Name or Manufacturer's Name is listed and or referenced within this Specification, the words "or equivalent" will be deemed to be included and it will serve as a benchmark for quality & standard for that product. Hence, an equivalent Manufacturer's Product (i.e. meeting the Specification in all respects) is acceptable (without prior approval) and that the onus is on the Electrical Contractor to ensure that the Product meets the standard required. Such output requirements might include a requirement for a test or Agreement Certificate or Insurance backed guarantee or other means of proof of compliance to the Engineer's satisfaction.

2.28.2 The Electrical Contractor shall also be aware that naming a specific product is not prohibited as part of implementing the European Union (Award of Public Authority Contracts) Regulations 2016 and EU Directive 2014/24/EU and SI No.329/2006 Communities (Award of Public Authorities Contracts) 2006, where 'justified' by the subject matter of the Contract.

2.28.3 In these Specifications trade names and/or Suppliers are occasionally used for the purpose of brevity and clarity of technical, aesthetic and functional intent.

2.28.4 Such references are for the convenience of the Tenderer in clearly indicating the standard of technical, aesthetic and functional requirements sought by the Specifier. The intention is not to favour one product over another or to eliminate other Products/Suppliers from consideration.

2.28.5 Other Materials/Suppliers may be put forward for consideration as equivalent Materials/Suppliers to those stated in the Specification.

2.28.6 Comments on substitution of equivalent Materials/Suppliers will be given where the alternative Material/Supplier are demonstrable equal in full accord with the Specification.

2.28.7 Equivalence of an offered Substitution will be judged on the basis of objective, clear and independent proof of compliance with equal Standards to those specified.

2.28.8 Where appropriate verification is provided through a detailed technical dossier, drawings, data sheets and/or a test report from a Recognised Body, a Material/Product Substitution will be permitted by the Architect/Engineer who is the Tipperary Courthouse & Bridewell Representative. Any increased costs arising whatsoever from such a substitution in terms of redesign, rescheduling, health and safety issues, etc., shall be borne by the Electrical Contractor.

2.28.9 The evaluation of substitute Materials/Products will include an assessment of their environmental characteristics.

2.28.10 Alternative Suppliers/Installers will need to prove their ability to perform their sub-element part of the Main Contract through the submission of proof of their technical and/or professional capacity (education, experience, equipment, etc.); including their ability to manage in an environmentally sound manner such as OHAS or other certified Environmental Management Systems or details of such measures taken in previous contracts.

2.28.11 The Contracting Authority through its Architect/Engineer, who is the Client Representative, will evaluate on a case-by-case basis, from a technical, aesthetic, and functional perspective, what constitutes an equivalent Standard and or Product. Evaluation will take place only after the Award of the Contract, as part of the Contract Management Regime.

2.28.12 Where the specified Product satisfies the criteria for enhanced capital allowances and hence is published within the Energy Technology Product List, the alternative Product must do likewise.

2.29 Damage to Installation or Building

2.29.1 The whole of the Works shall be under the Contractor's sole charge until the date of the Engineer's Certificate of Completion and notwithstanding any payment which may have been made on account, the Contractor shall make good all damages which may be caused by fire, tempest or from any cause whatever to the works included in this Contract and shall make good all damages which may arise to the Building or its contents as a consequence of the erection of the Works.

2.29.2 The Client shall be indemnified by the Contractor and held harmless from all costs, damages and expenses of any and every kind whatever which may be incurred by the Client by reasons of any injury to property or person in connection with the execution of the Works.

2.30 Practical Completion Certificate

2.30.1 A Certificate of Practical Completion shall be issued by the Engineer following completion of the following Works:-

- Handover and Demonstration of Systems/Installations to the Client;
- Handover of O&M Manuals and Safety File to the Client.

2.31 Defects Liability

2.31.1 The Defects Liability Period shall be 12 months from the date of certified Practical Completion as described above i.e. one year from the date on which the Installation was completed by the Electrical Contractor to the satisfaction of the Engineers and handed over to the Client.

2.31.2 Any defects or faults which appear before the expiration of the Defects Liability Period which are, in the opinion of the Engineers, due to materials or workmanship not in accordance with the Contract, shall within a reasonable time after receipt of the Engineers written instruction be made good by the Electrical Contractor at their own cost.

2.31.3 The Electrical Contractor shall be responsible for rectifying, any faults which occur in the Installation resulting from faulty Workmanship or Material or failure of the Electrical Contractor to observe the requirements of this Specification or the instruction of the Manufacturer or the Engineer.

2.31.4 In the event of the Electrical Contractor refusing to rectify defects within a reasonable period, the Engineers will have the work done by others and any charges arising shall be at the expense of the Electrical Contractor.

2.31.5 The Client shall be entirely responsible for the normal Maintenance and Running Cost of the Electrical Installations during and after the Defects Liability Period.

2.32 Insurances

2.32.1 The Electrical Contractor shall include for all necessary insurances, including Employers Liability, Public Liability, Third Party, Workman's Compensation, and Contractors All Risks, and all other Statutory Requirements applicable. Refer to the Main Contract Preliminaries for minimum insurance levels required.

2.33 Guarantee Bond

2.33.1 The Electrical Contractor shall be requested to obtain a Guarantee Bond to cover 10% of the value of the Contract Work. The Electrical Contractor shall enter into a Bond with an approved Insurance Company. The Electrical Contractor shall include in the Summary of the Tender the cost of obtaining such Bond.

2.34 Site Cleanliness

2.34.1 The Electrical Contractor shall allow for cleaning up and carting away all their own rubbish as it accumulates during the progress of the Works, including that of their Sub-Contractors/Specialists, and on completion, they shall clear up and cart away all superfluous materials, clean down external faces of Buildings affected by the Works, scrub paving's and floors, clean out gullies and gutters etc., clean glass inside and out, remove all spots, splashes, and stains and leave the Works and all parts of the Premises affected by them clean and in good order to the entire satisfaction of the Contract Administrator. At the end of each working day, all their own rubbish shall be cleared away. The Electrical Contractor shall ensure that all rubbish, waste and offcuts etc. are cleared away in accordance with the Main Contractor's Waste Management Plan.

2.35 Health & Safety

2.35.1 The Electrical Contractor shall fully comply with the Safety, Health and Welfare at Work (Construction) Regulations 2013.

2.36 Brexit

2.36.1 CE Marking/Declaration of Performance and relevant Product-related Documentation are to be appropriate to demonstrate and ensure compliance with the Building Regulations.

2.36.2 UK 'Notified Bodies' (those registered in Great Britain or Northern Ireland) will lost their legal status as EU 'Notified Bodies' from the date the UK left the EU. Construction Products relying on certification from a UK 'Notified Body' may not be placed on the EU Market from the date the UK left the EU. The Electrical Contractor shall include for all requirements to ensure only EU certified CE Marked Products and Systems are used on the Project for the duration of the Construction Period.

2.36.3 The Electrical Contractor is required to confirm full detail of the Notified Body responsible for testing each CE Marked Product forming part of a Submittal. Contractors are required to source all products from EU-27 Certified Manufacturers/Testing Bodies.

2.36.4 A Brexit Management Plan by the Electrical Contractor is required to be submitted prior to starting on Site – noting the following:-

- Management Plan for recording and tracking Names, Contact Details and validity for each CE Marked Product being used on the Project;
- Actions required where Products have lost accreditation during the course of the Construction Works to ensure full certification on completion of the Project;
- All requirements to ensure compliance are deemed to be included as part of the Works Requirements.

2.36.5 The Electrical Contractor is required to comply with the requirements of any negotiated Brexit Agreement between the UK and the EU in relation to compliance with Product and Material Standards.

2.36.6 The Electrical Contractor shall include in this Tender all costs associated with compliance in the event of no deal or managed Brexit Agreement.

2.37 Building Control (Amendment) Regulations 2014

2.37.1 A Works Inspection Plan shall be applied to this Project, in accordance with S.I. No.9 of 2014 and the Electrical Contractor shall include for all costs associated with Electrical Contractor/Sub-Contractor duties required under same. If in any instance it is found that an item of Plant or Equipment has been installed that is not in compliance with the agreed Installation Methodology and/or Specification, the Electrical Contractor shall be required to remove/rectify/replace the Installation/Equipment/Plant in question at no expense to the Client.

3 General Conditions of Contract

3.1 Basis of Contract

3.1.1 The particulars of the Contract are detailed in the Main Contract Specification, to which the Electrical Contractor shall refer prior to submitting their Tender.

3.2 Examination of Site

3.2.1 Electrical Contractors tendering are strongly advised to inspect the Site before completing their Tender in order to acquaint themselves with the local conditions including access to the Site, the conditions that may affect labour and to ascertain the exact amount of Work involved in the installation of new Electrical Services, interconnections and alterations required to existing Electrical Systems under the proposed Works.

3.2.2 The Electrical Contractor may visit the Site at any time, however, they must liaise with Tipperary Courthouse & Bridewell Facilities to organise access.

3.2.3 Should the Electrical Contractor identify any details during their Inspection that conflict with the data they shall bring this to the attention of the Main Contractor in writing before their Tender is submitted.

3.2.4 The Electrical Contractor shall visit site during the Tender Period and shall have satisfied themselves of the following:-

1) Local Conditions;

2) Nature and accessibility of the Site;

3) The Nature and Extent of the Operations;

4) The supply of and conditions affecting labour;

5) Storage Space for Materials;

6) Position of Underground Services and Drains;

7) Space available for the execution of the Works generally.

3.2.5 The Electrical Contractor shall include in this Tender for all costs necessary to take account of the above and arrange for their delivery of Materials so that no congestion occurs and shall include for all additional handling and transporting due to site conditions.

3.2.6 No claim shall be allowed in the settlement of the account in respect of the aforementioned items, neither will the lack of knowledge or ignorance of conditions be accepted as justifying such a claim.

3.2.7 An Infection Control Risk Assessment shall be provided by the Electrical Contractor prior to carrying out the works on Site.

3.3 Limitations on Working Hours and Working Space

3.3.1 Construction Working Hours deemed to be between 8.00am and 6.00pm Monday to Friday.

3.3.2 Saturday Working Hours deemed to be between 8.00am and 1.00pm. No Works are authorised to be completed on Sundays.

3.3.3 "Noisy" Works and all other operations likely to cause undue disturbance to Building Occupiers and other Building Users are to be undertaken outside of normal working hours upon the instructions of the Engineer or Client's Representative at no extra cost to the Contract.

3.3.4 All Works outside of the Tipperary Courthouse & Bridewell shall be included for "Out of Hours".

3.4 Programme for Completion of Works

3.4.1 Refer to The Main Contract Preliminaries.

3.4.2 The Electrical Contractor shall prepare and submit a Master Programme clearly showing their proposed sequence and timing of the Works. The Programme should include procurement, construction test and commissioning and handover with all key elements identified with a clear critical path.

3.4.3 The Programme shall be produced as bar charts, two copies of which shall be given to the Main Contractor. Actual progress achieved shall be reviewed and measured against this Programme at each Site Meeting. It shall be updated on a weekly basis by the Electrical Contractor and issued to the Main Contractor.

3.5 Project Description

3.5.1 The Works shall consist generally comprise of the following, and as indicated on the Drawings:-

- Complete supply, installation and commissioning of communication hardwired cable link between Phase 1 and Phase 2.
- Complete supply, installation and commissioning of Intruder alarm hardwired cable link between Phase 1 and Phase 2.
- Complete supply, installation and commissioning of fire alarm hardwired cable link between Phase 1 and Phase 2.
- All associated works required for the electrical strip out of the existing building on the as outline in the pricing schedule.
- Complete Cable Containment System, including LV Tray, LV Cable Trunking, Extra Low Voltage Cabling Tray and Fire Alarm Cable Tray & Conduits;
- Complete supply, installation and commissioning of all new general and emergency lighting;

- Complete supply, installation, and commissioning of all new general services.
- Complete supply, installation, and commissioning of all new Cat 6A ICT Infrastructure including Structured and backbone Cabling.
- Complete supply, installation, and commissioning of all new Fire & Occupant Warning Systems.
- Complete supply, installation, and commissioning of all new Access Control System.
- Complete supply, installation, and commissioning of all new Intruder Alarm System.
- Complete supply, installation, and commissioning of all Mechanical Power Supplies and provisions for Plant & Equipment.
- Complete supply, installation, and commissioning of all Mechanical BMS Power Supplies and control wiring.
- Complete **design**, supply, installation, and commissioning of all new Lightning Protection System.
- Complete **design**, supply, installation, and commissioning of all electrical containment & associated bracketry.
- Complete testing, commissioning & handover of all electrical, lighting, and sub-systems including witness testing for the complete installation
- Testing, Commissioning, Handover and Client Demonstrations;
- Complete Online Safety File Production and Co-Ordination with the Main Contractor.

3.5.2 This list is not exhaustive and is provided to give a general understanding of the Works only.

3.5.3 Please refer to Main Contractor's Specification for a full description of the overall Works.

3.6 Schedule of Electrical Tender Drawings

Drawing No.	Drawing Title.
CCT-JVT-PH2-BW-ZZ-DR-EE-6100	ELECTRICAL SERVICES - DISTRIBUTION SERVICES - GROUND & FIRST FLOOR - BRIDEWELL
CCT-JVT-PH2-BW-ZZ-DR-EE-6200	ELECTRICAL SERVICES - GENERAL SERVICES - GROUND & FIRST FLOOR - BRIDEWELL
CCT-JVT-PH2-BW-ZZ-DR-EE-6300	ELECTRICAL SERVICES - GENERAL & EMERGENCY LIGHTING - GROUND FLOOR & FIRST FLOOR - BRIDEWELL
CCT-JVT-PH2-BW-ZZ-DR-EE-6500	ELECTRICAL SERVICES - MECHANICAL WIRING SERVICES - GROUND & FIRST LEVEL- BRIDEWELL
CCT-JVT-PH2-BW-ZZ-DR-EE-6700	ELECTRICAL SERVICES - SECURITY SYSTEM GROUND & FIRST FLOOR- BRIDEWELL
CCT-JVT-PH2-BW-ZZ-DR-EE-6800	ELECTRICAL SERVICES - FIRE & OCCUPANT WARNING SERVICES GROUND & FIRST FLOOR- BRIDEWELL
CCT-JVT-PH2-XX-R0-DR-EE-6800	ELECTRICAL SERVICES - LIGHTNING PROTECTION & EARTHING ROOF PLAN - COUTHOUSE & BRIDEWELL

3.7 Commissioning

3.7.1 The Electrical Contractor shall be responsible for commissioning the entire Electrical Services for the installation to the satisfaction of the Engineers and the Tipperary Courthouse & Bridewell Maintenance Team. The Electrical Contractor shall produce for the approval of the Engineers a detailed specification for Commissioning Procedures for the completed installation. This Specification shall be provided well in advance of the Commissioning Programme and at a time agreed with the Main Contractor.

3.7.2 The Commissioning Procedures Specification shall include the following:-

(a) Detailed Operating Programme;

(b) Bar Chart showing weekly analysis of Programme;

(c) Data to be used for each stage of Commissioning;

(d) Detailed Commissioning Schedules for each item of Plant and Equipment;

(e) Requirements and involvement of Engineers;

(f) Method of logging all performance data with processing and issuing to the Engineers and Client;

(g) Method of issuing Certificates including Suppliers Certificates;

(h) Instruments and Method of Measurement to be used in Commissioning;

(i) Instructing Staff in the use of Plant and Systems.

3.7.3 The Electrical Contractor shall co-ordinate with the Mechanical Contractor in arranging a seminar to present and explain the commissioning methods and programme they propose for the Installation. They shall also arrange for all Specialist Suppliers/Installers involved in the Electrical Installation to be in attendance to outline their own commissioning procedures.

3.7.4 The Electrical Contractor shall include for the complete testing and commissioning of all sections of the Electrical Services Installation prior to the Date of Practical/Substantial Handover. Prior to this date the Electrical Contractor shall also ensure that all Test and Commissioning Certificates and As-Installed Drawings and Manuals are handed over to the Engineers.

3.8 Seasonal Commissioning

3.8.1 Seasonal Commissioning constitutes the validation of Building Performance under full-load operating conditions during peak heating and peak cooling seasons, as well as part-load conditions in the Spring and Autumn. During the 12 months after handover, the Building shall be seasonally commissioned as part of this Contract. The Energy Metering System shall be included in this Performance Validation Exercise with regard to the Building's Energy Management and Electrical Loadings and see if any adjustments can be made.

3.8.2 The Electrical/Specialist Contractor/Installer shall be responsible for executing seasonal commissioning work. This will include the provision of appropriately qualified personnel and all necessary Equipment and Materials. It will also include the organisation of all input required from Plant and Equipment Suppliers and Sub-Contractors.

3.8.3 Any performance deficiencies found during seasonal commissioning works shall be corrected.

3.8.4 All seasonal commissioning work shall be carried out in accordance with an approved commissioning method statement, manufacturers' guidelines and the day-to-day operational requirements of the people using the Building.

3.8.5 All seasonal commissioning works shall be fully recorded by the Electrical/Specialist Contractor/Installer. A Commissioning Manager shall review and approve the Works and include the results in the Commissioning Report for the Project.

3.8.6 Following seasonal commissioning works, the Electrical/Specialist Contractor/Installer shall be responsible for making any required changes to Building Documentation, such as As-Built Drawings and/or O&M Manuals.

3.8.7 The Client will advise suitable working periods to fit in with their business operations and make facilities management or maintenance staff available to assist with plant operation/switching, shut-downs, access arrangements, etc.

3.8.8 It may also be necessary for certain tasks to be carried out when the Building is heavily or, conversely, lightly populated. The Client will advise the Commissioning Team when these conditions occur, allowing adequate time for arranging witnessing by third parties, labour, materials, etc.

3.8.9 As the Seasonal Commissioning activities are an extension of the Works under the original construction contract, they shall be carried out by the same organisation or team.

3.8.10 Seasonal Commissioning works shall be fully recorded, signed off by the Commissioning Team Representative and retained in the Building Documentation.

3.8.11 As the Building may be occupied during seasonal commissioning activities, all health and safety requirements shall be complied with, and any commissioning works shall be in accordance with the necessary statutory and good practice requirements.

3.8.12 In addition to the Seasonal Commissioning described above, the Electrical Contractor is required to carry out the full maintenance of all Electrical Plant during the Defects Liability Period.

3.9 Building Control (Amendment) Regulations 2014

3.9.1 A Works Inspection Plan shall be applied to this Project, in accordance with S.I. No.9 of 2014 and the Electrical Contractor shall include for all costs associated with the Contractor/Sub-Contractor duties required under same.

3.9.2 If in any instance it is found that an item of Plant or Equipment has been installed that is not in compliance with the agreed installation methodology and/or Specification, the Electrical Contractor shall be required to remove/rectify/replace the Installation/Equipment/Plant in question at no expense to the Client.

3.9.3 All Works shall be carried out to the new Building Control (Amendment) Regulations [BC(A)R], S.I. 9 of 2014, and therefore the Electrical Contractor shall allow for the following over the subsequent stages of the Contract:-

COMMENCEMENT STAGE

- Familiarise themselves with the Drawings, Specifications and Documents lodged with the Commencement Notice;
- Ensure a competent person is assigned to oversee the Construction Works.

DURING CONSTRUCTION

- Install the Services and construct the Building in accordance with the Plans and Specifications;
- Ensure that the Workmanship complies with the requirements of the Building Regulations;
- Ensure that Materials which they select and for which they are responsible comply with the requirements of the Building Regulations;
- Co-operate with the Design Team, the Assigned Certifier and other Certifiers;
- Co-operate with the Assigned Certifier for the implementation of the Site Inspection Plan, and co-operate with any other Client Inspections;
- Address all items raised by the Designers in the Site Inspection Reports in a timely manner. Issue updates to the Site Inspection Reports to confirm: - status of all items raised; actions taken to address issues; advise when items are complete for review; provide photographic evidence of actions complete.

UPON COMPLETION

- Sign the Certificate of Compliance (Completion);
- Provide to the Assigned Certifier, such Documents for which they are responsible, as may assist the Assigned Certifier to collate particulars for the purposes of handover and certification, and/or for further submissions to the Building Control Authority;
- Ensure the co-ordination and provision of all test certificates and confirmations to the satisfaction of the Assigned Certifier or other designated Inspectors or Certifiers providing Ancillary Certificates;
- Maintain Records.

PHOTOGRAPHIC EVIDENCE

3.9.4 The Electrical Contractor shall allow for photographing the Electrical Installation on a bi-weekly basis for records. These photographs shall be detailed in a weekly report, which highlights what works were carried out and shall include photographic evidence of that work. These Reports shall be submitted to the Building Contractor on a bi-weekly basis for inclusion in the Progress Report. These Reports shall be signed and witnessed by the Building Contractor.

3.9.5 At the end of the Project, the Electrical Contractor shall include a copy of these Reports in the Operation and Maintenance Manual.

3.9.6 The Electrical Contractor shall allow for submitting photographic evidence on the following over the course of the Project:-

- All Electrical Services above the ceiling including all cabling and associated containment and support installations;
- All Electrical Services below Ground Level including any underground cables/ducting installed. Evidence to be taken and approved before filling in Ground;
- All Electrical Services to be included in voids, walls, building fabric, etc. Evidence to be taken and approved before services are covered;
- Photographic evidence of all fire collar installations;
- Any other Works deemed necessary.

3.10 Metering

3.10.1 All Energy Metering installed shall comply with the Measuring Instruments Directive 2014/32/EU including the OPW Metering Specification.

3.10.2 This complete Metering Installation shall be fully networkable to the on-site BMS System for view and recording etc. and capable of pulse outputs for remote monitoring by the OPW. The quantity of meters shall be as indicated on the Drawings.

3.10.3 Meters shall comply with the current EU Regulations on Energy Performance of Buildings and shall be capable of cumulative recording of power usage statistics in the Building. The central control unit shall be capable of preparing power usage reports on weekly, monthly and annual basis.

4 Design

4.1 Design Philosophy

4.1.1 The design philosophy is to provide engineering solutions for the mechanical and electrical services engineering installations, which ensure the various spaces are adequately serviced in line with specific client requirements, CIBSE guidelines, building regulations, best practise, National and European standards, and to provide an ease of maintenance and simplicity in operation.

4.1.2 There is an equal commitment in providing design solutions to reduce the overall energy consumption of the building. Energy efficient design will be incorporated as part of the mechanical and electrical engineering services installations.

4.1.3 The mechanical and electrical engineering services shall be fully integrated with the architectural and structural design and layouts, and other specialist installations.

5 Electrical Site Services (Element 60)

5.1 Extent of Works

5.1.1 The works shall consist of the supply, installation, testing, commissioning and maintenance of the following main site services;

- The Electrical contractor shall be responsible for liaison and co-ordination, with the ESB for completion of all works. The Electrical Contractor shall be responsible for ensuring that all ESB Works are scheduled and complete to allow commissioning of the Building including all electrical services and to ensure that the Building can be handed over in accordance with the Main Contract Programme.

- The Electrical Contractor shall schedule a meeting with the ESB before ordering of Switchgear Equipment or commencement of works to discuss the entire installations proposed.

- The Electrical Contractor shall note the requirement for Client selection of Customer Agreement Connection to an Electricity Vendor and shall advise of connection programme to ensure that such agreements are in place as required to ensure power on dates are achieved.

- Site electrical services distribution including the main power supplies from the main Site LV (low-voltage) switchboard and Site services mini-pillars to sub-distribution boards

- A new fibre Broadband and Telecoms Virgin Media infrastructure is to be provided to the new comms room.

- The Electrical Contractor shall be responsible for ensuring that all Telecoms Works (fibre optic cable links and multicore telephone, cable links) are scheduled and complete to allow commissioning of the Building.

- Complete installation for external site lighting.

5.2 Underground Services

5.2.1 The Contractor shall provide separate underground service ducts to accommodate each of the following:

- Incoming electrical supply

- Incoming telecommunications and broadband supplies

- Low Voltage (LV) services

- Control cabling services

- Extra Low Voltage (ELV) services

- Fire alarm services

- Spare ducts with draw-ropes for future service connections

- Any other ducts/services as indicated on the Site services drawing.

5.2.2 All underground electrical services cables shall be within ducts. All ducts for containment of electrical services cables shall be high-impact uPVC and red in colour except in the case of communications where grey shall be used. Ducts for Eir, Virgin and other utility bodies shall be in accordance with specifications provided by such bodies. Easy-sweep bends and draw-in chambers shall be utilized on all duct runs to enable ease of drawing in of cables. Suitable pre- formed duct bends that meet the requirements of the cable manufacturer for bending radii shall be used at ends of duct routes where cables rise out of the ground.

5.2.3 Ducts for respective services shall be buried to depths below finished ground level in accordance with IS10101 and in accordance with the specific requirements of the various utility providers. Yellow warning tape with a black legend shall be provided for duct identification along the duration of all duct routes. In the case of ESB Networks, supplementary heavy-duty marker tapes shall also be used along each ducting route as outlined in ESB Networks specification documents. It shall be ensured that ducting routes shall reside outside the zones identified for future extensions to the buildings. In the case of utilities, the ducting specification, marker tape, burial depths, etc. shall meet the requirements of the respective utility bodies.

5.3 Cables in Ducts

5.3.1 The Main Contractor shall provide any required trenches, underground cable ducts and manholes/inspection chambers for the External Electrical Services in accordance with the Specification.

5.3.2 Underground Cables installed externally shall be laid direct through ducts.

5.3.3 When cables are laid in ducts, the trenches shall be back-filled within twenty-four hours. Safety precautions shall be taken at all times and arrangements made to prevent damage to the cables.

5.3.4 The Main Contractor shall carry out a Survey of the trench route. Establish the location, if any, of any underground service.

5.3.5 All excavation shall be kept free of water and properly shored up.

5.3.6 Cables shall generally be installed in ducts. Ducts shall be of a size suitable for the cables, the minimum size of bore shall be 100mm or twice the diameter of the cable, whichever is the larger. All cable ducts in the same position shall be same size.

5.3.7 All External Cables in trenches shall be installed in twin walled high-density polyethylene pipes at a depth of 600mm minimum below the finished ground level.

5.3.8 Where services cross, the minimum clearance shall be 50mm.

5.3.9 Fine sand shall be spread in the excavations to form an underlay for the cable ducts. The sand shall be not less than 50mm deep.

5.3.10 All pipe ducts shall be colour coded to IS 370: 2016 and the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

5.3.11 Entries into buildings shall be by ducts with easy bends terminating flush with the finished floor level at an agreed position in the Building. Care shall be taken when drawing in cables to ensure that undue stress or strain is not placed on the cable.

5.3.12 Each Cable Duct run shall be marked at the point where it leaves the Building or other current controlling device and shall be marked at approximately every 12m along the cable run with an additional marker at each change of direction of the cable run.

5.3.13 Identification Disks shall be provided for cables entering the Building.

5.3.14 Where underground pipe work enters the Building the radius of the pipe bend shall be of the "Slow" type not exceeding the minimum-bending radius of the cable.

5.3.15 Where underground cables enter the Building below the water table of the surrounding ground a 'puddle flange' shall be built into the Structure by the Main Contractor for each cable. All 'puddle flanges' shall be cast iron with drilled flange for the attachment of backing and sealing glands.

5.3.16 All underground pipe work terminating in the Building or manholes shall after the final installation and testing of the cables, be sealed by packing with hessian and 'skimming' with a weak concrete mix approximately 25mm thick, by the Main Contractor.

5.3.17 Pipe Ducts shall be provided with sealed sleeves so that the complete system is watertight. The Building will not get substantial completion if water ingress is evident through any part of the Building Envelope.

5.3.18 All Lighting Ducting shall comply with latest version of EN 61386-1-21-2223-24 and shall be single wall, coloured red and manufactured from high-density polyethylene. The nominal external diameter of the duct shall be 107mm with a minimal wall thickness of 5mm.

5.3.19 All ducts shall be plugged with wooden plugs before and after each test. Wooden plugs shall be inserted at the ends and each section of duct to prevent entry of soil or stones.

5.3.20 All ducts shall be installed complete with 6mm diameter polypropylene rope for subsequent pulling of supply cable.

5.3.21 Armoured cables shall not be installed when the air temperature is 0oC or less and shall have been subject to a temperature not lower than 4oC for a period of 24 hours prior to installation.

5.3.22 After the cables have been installed both the cable and exposed duct shall be capped with tape, which shall be rendered with patent intumescent fire-stopping compound, painted with epoxy paint to form a gas, water and fire barrier.

5.3.23 The minimum internal radius of bend of cables shall be in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

5.3.24 Cables run on parallel routes shall be spaced such that the clearance between cables is not less than eight times the overall diameter of an individual cable.

5.3.25 Cables shall be un-jointed throughout their length. Parallel cables shall run along the same route.

5.3.26 Conductors shall terminate at equipment in soldered or crimped cable lugs of an approved type as recommended by the Cable Manufacturers.

5.3.27 A warning tape shall be placed above each cable duct. The tape shall be laid at a depth of 300mm below the finished surface level except where the depth of roadway or paved area base exceeds 300mm in which case the tape shall be laid immediately below the base.

5.3.28 The tape shall run the full length of the cable route.

5.3.29 Warning tapes shall be of polythene not less than 150mm wide and 0.1mm thick.

5.3.30 They shall be yellow in colour and bear the continuously repeated legend- "Caution Electric Cable Below" or similar, in black letters not less than 30mm high.

5.3.31 At each draw-in point, joint or junction box the cable shall be mounted on cable ladder/tray. Every manhole wall shall have two support racks mounted in order to support cable.

5.3.32 Cable markers are to be precast concrete units reinforced with mild steel bars and fitted with lead insert labels indicating the size and rating of the cable. They are to be provided in sufficient quantity to enable the runs to be clearly identified. All changes of direction are to be indicated together with underground joint boxes. The maximum interval between markers is to be 45m unless agreed to the contrary by the Engineer.

5.3.33 Manholes shall be constructed from reinforced concrete complying with IS 420 and shall be of adequate size to allow easy pulling and bending of cables.

5.3.34 The base, and benching shall be formed in situ of grade 20 concrete. The base shall be 225mm thick and the channel be purpose made half round channels.

5.3.35 The precast rings shall be surrounded in 150mm thick grade 20 concrete.

5.3.36 A flexible joint shall be provided to each pipe within 500mm of the inner face of the manhole wall.

5.3.37 Projecting pipes shall be surrounded with grade 20 concrete with the base been cast monolithically with the manhole base.

5.3.38 Covers manhole covers and frames to comply with the requirements of IS/EN 124: 2015.

5.3.39 Covers in roadways to be an approved minimum class d400 with 600mm clear opening. Covers in grassed areas and footpaths not adjacent to roadways to be minimum class c250 with 600mm clear opening blockwork to slightly inside the chamber. It shall be complete with cable chamber frame/cover to finished pavement surface level.

5.3.40 Manhole frames and covers shall conform to EN 124 grade B125. The cover shall be retained in position by a stainless steel bolt with 'Allen Key' type head and bolt lid.

5.3.41 All Manhole Covers and or Inspection Chamber Covers installed or encountered as a result of these Works shall be finished flush with the Ground. All Covers shall be tested so that they can be removed after the completion of the Works.

5.3.42 Pre-cast concrete manholes type structures shall be rectangular and comply with EN 1916: 2002. Units which bed onto bases shall be manufactured such that full wall thickness is in contact with the base.

5.4 Site lighting

5.4.1 The Contractor shall provide an exterior Site lighting installation to comprise a combination of external amenity luminaires around the perimeter of the buildings and luminaires on root-mounted hinged columns associated with the proposed carparks and avenues. Other areas of lighting include ground mounted bollard lighting, architectural column lighting and emergency luminaires.

5.4.2 Footpaths, courtyards/ terrace Carparks and Roads

- External light fittings shall be a minimum of IK 10 vandal resistant and IP67 rated (or as otherwise specified in the luminaire schedule)
- The installation of external lighting shall be coordinated with the positioning and selection of external CCTV systems.

5.4.3 Plant Spaces

- Plant Room fittings shall be a minimum IK 10 and IP67 rated.
- Areas with gases shall be ATEX compliant fittings, and spark proof e.g. Oxygen room (where applicable).
- Pilot lights on switch plates shall be fitted with a neon lamp, limiting resistor and red lens and comply with the latest BS standard.

5.4.4 External Light fittings

- The Electrical Contractor shall provide for the Design, Supply, Installation, Commissioning and Handover of an External Lighting Installation with the External Luminaire Manufacturers' for the Building. The External Luminaires shall be as indicated on the Schedule of Luminaires included under this Contract.

- External Luminaires listed in the Schedule have been selected on the basis of aesthetics and technical performance. Substitutions or alterations to any of the External Luminaires listed shall only be permitted on an equivalent basis.

- External light fittings shall be weatherproof rated IP65 minimum. In the event of water damage or fault, the Contractor shall return the Fittings to the Supplier and ensure that replacements are correctly installed in a waterproof manner.

- External fittings shall be a minimum of IK 10 vandal resistant.

- The installation of External Lighting should be co-ordinated with the positioning and selection of any external Camera Surveillance Systems.

- External lighting points shall be wired from a MCB or RCBO (if located under 2.8m AFFL) in the Local Distribution Board. External fittings shall not be wired on the same circuit as internal fittings. Surge protection shall be provided in accordance with the requirements of the Lightning Specialists Risk Assessment.

- The switching of all External Luminaires shall be controlled by means of the Buildings Lighting Control System and controlled via a Photo Cell Contactor. Hand-Off-Auto-Remote Switches for the External Lighting shall be included in the Tipperary Courthouse & Bridewell.

- Photo Electrical Cell shall be normally open, close on low-light type, complete with conical plastic cover and shall be mounted at Roof Level away from all direct light sources. Photo-Electric Cell shall also be adjustable type, setting from 2 -800 lux, and complete with sixty seconds time delay On/Off.

- A fully operational sample of the External Luminaires specified shall be displayed on Project for review by the Engineers and Client for comments or final approval. The Electrical Contractor shall include for supplying, erecting and connection of all Sample Luminaires.

- A co-ordinated external lighting design shall be developed, and fully coordinated with the Façade and Landscape Design, as indicated on the Architects Drawings and the requirements of the Planning Authority.

- All External Sign Lighting shall be illuminated with LED technology, or other similar energy efficient solution to provide clear visual sign recognition.

5.4.5 Commissioning and Certification of the Installation shall be undertaken by a Specialist Supplier. A Commissioning Certificate in accordance with CIBSE Code L: 2018 to include a drawing indicating all measured lux levels at commissioning stage is required, to demonstrate compliance with LG2 and LG7 and Design Specifications. This shall be a requirement for practical completion.

6 Electrical Energy Centre and Power Distribution (Element 61)

6.1 Extent of Works

6.1.1 The Works covered under this Section shall include the following:-

- Main/Intake Switchboard including Authority metering;

- Sub-Distribution Board;
- Cable Trunking and Cable Tray;
- Conduit and Final Circuit Cable Installations;
- Mains Power Distribution Installation;
- Earthing and Equipotential Bonding.

6.1.2 The Contractor shall fully survey the Site to ascertain the full extent of works to be carried out. A detailed methodology shall be submitted by the Contractor to the Employers representative and Engineers for review of diversion of any affected services.

6.1.3 The Contractor shall submit proposals for electrical energy centre and power distribution to the Employers representative and Engineers for review including proposed trenching layouts.

6.2 Low Voltage Connections

6.2.1 The Electrical Contractor shall be responsible for the manufacture off-site, testing, supplying, delivering, installing and witnessing test and commissioning of new Switchgear.

6.2.2 The Electrical Contractor shall be responsible for the manufacture off-site, testing, supplying, delivering, installing and witnessing test and commissioning of new Sub-Distribution Boards.

6.2.3 A Full Discrimination Study for the new Sub-Distribution Board shall be provided by the Switchgear Manufacturer.

6.2.4 The Electrical Contractor shall include for the complete Power Distribution Services Installation as indicated on the Drawings and specified herein.

6.2.5 STANDARDS AND REGULATIONS

- 5th Edition National Rules for Electrical Installations, IS 10101: 2020;
- EN 50110-1: 2023 Operation of Electrical Installations;
- EN 61936-1: 2021 Power Installations exceeding 1 kV a.c.
- EN 60947-1: 2021, Low Voltage Switchgear and Control Gear, General Rules;
- EN 61439-1: 2021, Low Voltage Switchgear and Control Gear Assemblies- General Rules;
- EN 61439-2: 2021, Power Voltage Switchgear and Control Gear Assemblies; Power Switchgear and Control Gear Assemblies;
- EN 61439-3:2012, Low-voltage switchgear and control gear assemblies. Distribution boards intended to be operated by ordinary persons.

6.3 Provision of a New Low Voltage Sub Distribution Boards

6.3.1 A new LV Electrical Sub-Distribution Board shall be provided within the dedicated Low Voltage Electrical Cupboard.

6.3.2 The Sub-Distribution Board incoming cable compartments, main isolation/circuit breaker termination compartments and sub-section circuit breaker compartments (Lighting/Power/General Services) shall be Form 3B separation.

6.3.3 MCB and RCBO distribution sections shall be as Form 2B, with all outgoing cables wired to cable terminals which should be fixed onto a din-rail.

6.3.4 Each neutral conductor shall be wired to a separate neutral terminal, for the associated circuit, and labelled accordingly in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

6.3.5 The minimum IP Rating permitted shall be IP 54.

6.3.6 The Electrical Sub-Distribution Board shall be of sheet steel construction and shall be wall-mounted top entry/exit Class II construction and comply with EN 61439-1: 2021.

6.3.7 All Lighting, Power and General Services Sections of the Sub-Distribution Board shall be segregated including the separation of their respective MCBs and devices.

6.3.8 The Sub-Distribution Board shall be suitable for continuous operation. The insulation level of the Board shall be 1000 volts and the fault shall be adequate to withstand the maximum fault conditions.

6.3.9 The Sub-Distribution Board shall be reinforced against distortion by suitable flanges and stiffening members.

6.3.10 The Sub-Distribution Board shall have separate compartments for incoming isolator, for outgoing circuits, and for outgoing terminal blocks.

6.3.11 The incomer of the Sub-Distribution Board shall have a door-interlocking feature with padlocking in “Open” position.

6.3.12 Neoprene gaskets shall be provided for doors/detachable covers, gland plates, etc.

6.3.13 The Sub-Distribution Board shall have internal wireways so that in combination with trunking installed across the top, there shall be no top entry into sections with equipment.

6.3.14 The Sub-Distribution Board shall be fitted with an internal cableway of adequate size to allow for incoming and outgoing cable glanding, this section shall allow crossover and easy distribution of cables/wiring where necessary. The minimum height of the cableway shall be 200mm. The cable way shall form part of the Sub-Distribution Board and the glanding space provided shall be adequate for the cable quantity, size and glanding. Glanding space shall include for future cables for the spare capacity and future capacity breakers.

6.3.15 All outgoing circuit breakers including those shown as 'spare' in the single line diagram shall be fitted and wired up to terminals.

6.3.16 The busbars and other necessary accessories shall be fitted to accommodate future (spareways) circuit breakers. This arrangement shall be provided to accommodate 25% future circuit breakers.

6.3.17 The Sub-Distribution Board shall be fitted with suitable fixing brackets to enable the Board to be wall mounted.

6.3.18 The Sub-Distribution Board shall be supplied with undrilled removable gland plates on the header to facilitate the termination of the incoming supply and the outgoing circuit cables. The clear space (minimum 150mm) between the terminal block and gland plate shall be provided for ease of termination and connection of cables/wires. Cable gland plates shall be 2mm mild steel, using 2mm hex bolts. Self-tapping screws are not acceptable.

6.3.19 Lifting lugs to be provided to avoid damage to the Sub-Distribution Board components, enclosure and finish.

6.3.20 The Sub-Distribution Board shall be suitably rated and each outgoing MCB/RCBO shall have its own associated neutral terminal.

6.3.21 All internal cabling of the Sub-Distribution Board shall be carried out by the Manufacturer to labelled terminals. Each unit shall include a header trunking above the terminal strip within the cabinet. The header trunking shall be accessible through a removable cover plate separate from the terminal strip cover.

6.3.22 The Sub-Distribution Board shall be complete with all standard fixings and accessories. The layout of the various units shall be symmetrical and shall also incorporate cable terminating boxes to suit the outgoing stranded copper cables.

6.3.23 Adequate space for cable terminations shall be provided.

6.3.24 Terminals shall be provided at the top of the cubicle and shall comply with IEC 60947-7-1: 2009. All items of Equipment shall be wired to these terminals and they shall be capable of accepting the incoming cable sizes as specified. They shall be of P.V.C. grade and be identified by means of terminal numbers. A terminal list or numbered Drawing shall be provided by the Manufacturer.

6.3.25 Wiring shall be by means of PVC cables; minimum size 1. 5sq.mm cross-section.

6.3.26 Cable shall be supported or enclosed in P.V.C. trunking. Where enclosed in trunking their spacing factor shall not exceed 30% and shall be grouped and labelled at intervals of 300mm maximum.

6.3.27 Cables to any moving parts (i.e., doors etc.) shall be flexible and housed in P.V.C. spiral wrap or some other equal and approved means of protection.

6.3.28 All circuit breakers shall be of the same manufacture and shall be manufactured by Merlin Gerin, Schneider, Siemens, ABB or Mitsubishi.

6.3.29 The Switchgear Manufacturer shall select the circuit breakers to ensure full discrimination is achieved, throughout the entire installation. The Switchgear Manufacturer shall submit computer calculations to indicate the prospective fault levels throughout the Installation along with verification that full discrimination is achievable.

6.3.30 MCCBs shall be provided with adjustable electronic releases to provide the following (LSIG) protections:-

- Overload protection should be provided with a continuously adjustable setting from 0.4 times the rate of current up to full rated value;
- Adjustable selected short circuit protection shall be provided;
- Instantaneous short circuit shall be provided,
- Earth fault protection shall be provided.

6.3.31 The Sub-Distribution Board shall be provided with Electronic Surge Protection, selected in accordance with the requirements of the Lightning Protection Risk Assessment and EN 62305: 2011.

6.3.32 The Sub-Distribution Board shall be provided with Lightning Protection Surge Protection Device, in accordance with IS EN 62305: 2012. The Electrical Contractor shall include for 2 additional data points in the Electrical Cupboard to facilitate this function.

6.3.33 The Sub-Distribution Board shall incorporate networkable multi-function metering capable of relaying Electrical Usage Data, Power Factor, Harmonic Content and Energy Consumption Data for the Building. All Meters fitted within the Sub-Distribution Board shall be installed complete with pulse output communications module.

6.3.34 All sub-sections (Lighting/Power/General Services) shall incorporate multi-function metering. All metering shall be linked to the Energy Monitoring and Metering System for remote interrogation.

6.3.35 The completed structure shall have a Factory-Tested assembly (FTA) certificate to comply with EN 61439-1.

6.3.36 A Certificate of Compliance with EN 61439-1 shall be required and the Type Tested Assembly shall comply with the requirements of this Standard, notably in relation to continuous operation at full load for a 24 hour period. Evidence of the above shall be required.

6.3.37 A Laminated Schematic Drawing shall be provided detailing all schematic details.

6.3.38 A Rubber Mat 1200 mm wide 12 mm thick complying with the relevant Standard shall be provided to suit the full length of the new Sub-Distribution Board.

6.4 Labelling

6.4.1 Labels shall be provided on all chambers inside and outside the Panels, indicating the function of every item. Every sub-circuit shall be labelled to indicate its function and rating and shall be suitably indicated on heat-sealed charts.

6.4.2 The Sub-Distribution Board shall have a main designation label to EN 61439-2: 2021 bearing the following minimum information: -

- Supplier's Name or Trademark;
- Country of Origin;
- Type, Designation, Number of Code;
- Rated Voltage;
- Rated Frequency;
- Rated Current of the Main Busbar System;
- Rated Peak and Short Time Withstand Current and Withstand Time;
- Degree of Protection (IP rating);
- Form of Internal Separation;
- Internal Arc Resistance Rating (Current and Duration);
- Year of Manufacture;
- Purchaser's Equipment Tag Number as per the Datasheets.

6.4.3 Labels shall be engraved black on white background, "Traffolyte", or similar.

6.4.4 Labels shall be fixed with non-ferrous rivets or non-corrodible screws.

6.4.5 Lettering shall be a minimum of 4mm high.

6.4.6 Each compartment in the Sub-Distribution Board shall have an external label. Supplier shall agree nameplate designations with Engineer before engraving.

6.4.7 All Warning Labels shall be engraved red on white background "Traffolyte", or similar. Covers to busbar chambers shall be fitted with warning labels and engraved with 6mm high letters as follows. "DANGER LIVE BUSBARS".

6.4.8 All Switches and Circuit Breakers shall be marked with the ON and OFF positions.

6.4.9 The indicating lamps shall be provided with a label identifying the purpose.

6.4.10 The Sub-Distribution Board shall be fitted with a typed sub-circuit chart in waterproof heavy clear polythene envelopes fixed to the back of the door.

6.4.11 Labels giving circuit designation (R1, S1, T1; L1, L2, L3 etc.) shall be provided for various components such as fuses, switches and terminal blocks inside the Panel. Equipment Nameplate shall also be provided.

6.4.12 Labelling shall be White Tag/Black Lettering = Non Fire-Rated Cabling and Red Tag/Black Lettering = Fire-Rated Cabling.

6.5 Moulded Case Circuit Breakers (MCCBs)

6.5.1 Moulded-Case Circuit Breakers (MCCBs) shall be installed in the Sub-Distribution Board up to 1000A rated capacity.

6.5.2 MCCBs shall comply with the following Standards:-

- EN 60947- 1: 2021;
- EN 60947-2: 2017 + A1: 2020;
- EN 60947-3: 2021;
- EN 60947-4-1: 2023;
- EN 61000.

6.5.3 The MCCB Manufacturer must have a Certificate of Compliance with the above Standards according to EN ISO/IEC 17025:2017.

6.5.4 MCCBs shall be suitable to provide isolation according to EN 60947-3.

6.5.5 Trip Unit with overload protection in accordance with EN 60947-4-1 shall be available for motor protection.

6.5.6 MCCBs shall comply with EC “Low Voltage Directives” (LVD) n° “Low Voltage Directive” (LVD) 2014/35/EU and “Electromagnetic Compatibility Directive” (EMC) 2014/30/EU.

6.5.7 Conformity with the Product Standards must be carried out in observance of the European EN ISO/IEC 17065: 2012 Standard by a certification body recognised by the European LOVAG organisation or equivalent competent body.

6.5.8 The Materials used shall comply with the following International Regulations:-

- RoHS II, Directive (EU) 2024/232;
- China RoHS;
- REACH, 2006/1907/EU, Registration, Evaluation, Authorisation and Restriction of Chemicals;
- WEEE 2012/19/EU -Waste Electrical & Electronic Equipment.

6.5.9 MCCBs shall be suitable for installation with air temperature between -25°C and+70°C (ambient temperature).

6.5.10 The Manufacturer shall provide the maximum rated current of MCCBs according to ambient temperature and terminals' type, to guarantee performance and avoid mechanical degradation.

6.5.11 MCCBs shall be designed to operate in environments with pollution degree 3 according to IEC 60947-2 Standard Classification.

6.5.12 MCCBs in fix execution with rated current 630A shall carry the full current without derating with ambient temperature up to 55°C.

6.5.13 MCCB range shall be suitable to cover rated uninterrupted current from 160A up to 1600A with some accessories shared among all the frames in order to allow inventory optimization.

6.5.14 Main breakers' parameters must be clearly and indelibly marked on the circuit breaker in a position visible when the breaker is installed, in compliance with EN 60947-2.

6.5.15 Operation level shall clearly indicate the exact position of contacts (positive operation) by means of reliable signs I=open, O=closed and yellow-green line = tripped.

6.5.16 Slots for fit-in accessories, operating mechanism and front part of MCCBs must be separated from live power parts with double insulation, to ensure safety of technician during operations.

6.5.17 Insulation distances between live internal parts and at terminals shall be higher at least equal to minimum requirements of UL 489, to provide maximum safety.

6.5.18 A test button for the correct functionality check (moving contacts opening) must be placed in front of the breaker to be accessible even when the MCCB is installed.

6.5.19 The operating mechanism shall be designed to operate simultaneously all poles of the Circuit Breaker for making, breaking and tripping.

6.5.20 All the installation positions must be possible without jeopardizing the function of the apparatus for all frames and all executions.

6.5.21 Front part of the Circuit Breaker with cover or direct rotary handle shall have a minimum degree of protection of IP40, excluding terminals' area. It shall be possible to reach IP40 at terminals by using terminal covers.

6.5.22 Rated Service Voltage shall be 690V even when the Circuit Breaker is accessorised with residual current release type A and AC.

6.5.23 Rated Impulse Voltage shall be at least 8kV, suitable also for installation at origin of the installation.

6.5.24 Insulation Voltage shall be at least 800V up to 250A and 1000V for higher rated current, even when a RCD module is installed.

6.5.25 MCCBs with rated current from 500A and above shall be category B to ensure selectivity with downstream devices.

6.5.26 MCCBs shall be available with different breaking capacity up to 200kA @420V.

6.5.27 MCCBs shall be equipped with interchangeable trip units from frame 160A to make easy the upgrade of the installation, and it shall be possible to choose among thermomagnetic and electronic trip units.

6.5.28 Trip unit shall be integrated in the volume of apparatus.

6.5.29 Trip units shall be adjustable, and it shall be possible to fit lead seals to prevent unauthorized access to settings.

6.5.30 Thermomagnetic trip units shall be fitted with protection threshold against overload (whose thermal element must consist of a bimetal) and with protection threshold against short circuit.

6.5.31 The protection threshold against overload must be continuously adjustable starting from 0.7 times the rated current of the trip unit and up to its rated value.

6.5.32 The reference temperature for setting the thermal element of the protection trip unit shall be 40°C and temperature performance of the trip unit must be indicated as the temperature varies.

6.5.33 Thermomagnetic trip unit shall be available from rated current of 1.6A to 800A, it shall be possible to select thermomagnetic unit with fix magnetic threshold and adjustable thermal setting up to 40A, for higher rated current both thermal and short circuit setting shall be adjustable.

6.5.34 Adjustable thermomagnetic trip units from rated current from 80A shall have magnetic setting adjustable from 5 up to 10 times the rated current.

6.5.35 In four pole version, the neutral pole shall be protected, and for rated current equal or higher than 125A protection of neutral shall be settable at 100% or 50%, while for lower rated current shall be always 100%.

6.5.36 For MCCBs with rated current from 16A to 630A, a thermomagnetic trip unit shall be available for generator protection with adjustable thresholds.

6.5.37 The electronic overcurrent trip units shall be self-supplied and must be able to guarantee correct operation of the protection functions even in the presence of a single phase supplied with a current value equal to 20% of the phase current.

6.5.38 Electronic trip unit must be unaffected by electromagnetic interference in compliance with the EMC directive and Annex F of IEC 60947-2.

6.5.1 All MCCBs shall be fitted with protection functions against overload (function L), against instantaneous short-circuit (function I) and with intentional delay (function S) and also with protection threshold against earth fault (function G). All the protection functions except for protection against overload must be excludable).

6.5.2 The electronic trip unit shall have LEDs on the front to indicate the status of release (on/off) and information about protection trip.

6.5.3 The electronic trip unit shall be available from a minimum rated current of 10A up to 1600A; from 630A frame, it shall be possible to decrease the rated current of trip unit with rating plug according to system requirements.

6.5.4 Accessories for electronic trip units shall also be available, including:-

- The test unit for checking functioning of the tripping coil;
- A trip signalling unit of the protections;
- A test and configuration unit which allows the electronic trip unit protections to be tested and configured.

6.5.5 The minimum performances of the protection functions of basic electronic protection trip unit for distribution, where present, must be:-

- Function L: adjustable trip threshold I1= (0.4-1) x In, trip curves for the basic version with at least 2 different trip curves times - (at 3 times the set threshold). It shall not be possible to exclude overload protection;
- Function S: adjustable trip threshold I2= (1-10) x In, trip curves for the basic version with times from 0.1 to 0.2 seconds – 2 different trip curves. It shall be possible to exclude S protection;
- Function I: adjustable trip threshold I3= (1-10) x In for the basic version (instantaneous trip). Offsetting of this protection shall enable the maximum setting for protection against short circuit;
- Function G: adjustable trip threshold I4= (0.2-1) x In with trip times from 0.1 to 0.8 s. It shall be possible to exclude G protection.

6.5.6 The MCCBs supplied should comply with the following characteristics:-

Rated Service Voltage	690V AC
Insulation Voltage	800V AC
Short Circuit	Level Main
Incoming MCCB	65kVA
Short Circuit	Level Outgoing
MCCB	65kVA
Operating Temperature	-25˚C - + 70˚C
Maximum Relative Humidity	90%
Maximum Altitude above sea level	2,000m

6.5.7 Different types of terminals (both front and rear) must be available for all the MCCB sizes, suitable for connection with copper, copper-aluminium cable and bus bar connections. Terminal covers and phase separators shall also be available. Terminals shall have laser marking on the surface, indicating the tightening torques for cables and bars.

6.5.8 Support for fixing onto DIN rail: supports for fixing onto DIN EN 50022 rail shall be available up to the rated current of 250 A inclusive.

6.5.9 Rotary handle operating mechanism both in the direct and transmitted version shall be available for the whole range of circuit-breakers, both padlockable in the open position.

6.5.10 Lateral rotary handle shall be available for breakers with rated current from 160A to 630A.

6.5.11 It shall be possible to fit padlocks or key locks that prevent the circuit breaker from being closed and/or opened:-

- Directly on the front of the circuit-breaker;
- On the rotary handle operating mechanism;
- On the front for lever operating mechanism;
- On the motor;
- On the front of the thermal-magnetic trip unit, to prevent the adjusting of the thermal part from being tampered with;
- On the shutters of the fixed part;
- In closed position, the locks do not prevent the mechanism from tripping due to the trip unit or a service release.

6.5.12 Shunt opening and under-voltage releases must be available with different power supply voltages both in AC and DC.

6.5.13 Service releases shall be installed without screws and shall be available in cabled version suitable for all breaker execution and not cabled version for fix and plug-in breakers.

6.6 Switchfuses

6.6.1 Where specified, Switchfuses shall consist of isolation switches with load break fault make capacity and fuse protection. The units shall comply with the following:-

- EN 60947-1: 2021;
- EN 60947-3; 2021.

6.6.2 Switchfuses shall comprise double break wiping type knife contacts (NH) with self-cleaning construction and arc chute plates. The contact surfaces shall be silver-plate not less than 20µm thick.

6.6.3 The operating mechanism for the Switchfuse shall be of operator-independent construction. The Switchfuse shall be fitted with an external operating handle and shall have an IP65 degree of protection and clear marking showing on/off. The handle shall be fitted with a facility to be padlocked in the off position and shall have door interlocking feature in the padlock position.

6.6.4 The Switchfuses shall comply with the following requirements:-

Rated Service Voltage	690V AC.
Insulation Voltage	800V AC.
Short Circuit Level	As per Schematic Drawing.

6.7 Miniature Circuit Breakers (MCBs)

6.7.1 Miniature circuit breakers (MCB's) shall conform to the requirements of EN 60898-1: 2019. Miniature circuit breakers shall be rated for uninterrupted duty at an operating voltage of 230/400V, within the enclosure in which they are installed, given an ambient air temperature of 35°C.

6.7.2 MCB's with a minimum rated short circuit capacity of 10 kA shall be provided unless stated otherwise. The type and current rating shall be as stated on the Drawings. Where no type number is indicated, type B breakers shall be fitted.

6.7.3 MCB's shall be of the quick-make, quick-break, over centre, trip free type, with positive contact ON/OFF indication. The operating mechanism shall have a facility for locking in the OFF position.

6.7.4 The contacts of multi-pole MCB's shall operate simultaneously.

6.8 Residual Current Device/Residual Current Breakers (RCD/RCBOS)

6.8.1 Where residual current devices (RCD's) are required they shall comply with the requirements of EN 61009-1: 2012 + A13: 2021 and EN 61009-2-1/2 for devices with integral overcurrent protection (RCBO's). Generally RCBOs shall be installed throughout.

6.8.2 All RCBOs shall have the appropriate short circuit rating for the location in the system at which they are connected (minimum 10kA), and RCBO's shall have operating and rating characteristics not less than the comparable MCB distribution boards in which they are installed.

6.8.3 All RCBOs shall operate within 0.4 seconds, and unless otherwise stated, the sensitivity of RCBOs shall be 30mA in 30 mS. All RCBOs shall be B type as defined in 5th Edition National Rules for Electrical Installations, IS 10101: 2020 (RCDs which can detect full wave AC and pulsating DC residual currents). All RCBOs shall be Trip Characteristic B as defined in the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

6.8.4 Each RCD shall have a clearly labelled test button and "Test Reminder Notice" shall be provided in the Sub-Distribution board, in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

6.9 Load Break Switches

6.9.1 Load Break Switches shall be of the Rotary Air Break type and shall comply fully with EN 60947-3: 2021 or equal and approved.

6.9.2 Their prospective short circuit current rating shall be adequate for their duty. They shall have on/off indication and be complete with door interlock to prevent inadvertent contact with live parts and must be lockable in the off position.

6.10 Busbars

6.10.1 Busbars shall be HDHC copper of uniform cross section and shall comply fully with EN 61439-1: 2021 and EN 61439-2: 2021. The busbar system shall be type tested in accordance with EN 61439 and be capable of carrying the continuous load current. The Busbars shall be fully rated over their entire horizontal length.

6.10.2 Neutral busbars shall be the same cross-section as phase bus-bars unless agreed otherwise with the Engineer and the earth bus-bars shall be a minimum of half size.

6.10.3 All Busbar joints shall be proprietary torqued and shrouded and shall be made with high tensile steel bolts with a protective finish such as zinc chromate for corrosion resistance.

6.10.4 Busbar connections up to 63 Amp may be effected by means of cable, braced and supported as necessary, whereas, connections above 63 Amp shall be made by means of H.D.H.C. rectangular section copper busbar, insulated and supported as necessary.

6.10.5 They shall be fully enclosed in their own sealable compartment extending the full length of the Switchboard and shall be fully shrouded internally on all sides to prevent accidental contact.

6.10.6 All busbars, neutral busbars and earth connections shall be colour coded with phase dots, using an insulating material that will not degrade at the highest conductor surface temperature. Phase identification dots shall be located inside each cubicle busbar connection and interface connection point.

6.11 Contactors

6.11.1 Contactors shall comply fully with EN 60947-4-1: 2023.

6.11.2 All Contactors shall be three phase and din rail mounted.

6.11.3 They shall be rated for AC3 Category Class 1 Duty and shall have at least 1 N/O and 1 N/C spare auxiliary contacts. All spare contacts shall be wired up to terminals.

6.11.4 Contactors shall be metal clad of the continuously rated pattern, as required by the particular duty and the number of operations per hour.

6.11.5 Each Contactor shall be provided with the appropriate main contacts, one normally open and one normally closed auxiliary contact. The main contacts shall be rated at a minimum of 15A inductive unless the load exceeds this when they shall be rated to suit the application.

6.11.6 Unless specified otherwise, contactor coils shall be suitable for a single phase AC supply. Coils shall be supplied through a rectifier, one per coil, with a separate fuse for the control circuit.

6.11.7 Where small contactors are incorporated in composite panels the wiring shall be brought to adjacent terminal blocks so that each complete unit can be easily removed and replaced. Such contactors, together with any associated relays, shall be din-rail mounted and housed in a separate compartment with its own hinged lid.

6.12 Pilot Lights & Indicators

6.12.1 Pilot Lights shall be in accordance with EN 60947-5-1: 2017 and have a protection rating of IP65, and be the same manufacturer as the push buttons.

6.12.2 Their maximum Voltage shall be 230V Volt but where possible they shall be of either 110 Volt or 24 Volt, as specified.

6.12.3 Neon indicators shall not be used. Pilot lights shall either be of Transformer type or Series Resistor type.

6.13 Time Switches

6.13.1 Time Switches shall be 7 day, 24 hour type, complete with day omission and 36-hour spring reserve.

6.13.2 All Time Switches shall have:-

- A minimum of twenty-one operations per week;
- Automatically recharged battery back-up capable of maintaining memory and display for 200 hours;
- Override facility with automatic reset;
- Clear LCD Display;
- User friendly system with multi-function operating buttons and “prompt” system for the operators use.

6.13.3 Time shall be labelled with the originating Switchgear designation and details of the Equipment controlled.

6.14 Instrumentations

6.14.1 Instruments shall be provided where indicated and shall comply with I.E.C.60050-300: 2001/A1: 2020 in all respects. They shall be of minimum 96mm x 96mm unless agreed otherwise with the Engineer.

6.14.2 Instrument Transformers shall comply in terms of rated Current, rated Voltage, limits of error etc., with EN 61869-2: 2012.

6.14.3 Multi-Function Meters shall be provided as detailed under the Metering Section and Appendix of this Specification.

6.15 Push Buttons and Control Switches

6.15.1 Push Buttons shall be in accordance with EN 60947-5-1:2017 and EN 60073: 2002 and have a protection rating of IP65.

6.15.2 Push Buttons shall be colour coded as follows:-

- Start/On - Green
- Stop/Off - Red
- Reset - Yellow/Black

6.16 Factory Testing

6.16.1 The Sub-Distribution Board shall be tested in accordance with the applicable parts of IS EN 61439 and the 5th Edition National Rules for Electrical Installations, IS 10101: 2020. All instrumentation and controls functions shall be tested to prove their correct operation. The set points for adjustable devices, such as sensing relays, shall be recorded on test results and additionally marked within the Board, with adjustment points sealed to prevent movement and unauthorised tampering. Calibrated instruments shall be used for all tests.

6.16.2 Results of all tests including dielectric strength, and the instruments used to conduct tests, shall be recorded and a copy provided within the operation and maintenance manual. Where initial tests are unsuccessful, the results of these tests together with the corrective measures taken shall also be provided. All test results shall be signed and dated.

6.16.3 Proposed commissioning test schedules and protocols shall be submitted for approval in conjunction with shop drawings. Protocols shall be fully detailed and include, but not be limited to, schedules in tabulated format covering:-

- Proposed calibrated and where permissible non-calibrated, instruments to be used and the tests for which each shall be used.
- Functioning of all Sub-Distribution Board to confirm correct and uninhibited operations over all phases.
- Injection tests for all meters with 0%, 50% and 100% of full scale readings.
- Confirmation of all derived metered values, such as hours run, kWh, Power Factor, kVA, etc.

- Set points for all adjustable devices such as sensing relays, timers and the like.
- Function of all control circuits with all inputs and outputs for simulation listed, detailing the specified response and with space for recording the actual response.
- Functioning of all monitoring points provided either for immediate or future connection to internal or external systems.
- Other functional requirements where specified.
- Space on each page for signature and date of witness tests.

6.16.4 Factory testing of controls shall be accomplished using a purpose made and labelled test panel with all required inputs simulated by the operation of switches, and all required outputs indicated by lamps.

6.16.5 Factory testing shall include the demonstration of monitoring systems specified as part of this contract, in conjunction with metering, controls and function testing detailed above.

6.16.6 Once testing has been completed, factory test results shall be verified and submitted for approval.

6.17 Testing and Commissioning

6.17.1 On completion of the Installation, the Electrical Contractor shall engage the Equipment Supplier to attend Site and carry out a final test and inspection on the installation. The test and inspection procedures shall be as noted below:-

Visual Control:-

- Check that the front view of the Panels is in accordance with the front drawing, and that the surface is undamaged;
- Check that all components mounted in doors or panels are correctly fitted;
- Check that instruments have right scales, according to Specification;
- Check that markings of components are in accordance with the Drawings;
- Check that wiring is acceptable;
- Check that the Panel has been cleaned;
- Check that Doors and Panels are aligned;
- Check that labelling is in accordance with the Specification;
- Check that parts for the mechanical and electrical assembly of the transport sections are delivered with the Panel;
- Check the degree of protection is in accordance with the Specification;
- Check that the Panel number is in accordance with the drawing and that it is fitted on the front, according to the Regulations.

Mechanical Control:

- Check that all mechanically operated components work properly;
- Check interlock systems;
- Check door functions;
- Check that all clearance distances between phases and between - phase/earth are correct;
- Check that all creepage distances between phases and between - phase/earth are correct;
- Check that all bolt and screw connections are tightened with the specified torque;
- Check connections from busbars to components;
- Check that flexible wiring to components in doors are correctly fitted in protection spiral;
- Check for loose connections;
- Check earth connection to all doors with electrical components;
- Check that unintended contact with live parts is impossible during normal operation conditions;
- Check that internal form of separation is in accordance with the Specification;
- Check that degree of protection is in accordance with the Specification.

Electrical Control:

- Check that the Panel complies with the specified standards;
- Check the function of timers, relays, starters, air circuit breakers, contactors, earth fault relays and other electrical units;
- Check current transformer circuits;
- Check all settings on short circuit protection relays, overload relays, reverse power relays and other electrical protection devices;
- Check all control circuits are functioning in accordance with wiring diagrams or key diagrams;
- Check that ratings on components, fuses, relays, etc. are in accordance with Specifications and Drawings;
- Check that dimensions of wires are correct, and make sure that demands for extra insulation is fulfilled;
- Check selector switches in all positions.

6.17.2 High voltage test to be performed between phases, between phase/earth and phase/neutral. The duration of the test shall be 1 minute and with a voltage of 3kV.

6.18 Site Testing

6.18.1 Upon completion of the installation, complete testing of all the Switchgear controls with all internal and external interfaces and controls connected and operational to confirm their functionality. Retest any functions requiring rewiring adjustment or modification.

6.18.2 Submit signed test results confirming the completion of these tests, prior to arranging witness testing by Tipperary Courthouse & Bridewell Maintenance/Engineer.

6.19 Switchgear Certificate

6.19.1 All Distribution Panels having a rated voltage not exceeding 1000V AC or 1200V DC shall be built in accordance with I.S. EN 61439 set of Standards.

6.19.2 Before a Board is delivered to Site, the Electrical Contractor shall present to the Engineer a completed Standard Form of Declaration by the Manufacturer, in accordance with Appendix C of the above-mentioned Code.

6.20 Surge Protection

6.20.1 Surge Arresters shall be fitted on all Switchgear. The Surge Arresters shall comply and have been tested to EN 62305-4: 2011.

6.20.2 The Surge Arrester (SPD) for Main Switchboards shall be capable of diverting both Direct Lightning impulses 25kA 10/350µs per pole and Surge Currents 40kA 8/20µs per pole e.g. combined Arrester type 1/2/3.

6.20.3 The Surge Arrester shall be 3-stage combined arresters e.g. Type 1, 2 and 3 to protection level 1 100kA 10/350µs per device or 25kA 10/350µs per pole. The Arresters must be fully co-ordinated between Lightning and Surge Currents.

6.20.4 The let-through voltage shall not exceed 1kV even in the event of 100kA 10/350µs lightning impulse and shall also limit follow currents.

6.20.5 Only hermetically sealed gas filled spark gap Arresters shall be supplied. The Arrester shall comply with EN 62305-4: 2011 and EN 61643-11: 2012 + A11: 2018 and shall be equipped with a fault alarm contact to remotely signal if the device fails.

6.20.6 The SPD's shall be Dehn or ABB Furse type T1/2/3 or Equal which are self-protected from end-of-life short circuits DC without the necessity for back-up protection up to 100A and conform to EN 61643-31: 2019.

6.20.7 The Sub-Distribution Board shall have SPD's with maximum discharge current 40kA 8/20µs waveform per pole 160kA 8/20µs TP+N systems type 2.

6.20.8 The Sub-Distribution Board Arresters shall have visual indication of status LED's and shall be constructed so as to have no earth leakage currents.

6.20.9 The Sub-Distribution Board Arresters shall comply with EN 62305-4: 2011 and EN 61643-11: 2012 + A11: 2018.

6.20.10 Arresters shall be equipped with a built-in thermal fault alarm contact to remotely signal if the device fails.

6.20.11 The SPD's shall be Dehn or ABB Furse type T2 or Equal which are self-protected from end-of-life short circuits DC without the necessity for back-up protection up to 100A and conform to EN 61643-31: 2019.

6.21 Sub-Metering of Electrical Services

6.21.1 The Electrical Contractor shall allow for a fully functional power metering units within the new Sub-Distribution Board, for all incoming and outgoing service terminations. All multi-function metering as fitted within the Sub-Distribution Board shall be networked to the Electrical Monitoring and Management Tracking System of the Building.

6.21.2 Meters shall comply with the current EU regulations on Energy Performance of Buildings and shall be capable of cumulative recording of power usage statistics in the Building. The central control unit shall be capable of preparing power usage reports on weekly, monthly and annual basis.

6.21.3 All Energy Metering installed shall comply with the Measuring Instruments Directive 2014/32/EU, including the OPW Metering Specification.

6.21.4 The Electrical Energy Monitoring Software shall measure, visualize analyses and control and show live data that demonstrates the yielded result from the alteration of these behaviours.

6.21.5 The System shall collect and verify Area metered based on analysis of usage which shall allow opportunity to further optimise and increase efficiency in the System via the metering interface.

6.21.6 The Energy Measurement System shall be capable of the following:-

- Collection of Energy Data from Modbus enabled Meters and Devices;
- Cloud based visualisation software updated hourly, viewable from any web-enabled device;
- Logging and storing historical data locally on-site for up to 2 years;
- Reporting functionality – export Reports as CSV/XL files, Energy bill generation. The ability to schedule data file export through email or UTP;
- Communications Protocol: Ethernet–Modbus TCP/IP, HTTP, UTP, SNMP (MIB2), TCP, UDP, IP, ICMP, ARP; Serial–MODBUS;
- Communications interface: The System must be capable of connection to a LAN infrastructure and also capable of data transfer via GPRS/3G/4G network (GSM Modem and Sim);
- Setting upper and lower energy limits for each measured circuit and sending email alerts when values are outside these limits;

- Password-protected access to software levels.

6.21.7 The Electrical Meters shall have built-in communications protocols to ensure granular recording of energy usage.

6.21.8 Electrical Meters installed in the Sub-Distribution Board shall be networked via appropriate cabling and wired to terminals within the Board.

6.21.9 Each Board Logger shall be networked to the Metering Server all local data collection shall continue in the event of a failure on the Ethernet Network.

6.21.10 The overall integration of all the Electrical into the Energy Metering and Monitoring System shall be included under the Electrical Contract and the Electrical Contractor shall be responsible for the full integration of the Meters onto the Management Network.

6.21.11 During installation of the Sub-Distribution Board the current transformers and energy monitoring interfaces shall be installed locally to the Sub-Distribution Board to allow the User have full visibility on the System for operational and allow effective energy analysis.

6.21.12 A self-contained unit shall be provided to allow for all Energy Management Data and Remote Signal Monitoring.

6.21.13 The Sub-Distribution Board shall be networked to a built-in modem with secure isolated connection independent of the Client's IT Network to allow for transfer of Data from the Board to the Cloud Web Server.

6.21.14 The Metering System shall support protocols for 3rd party instruments interfacing to the System to include Modbus RTU.

6.22 Cable Tray

6.22.1 Cable tray shall consist of perforated medium duty steel tray, hot dip galvanised, to comply with EN ISO 1461: 2022. The Tray System shall be manufactured to comply with EN 61537: 2007.

6.22.2 The tray shall be manufactured from sheet steel, with less than 1.2mm in sizes up to 150mm wide, 1.5mm in sizes from 225-450mm wide, and 2mm from 600mm wide.

6.22.3 All bends shall be of the same material, thickness and finish as the Cable Tray and shall have an inner radius of 50mm and a straight length of 100mm at each end.

6.22.4 Tees, intersection units and sets shall be purpose made by the Manufacturer.

6.22.5 All brackets shall be of the clamp on type.

6.22.6 The cable tray shall be supported using galvanised steel rods to ensure that the maximum mid-span deflection when fully loaded does not exceed 10mm. Under no circumstances should the distance between supports exceed 1200mm. The cable tray system shall be supplied and installed complete with the Manufacturer's patent couplers, bends, tees, rises, etc. Copper earth link shall be provided across all joints and the cable tray shall be bonded at all switchgear terminals, busbar terminals, etc.

6.22.7 Cable Tray shall only be cut along a line of plain metal, not through perforations. Cut edges shall be prepared and treated according to the original finish of the metal. Holes cut in cable tray for the passage of LSZH covered cables shall be provided with grommets or, alternatively, bushed or lined to prevent damage to the cable covering.

6.22.8 Cable Trays shall be securely fixed at not more than 1,000mm intervals for trays up to 200mm wide and at 900mm for wider trays. Support shall ensure that there is no perceptible sagging of the trays when all the cables are in position. Trays shall be fixed at both sides of a change of direction at a maximum distance of 150mm from the direction change.

6.22.9 The Electrical Contractor shall ensure the continuity of the Tray/Ladder by the use of copper straps. The resistance of the Tray/Ladder shall not exceed 5 ohms at any point. All Cable Tray shall be bonded to the appropriate Switchgear Earth Terminals/Busbars. Flexible tin plated braided copper earth straps shall be provided across all expansion fittings.

6.22.10 End caps shall be installed on all "Unistrut" ends. Threaded rods shall be cut in a suitable fashion (10mm max).

6.22.11 Where Cable Trays pass through walls and slabs, the Electrical Contractor must ensure that the Opes are adequately fire-stopped. Cable Tray shall be manufactured from perforated mild steel sheet, hot-dipped galvanised in construction and finished in zinc-chromate paint with rigid sides and return flanges. Cable Tray shall comply with EN 61537: 2007, Cable Management, Cable Tray Systems and Cable Ladder Systems.

6.23 Cable Trunking

6.23.1 Trunking shall comply with the requirements of EN 50085-1: 2005 + A1: 2013, EN 50085-2-1: 2006 + A1: 2011 and EN 50085-2-2: 2008. The size of the Trunking shown on the Drawings is the minimum sizes acceptable and in all cases, it shall be the responsibility of the Electrical Contractor to ensure that the space factor shall not exceed 45%, in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020 Requirements.

6.23.2 Cable Trunking shall be sized in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

6.23.3 Medium Duty Cable trunking shall be specified for distribution of Lighting, General Services, Small Power and Mechanical Power Services. Medium Duty Cable trunking shall be manufactured from hot dip galvanised sheet steel and shall comply with BS EN 50085-1: 2005 + A1: 2013.

6.23.4 Trunking and fittings shall have a removable lid extending over their entire length. The lids shall be of the same material, thickness of sheet and finished as that of the trunking. The number of cables to be installed in trunking shall be such that a space factor of 45% is not exceeded and shall be in accordance with the Manufacturer's Recommendations.

6.23.5 The fixings and spacing's of fixing shall conform to the Manufacturer's Instructions and all trunking shall be adequately supported, so as to prevent sagging. Trunking shall only be installed in locations where it is completely accessible for rewiring.

6.23.6 Each length of trunking shall be adequately bonded to the adjacent section of trunking and the installation as a whole shall satisfy the requirements of Clause marked "Earthing". All bends, tees, off-sets, etc. required shall be supplied by the trunking manufacturers.

6.23.7 Steel Cable Trunking shall be manufactured from hot dipped galvanized steel sheet with a minimum sheet thickness of 1.2 mm. Trunking shall have a removable cover throughout its length with centre turnbuckle type latch fixings.

6.23.8 Trunking Fittings and Accessories shall be factory manufactured and finished by the Trunking Manufacturer. They shall be of a similar construction and finish to the Main Trunking. Trunking shall be internally reinforced by cross stays in such a manner that distortion will not occur during and after the installation of the cables.

6.23.9 All Trunking accessories including lids, couplings, offsets, elbows, expansion joints, adapters, end caps, attachment assemblies, hold down straps and suspension brackets shall be provided to form a complete system.

6.23.10 The trunking and suspension brackets shall be of a design to allow the trunking lid to be removed without disturbing the suspension brackets.

6.23.11 Trunking Covers shall be manufactured from the same material, thickness of sheet and finish as the trunking and shall have turned edges. They shall be fixed using patent quick release clips with 'coin' slot. In general, trunking shall be installed so that covers face downwards or directly outwards as appropriate.

6.23.12 Cable retainers shall be provided every 600mm. All Bends and Tees shall be gusseted.

6.23.13 All Trunking Radius or Fillet Bends shall be installed at all corners and all Tee-Sections shall have no reduction in the cross sectional area between the main and the tee.

6.23.14 Lengths of Trunking shall be connected by internally fixed rectangular coupling units of sufficient width to provide a minimum bearing face of 25mm to which the lengths shall be welded or bolted. The length of lids shall be so arranged that the joint always coincides with the centre of the coupling unit.

6.23.15 Multi-compartment Trunking shall be supplied complete with metal dividing fillets of the same gauge as the trunking material.

6.23.16 The Electrical Contractor should note that the Trunking Installation indicated on the Tender Drawings indicates the requirements in the specific areas detailed and does not indicate the total amount of conduit/trunking to be installed.

6.23.17 Trunking shall be rigidly fixed throughout its length and shall be supported by substantial brackets at intervals not exceeding those specified in EN 50085.

6.23.18 Trunking shall be firmly attached to its associated Equipment, either by bolted flanges or by hexagonal male bushes, couplings and compression washers, according to the direction of run in relation to the Equipment.

6.23.19 Earth Continuity shall be maintained between each section of steel trunking by copper links fixed to the outside of the trunking. The trunking system shall be bonded to Switchgear or Equipment Earths as appropriate. Flexible tin plated braided copper earth straps shall be provided across all expansion fittings.

6.23.20 Every entry to finished trunking shall be placed to prevent ingress of moisture. All removable covers shall be securely fixed after wiring is completed.

6.23.21 Every trunking shall be of an inner radius not less than 25 times the minor dimension of the trunking.

6.23.22 Trunking shall be secured at a maximum spacing of 4 metres but in all cases BS 499: 2009 shall be observed with respect to deflection under load i.e. the maximum deflection shall not exceed 1/325 of the span.

6.23.23 The continuity of the trunking system shall be maintained by a copper strip, securely fixed across every trunking joint.

6.23.24 Where more than one circuit is run in the same trunking or more than one service, the cables, for each circuit or service shall be bound together at 1200mm intervals with PVC Tape suitably coloured, so as to segregate and identify the various services.

6.23.25 Where trunking passes through walls, floors and ceilings, Fire Barriers, suitable fire resistant barriers, minimum 3 hours resistant, shall be provided within the Trunking. Care shall be taken to see that no aperture is left between the Trunking and the Structure through which fire might spread. The Fire Compartment drawings shall adhered to in relation to the specification of all internal fire protection within trunkings.

6.23.26 Where trunkings pass through walls, the lid passing through the wall shall be provided with a fixed section on both sides. The secured section of the trunking lid shall protrude 200mm from each side of the wall.

6.23.27 Care must be taken to ensure that all steel and brass particles and the like are removed from the trunking prior to the installation of the cables. All trunking shall be installed so that cables are not liable to mechanical damage due to abrasion.

6.24 Conduit and Final Circuit Cable Installations

6.24.1 Cables in conduit shall be protected throughout their length by screwed welded galvanised Class 4 Steel Conduit, terminating in cast iron or pressed steel boxes at the fittings, switches, etc. Conduit shall not be smaller than 20 mm dia. or have metal tubing less than 1.8 mm. The thickness of metal shall increase in proportion to the increase in diameter.

6.24.2 The capacity of the conduits shall be in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

6.24.3 C.I. oblong intersection joint 'T' and other necessary boxes shall be screwed full thread into which the conduit shall fit tightly. Screw cutting oil shall be used as a lubricant when screw cutting, which must be afterwards carefully removed.

6.24.4 Tubes are to be properly screwed, the thread fully worked and when screwed up no rings shall be noticeable on the outside of the tubes. Conduits are to be mechanically and electrically continuous across all joints and earthed in accordance with the Clause marked "Earthing" (Note: separate independent full size earthing conductors shall be installed throughout).

6.24.5 At junction and ceiling roses, galvanised steel junction boxes shall be used. At ganged switch positions special multiple switch boxes shall be used.

6.24.6 Conduit is to be concealed throughout and it shall be fixed in chases by means of suitable crampets, or concealed within stud partitions. The conduit where sunk in the walls shall have at least 15mm cover of plaster from the external surface. Chases for conduits shall be filled with sand and cement to 7mm from the finished surface.

6.24.7 All bends shall be made as far as possible from conduit and no bends shall have a radius smaller than 2.5 times the outside diameter of the conduit. Elbows and tees shall not be used except in positions approved by the Engineers. When complete the conduit must be water tight and electricity continuous throughout.

6.24.8 No cables are to be inserted until the conduit and boxes are fixed and the plastering complete and no pull greater than 15 kg shall be exerted. Socketed and screwed brass bushes shall be used on all ends through which cables or wire are moved in either direction.

6.24.9 All cables to be rated Class Dca s2, d2, a2 in accordance with EN 50575. The cables shall be stranded copper conductor EN 60228: 2005 with LSZH insulation Type E1.5 to BS 7655.

6.24.10 The cables shall be LSZH insulated 600 Volt grade made to comply with EN 60228: 200 5with stranded Class 2 copper conductors to EN 60228: 2005. The cables shall be supplied with the following colours:-

- Earth-Protective-Bonding Green/Yellow
- Neutral Blue
- First Phase Brown
- Second Phase Black
- Third Phase Grey

6.24.11 All conductors shall be stranded and shall not be smaller than 2.5 sq.mm for lighting and 4.0 sq.mm for services sockets. Connections between cables shall be made by means of mechanical connections of approved type. Conductor sizes for services other than lighting and sockets shall be as outlined hereafter or as indicated on drawing or schedule. A separate full circuit size earth wire shall be run with all circuits taken in trunking and conduit.

6.24.12 Every connection shall be easily accessible and shall have resistance not greater than that of the equivalent length of the largest conductor to which the connector is fixed.

6.24.13 The maximum voltage drop between the Sub-Distribution Board and the Main-Distribution Board shall not exceed 1.5% of nominal supply voltage as follows:

- 3.45Vac (single phase)
- 6.00Vac (three phase).

6.24.14 The maximum voltage drop between any final circuit outlet point and the Sub-Distribution Board shall not exceed 2.5% of nominal supply voltage as follows:

- 5.75Vac (single phase)
- 10.00Vac (three phase).

6.25 Flexible Conduit

6.25.1 Flexible conduit shall be used at final connections to potentially vibrating pieces of equipment, such as motors, etc. The flexible conduit shall consist of a helically wound galvanised steel strip with an LSZH outer sheath. The LSZH conduit system shall be provided with Manufacturer's termination fittings to ensure an overall protection class of IP66.

6.25.2 The flexible conduit shall be manufactured to comply with EN 61386-23: 2021 + A11: 2021 and IEC 61386-1: 2008 + A1: 2019.

6.26 Containment Testing and Commissioning

6.26.1 All Containment Testing and Commissioning shall be carried out in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

6.26.2 All Containment Installations shall be tested to ensure electrical continuity of bonding and earthing connections with a maximum of 3 Ohms resistance to Building Earthing connection.

6.26.3 Where discontinuities occur at adjustable splice plates and expansion splice plates, the Electrical Contractor shall provide a 16 sq.mm copper jumper earth strap.

6.26.4 Upon completion of the Containment Installation the entire Installation shall be checked to inspect sections, fittings and accessories.

6.26.5 The Electrical Contractor shall remove all burrs, dirt and construction debris and shall allow for repairing damaged finish including chips, scratches and abrasions. Galvanised finish damage shall be repaired with zinc rich paint as per the Manufacturer's Recommendations.

6.26.6 The Electrical Contractor shall include for the supply and installation of the appropriate coloured labelling tags throughout the entire length of the Containment Installations.

6.27 Cables in Trunking, Conduits and Flexibles

6.27.1 Single core cables within conduit or trunking and flexibles shall be LSZH insulated. Cables shall comply with BS 6724: 2016 and EN 50525.

6.27.2 Cables in trunking or conduit shall be 600/1000-volt grade. Flexible cables shall be 300/500-volt grade LSZH insulated and LSZH sheathed.

6.27.3 Cables shall only be drawn into conduits or laid in trunking after conduits and trunking have been finally fixed and cleaned out.

6.27.4 Each circuit of cables contained in trunking shall be taped and bound at one-metre intervals throughout the run and suitably labelled at each junction and terminal point for identification purposes. No joints will be permitted and cables shall be looped from point to point.

6.27.5 At terminations of wires and cables the insulation shall be neatly stripped without nicking the conductor. In no case shall bare conductors be allowed to project beyond any insulated shrouding or mounting of a terminal.

6.27.6 Connector blocks will not be permitted unless agreed with the Engineer.

6.28 Cables in Ducts

6.28.1 The Main Contractor shall provide any required trenches, underground cable ducts and manholes/inspection chambers for the External Electrical Services to the Christmas Tree External Mini-Pillar in accordance with the Specification.

6.28.2 Underground Cables installed externally shall be laid direct through ducts.

6.28.3 When cables are laid in ducts, the trenches shall be back-filled within twenty-four hours. Safety precautions shall be taken at all times and arrangements made to prevent damage to the cables.

6.28.4 The Main Contractor shall carry out a Survey of the trench route. Establish the location, if any, of any underground service.

6.28.5 All excavation shall be kept free of water and properly shored up.

6.28.6 Ducts shall be of a size suitable for the cables, the minimum size of bore shall be 100mm or twice the diameter of the cable, whichever is the larger. All cable ducts in the same position shall be same size.

6.28.7 All External Cables in trenches shall be installed in twin-walled high-density polyethylene pipes at a depth of 600mm minimum below the finished ground level.

6.28.8 Where services cross, the minimum clearance shall be 50mm.

6.28.9 Fine sand shall be spread in the excavations to form an underlay for the cable ducts. The sand shall be not less than 50mm deep.

6.28.10 All pipe ducts shall be colour coded to IS 370: 2016 and the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

6.28.11 Entries into the Building shall be by ducts with easy bends terminating flush with the finished floor level at an agreed position in the Building. Care shall be taken when drawing in cables to ensure that undue stress or strain is not placed on the cable.

6.28.12 Each Cable Duct run shall be marked at the point where it leaves the Building or other current controlling device and shall be marked at approximately every 12m along the cable run with an additional marker at each change of direction of the cable run.

6.28.13 Identification Disks shall be provided for cables entering the Building.

6.28.14 Where underground pipe work enters the Building the radius of the pipe bend shall be of the “Slow” type not exceeding the minimum-bending radius of the cable.

6.28.15 Where underground cables enter the Building below the water table of the surrounding ground a ‘puddle flange’ shall be built into the Structure by the Main Contractor for each cable. All ‘puddle flanges’ shall be cast iron with drilled flange for the attachment of backing and sealing glands.

6.28.16 All underground pipe work terminating in the Building or manholes shall after the final installation and testing of the cables, be sealed by packing with hessian and ‘skimming’ with a weak concrete mix approximately 25mm thick, by the Main Contractor.

6.28.17 Pipe Ducts shall be provided with sealed sleeves so that the complete system is watertight. The Building will not get substantial completion if water ingress is evident through any part of the Building Envelope.

6.28.18 All ducts shall be plugged with wooden plugs before and after each test. Wooden plugs shall be inserted at the ends and each section of duct to prevent entry of soil or stones.

6.28.19 All ducts shall be installed complete with 6mm diameter polypropylene rope for subsequent pulling of supply cable.

6.28.20 Armoured cables shall not be installed when the air temperature is 0°C or less and shall have been subject to a temperature not lower than 4°C for a period of 24 hours prior to installation.

6.28.21 After the cables have been installed both the cable and exposed duct shall be capped with tape, which shall be rendered with patent intumescent fire-stopping compound, painted with epoxy paint to form a gas, water and fire barrier.

6.28.22 The minimum internal radius of bend of cables shall be in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

6.28.23 Cables shall be un-jointed throughout their length. Parallel cables shall run along the same route.

6.28.24 Conductors shall terminate at equipment in soldered or crimped cable lugs of an approved type as recommended by the Cable Manufacturers.

6.28.25 A warning tape shall be placed above each cable duct. The tape shall be laid at a depth of 300mm below the finished surface level except where the depth of roadway or paved area base exceeds 300mm in which case the tape shall be laid immediately below the base.

6.28.26 The tape shall run the full length of the cable route.

6.28.27 Warning tapes shall be of polythene not less than 150mm wide and 0.1mm thick.

6.28.28 They shall be yellow in colour and bear the continuously repeated legend- "Caution Electric Cable Below" or similar, in black letters not less than 30mm high.

6.28.29 At each draw-in point, joint or junction box the cable shall be mounted on cable ladder/tray. Every manhole wall shall have two support racks mounted in order to support the cable.

6.28.30 Cable markers are to be precast concrete units reinforced with mild steel bars and fitted with lead insert labels indicating the size and rating of the cable. They are to be provided in sufficient quantity to enable the runs to be clearly identified. All changes of direction are to be indicated together with underground joint boxes. The maximum interval between markers is to be 45m unless agreed to the contrary by the Engineer.

6.28.31 Manholes shall be constructed from reinforced concrete complying with IS 420 and shall be of adequate size to allow easy pulling and bending of cables.

6.28.32 The base, and benching shall be formed insitu of grade 20 concrete. The base shall be 225mm thick and the channel be purpose made half round channels.

6.28.33 The precast rings shall be surrounded in 150mm thick grade 20 concrete.

6.28.34 A flexible joint shall be provided to each pipe within 500mm of the inner face of the manhole wall.

6.28.35 Projecting pipes shall be surrounded with grade 20 concrete with the base been cast monolithically with the manhole base.

6.28.36 Covers manhole covers and frames to comply with the requirements of IS/EN 124: 2015.

6.28.37 Covers in roadways to be an approved minimum class d400 with 600mm clear opening. Covers in grassed areas and footpaths not adjacent to roadways to be minimum class c250 with 600mm clear opening blockwork to slightly inside the chamber. It shall be complete with cable chamber frame/cover to finished pavement surface level.

6.28.38 Manhole frames and covers shall conform to EN 124 grade B125. The cover shall be retained in position by a stainless steel bolt with 'Allen Key' type head and bolt lid.

6.28.39 All Manhole Covers and or Inspection Chamber Covers installed or encountered as a result of these Works shall be finished flush with the Ground. All Covers shall be tested so that they can be removed after the completion of the Works.

6.28.40 Pre-cast concrete manholes type structures shall be rectangular and comply with EN 1916: 2002. Units which bed onto bases shall be manufactured such that full wall thickness is in contact with the base.

6.29 Mains Power Cable Installations

6.29.1 5 Core XLPE/SWA/LSZH cable shall be specified for sub-distribution cabling, and shall be sized to cater for the full load of the Sub-Distribution Board, taking account of volt drop, discrimination, and proximity to other services. In all cases, cables to Sub-Distribution Boards shall not be less than 160amp rated (when installed on perforated cable tray) to achieve discrimination between the feeder MCCB and each Sub-Section MCCB (Lighting, Small Power, General Services).

6.29.2 The maximum permitted volt drop from the Main Distribution Board to any final outlet shall be 4% overall.

6.29.3 LSZH insulated cables shall be manufactured to comply with BS 6724: 2016 and BS 5467: 2016. They shall be of minimum 1000-volt grade unless otherwise specified, with standard sector-shaped conductors. The conductors shall be stranded and each insulated with an LSZH sheath. Sheathed conductors shall be covered with an overall LSZH extrusion to form a bedding for the single galvanized steel wire armouring. The whole shall be covered with an extruded black LSZH sheath of the flame retardant type where the cable is installed within the Building.

6.29.4 Cables shall be manufactured, tested and installed in accordance with the following specifications:-

Conductors	Copper Stranded Class 2 Copper Conductors to EN 60228: 2005.
Insulation	XLPE Insulation Type GP8 to BS 7655-1.3: 2000.
Inner Sheath	Type LTS1 to BS 7655: 2006.
Armour	Mild galvanised steel wires to EN 10257-1: 2011 (or EN 10257-2).
Outer Sheath	Black LSZH Type LTS1 to BS 7655.
Fire Characteristics.	Flame retardant to EN 60332-3-24: 2018.
Temperature Rating.	90°C maximum conductor Operating temperature.
Voltage Rating	600/1000V.

6.29.5 XLPE insulated cables shall be installed as outlined above. The cables shall comprise copper stranded conductors insulated with XLPE enclosed in LSZH sheath and covered with steel wire armour which shall be covered with an LSZH sheath. Cables shall be of 600/1000 volt grade.

6.29.6 In general, main cables shall be run in high density polyethylene underground ducts or on cable tray inside the Building, with final design to determine the final routes and methodologies.

6.29.7 Where cables are run underground externally excavation of trenches and reinstatement shall be carried out by the Main Contractor. The Electrical Contractor shall include for all layouts necessary to lay the cables in position at a minimum depth of 600 mm below ground level (to the top of the duct). It is the responsibility of the Electrical Contractor to ensure that underground cable ducting meets the performance requirements as set out in the 5th Edition National Rules for Electrical Installations, IS 10101: 2020. Plastic marker tape with a repetitive inscription “Danger - Buried Electric Cables Below” shall be installed 300mm below ground level, along the route of the external cables.

6.29.8 The Cables shall be installed in strict compliance with the Manufacturer’s Requirements and bends in the cable shall be of the minimum radius of eight times the overall diameter of the cable.

6.29.9 All runs of cables inside the Building shall be securely fixed throughout their length with cable clamps and in all instances the spacing of supports shall comply with the Cable Manufacturers’ Recommendations.

6.29.10 All Cables shall be terminated in the maker's glands. Termination of the cable core shall be by means of the maker's compression termination lugs in accordance with the maker's instructions. The cable armouring shall be carefully made off in the maker's gland at each entry to MCCBs, switchfuses, etc.

6.29.11 LSZH insulated cables shall be terminated by compression type gunmetal or brass glands constructed to grip both the inner and outer sheath and so designed that any strain on the cable is taken by the steel wire armouring which shall be effectively bonded to the gland. Glands shall incorporate an effective seal between the gland itself and the outer cable sheath.

6.30 Fire Resistant Power Cables

6.30.1 Cable shall consist of stranded copper cores with XLPE insulation, LSZH inner sheath, steel wire armouring and PH220-rated fire-resistant outer sheath. The cable shall be installed in strict compliance with the manufacturer's requirements and bends in the cable shall be a minimum radius of 8 times the overall diameter of the cable.

6.31 Earthing and Equipotential Bonding Installations

Earthing System

6.31.1 The Earthing System to be employed shall be a Type TN-C-S system as outlined in the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

Main Earthing Terminal

6.31.2 An earthing busbar shall be provided as part of the Sub-Distribution Board and shall consist of a copper busbar 100mm x 10mm. The length of the busbar shall be adequate to take all of the protective and bonding conductors with a spare capacity of approximately 25%. A removable isolating link shall be provided at the main earthing bar to allow for the measurement of the earth electrode resistance.

6.31.3 Main Earth bars shall be provided in the Sub-Distribution Cupboard.

Protective Conductors

6.31.4 Protective conductors shall be supplied and installed with all main and sub-main circuits together with all final circuits to fixtures and fittings.

6.31.5 The protective conductor shall consist of stranded copper with LSZH insulation coloured Green/Yellow and the conductors shall be sized in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

6.31.6 The cross-sectional area of the conductors will be as a minimum as outlined in the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

Equipotential & Supplementary Bonding

6.31.7 All equipotential and supplementary bonding as required by the 5th Edition National Rules for Electrical Installations, IS 10101: 2020 shall be provided. Equipotential bonding conduction shall not be less than $6mm^2$.

7 Power Services Installation (Element 62)

7.1 Socket Outlets

7.1.1 General Service Socket Outlets shall be 13A 2-pole and earth to comply with EN ISO 180: 2019, BS 1363-1-2: 2023 and Part M of the Building Regulations.

7.1.2 Unless otherwise stated, socket outlets shall have integral double pole switches incorporated together with interlocking shutters, outboard rocker switches, graphite finish and neon indication. All sockets installed throughout shall be Anti-Bacterial and certified as such.

7.1.3 Socket Outlets shall be installed in galvanised sheet steel conduit boxes for either surface or flush mounting as appropriate.

7.1.4 Socket Outlets shall be mounted at 450mm above finished floor level unless otherwise indicated. Over worktops, socket outlets shall be mounted 200mm above the working plane.

7.1.5 Where sockets are installed in in-accessible positions, a 20Amp double pole isolating switch shall be installed in the nearest accessible area for isolation of the device in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

7.1.6 All Electrical Accessories in all Areas shall be Anti-Bacterial and shall achieve the LVR as per “Buildings for Everyone” Publication and Part M of the Building Regulations.

7.1.7 All fused spur outlet shall be as above, with neon indicators and shall be switched unless otherwise noted. All spur outlets installed throughout shall be Anti-Bacterial and certified as such.

7.1.8 Surface socket outlets shall not be supplied with manufacturer’s knock-outs, but must be drilled on-site for 20/25mm conduit installation.

7.1.9 Wiring for general service sockets shall consist of stranded copper conductors with LSZH insulation carried in galvanised steel trunking and steel conduit.

7.1.10 Typically, the socket circuits shall be carried in galvanised steel trunking from the Sub-Distribution Board through to the open area and meeting room. The final connection to socket outlets shall be taken from the trunking system in galvanised steel conduit dropping in partitions, etc. to socket outlets. Where there are no demountable or accessible ceilings, the entire socket installation wiring shall be carried in a loop-in system of galvanised steel trunking.

7.1.11 Unless otherwise specified, general service socket circuits shall be wired using 4.0mm^2 LSZH insulated copper cable with a separate 4.0mm^2 LSZH insulated earth wire.

7.1.12 Each socket shall be wired on a separate 3x4 sq.mm LSZH cabling, in galvanised steel conduit, from a 20A 2Pole RCBO (Type B trip characteristic, Class B sensitivity) in the Sub-Distribution Board.

7.1.13 The socket circuit shall be wired in radial circuits unless otherwise specified with no more than four twin socket outlets per circuit.

7.1.14 The earth terminal of all sockets shall be bonded to the integral earth terminal in the inlet box by means of a 2.5mm^2 LSZH earth conductor in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

7.1.15 Protective Devices for general services socket circuits shall be 20A amp RCBOs, B-Characteristic, Type B as defined in IS 10101: 2020 (RCDs which can detect full wave AC, pulsating DC and pure DC residual currents).

7.2 Fused Connection Units (Spurs)

7.2.1 All spur outlets installed shall be Anti-Bacterial and certified as such.

7.2.2 Fused Connection Outlets shall be installed for the following services:-

Small Power Services

7.2.3 Serving fixed outlets, supplied via mains from the new Sub-Distribution Boards.

7.2.4 Each spur shall be wired on a separate 3x4 sq.mm LSZH cabling, in galvanised steel conduit, from a 20A 2Pole MCB (or RCBO if serving water heaters) in the new Sub-Distribution Board.

7.2.5 All Fused Connection Outlets shall be supplied complete with neon indicators.

7.2.6 Each spur shall be installed in galvanised sheet steel conduit boxes for flush mounting.

7.2.7 Fused connection units shall be installed for local isolation of equipment, including (but not limited to):-

- Fire Detection and Alarm Equipment
- Access Control Equipment
- Camera Surveillance Equipment
- Mechanical Plant (below 1kW)
- ICT Systems
- Sundry Equipment
- Mechanical Plant, Local fans, Local Controllers etc.

7.2.8 Fused connection units for local isolation shall be complete with neon indication and shall be graphite plate finish with black switches.

7.3 Local Isolators Installation

7.3.1 The Electrical Contractor shall supply, install, test and commission the local isolator installation as indicated on the Drawings and specified herein.

7.3.2 Supplies to all pieces of field equipment shall terminate in a local isolating switch.

7.3.3 Isolators shall be surface mounted with a rotary cam operation.

7.3.4 Isolators shall be either 230V/50Hz or 400V/50Hz as indicated on the Drawings.

7.3.5 Internally mounted isolators shall be IP54. Externally mounted isolators shall be IP67.

7.3.6 Isolators shall generally be surface mounted and shall be installed at 1100mm AFFL.

7.4 Labelling

7.4.1 The Electrical Contractor shall include for labelling all power outlet positions including the following:-

- Sockets, Spur Outlets, Isolators etc.
- All items listed in the Schedule of Mechanical Plant;
- All Electronic Control Sensors.

7.4.2 Traffolyte Labels with white background and black lettering shall be used for all Plant Items, Isolators and Control Items.

7.4.3 Transparent Labels with white lettering shall be used for all LRV Part M Compliant Socket Outlets, Spurs etc.

7.4.4 Each label shall contain the following information:-

- Circuit Reference;
- Phase Reference;
- Distribution Centre Reference.

7.4.5 The Labels shall be fixed to each cover plate. Each Cable Label shall be identified at the Riser.

7.4.6 The Electrical Contractor shall submit samples of the labels to the Engineer for approval.

7.5 Wiring for Mechanical Services Plant

7.5.1 The Mechanical Contractor shall supply and install Mechanical Services Plant and Equipment under the Mechanical Contract, to which the Electrical Contractor will wire and connect power and signal cabling.

7.5.2 The Electrical Contractor shall be responsible for the supply and correct functioning of the Control Systems associated with the Mechanical Services' Sub-Contract. The Electrical Contractor shall supply all Equipment and where indicated hand over to the Mechanical Contractor for fixing. The programmed supply of this Equipment shall be agreed with the Mechanical Contractor in accordance with the Main Building Programme.

7.5.3 The Electrical Contractor shall cable to all items of Mechanical Plant and Controls indicated on the Drawings including Extract Fans, etc.

7.5.4 Final connection to all items of Plant shall be made via local isolator and carried out in EPR/CSP cables enclosed in flexible metallic conduit in which case a separate earth continuity conductor shall be used, as flexible conduit **shall not** be used for earthing purposes.

7.5.5 The Contractor shall include for co-ordinating locations, program and wiring details with the Mechanical Contractor and the Specialist Suppliers to facilitate installation on Site. The Contractors co-ordination meetings and details should be agreed on Site prior to electrical first fix installation.

7.5.6 The Contractor shall refer to the attached Mechanical Services Drawings, indicating the locations/quantities of Mechanical Plant Field Devices and Equipment.

7.5.7 Power cabling to internal plant shall be installed on galvanised steel cable tray, terminated in suitably rated IP66 isolator within 1m of the plant location. Final connections to internal plant shall be via LSZH single cables, enclosed in IP66 LSZH armoured flexible conduits.

7.6 Wiring Requirements.

WC Extract Fans Wiring –Motion Sensor Controlled

7.6.1 All WC Fans shall be motion sensor controlled via the Lighting Circuit in the WC, the Electrical Contractor shall include for control wiring in 2x1.0mm^2 LSZH to the fan unit. The fan shall be powered via a switched fused connection unit with neon indicator located beside the fan, with final connection being made in flexible conduit and with control of the circuit via a Run-On Timer and Fan Motion Sensor. Each Fan shall be supplied under the Mechanical Contract complete with Humidity Sensor. An Isolating Switch for each Fan shall be located at the Door to each WC

7.6.2 The Electrical Contractor shall include for labelling all isolators fitted adjacent to each item of Plant, with both the circuit reference and also the device which it is feeding. Local electrical Isolation shall be supplied and installed by the Electrical Contractor for all Plant items, in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

Wiring To Motorized Valves.

7.6.3 The Electrical Contractor shall include for wiring to any Motorised Valves on the LPHW heating circuits. All valves shall be supplied and installed by the Mechanical Services Contractor, and shall be wired in 4 x 1.0mm^2 screened cable in galvanised steel conduit and in trunking.

7.7 Responsibilities

7.7.1 Unless otherwise indicated, the general allocation of responsibilities shall be as follows:-

Power Wiring.

7.7.2 The Mechanical Contractor to confirm to the Electrical Contractor the power wiring cabling requirements. Installation, glanding off, termination, testing and permanent labelling by the Mechanical Contractor.

Controls Wiring.

7.7.3 The Mechanical Contractor to confirm to the Contractor the controls wiring cabling requirements. Installation, glanding off, termination, testing and permanent labelling by the Mechanical Contractor.

Controls Devices.

7.7.4 Installation of pipeline and ductwork mounted instruments/devices by Mechanical Contractor. Installation of room mounted instruments/devices by the Electrical Contractor.

7.8 Wiring for Miscellaneous Services

7.8.1 The Electrical Contractor shall include for wiring to all Equipment, as detailed in the Room Data Sheets. All final connections, terminations and testing should be included for.

7.8.2 All miscellaneous services such as 3rd party equipment shall be provided with power and data connections, as required.

7.9 Earthing and Equipotential Bonding

7.9.1 The Electrical Contractor shall include for local equipotential bonding. Local bonding systems shall comply with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020 comprising and MEIGaN requirements, with local bonding generally 1x6sq.mm. LSZH earth wire in conduit bonding to stainless steel sinks and associated water services piping, shelving or tabling or similar units together.

7.9.2 All metal stud partitions shall be electrically bonded throughout.

7.9.3 All structural steel shall be electrically bonded throughout.

8 Lighting Installation (Element 63)

8.1 General Lighting Installation

Scope of Works

8.1.1 The Electrical Contractor shall provide for the Supply, Installation, Commissioning and Handover of a complete Internal and External Lighting Installation for in accordance in accordance with this Specification.

8.1.2 The Electrical Contractor shall supply and install the Lighting System complete with Luminaires, all tray/trunking, conduit, wiring and ancillary Equipment, required to form a complete and working Installation.

8.1.3 Light Fittings shall be as described in the Schedule of Luminaires included with this Tender.

8.1.4 The Internal General Lighting and Emergency Lighting Installation shall be LSZH insulated stranded copper cable, from a MCB in the new Sub-Distribution Board. All Cabling throughout the Building shall be carried out in galvanised steel trunking and in galvanised steel conduit, carried above ceilings and recessed in walls and partitions.

8.1.5 The wiring for the general Lighting Installation shall consist of LSZH Cables installed in conduit and trunking. A separate 2.5mm^2 stranded copper earth wire shall be taken with each lighting circuit and shall be bonded onto all Light Fittings and Light Switches. A maximum of 10 light fittings shall be wired on each 10amp MCB circuit.

8.1.6 Lighting Switches throughout the Installation shall be rated 20 Amp single pole, wide rocker switches, with graphite finish, for LRV Compliance. All Light Switches for the Building shall be Anti-Bacterial and be so certified.

8.1.7 All boxes shall be of galvanised steel and provided with earth terminals with bonding link to cover plate/switch grid. Cover plates shall be engraved as required to denote their function.

8.1.8 Multi-phase switch assemblies shall be complete with internal red phase warning faceplates clearly labelled '400 volts' and with vertical phase barriers in boxes.

8.1.9 Samples of Switches to be installed shall be submitted to the Client and Architect for approval before any Switches are placed on order. All Samples shall be complete with boxes.

8.1.10 The Electrical Contractor shall supply and install all LED Luminaires complete with all necessary LED Drivers and/or LED Dimmable Drivers.

8.1.11 The Trunking and Conduit System to the Luminaires shall include for all brackets (clamp-on type) suspension rods, etc.

8.1.12 The Electrical Contractor shall co-ordinate the trunking and conduit etc. with all other Services and route the containment to avoid all pipe and ductwork.

8.1.13 Heat resistant glass fibre sleeves shall be fitted to all of the final wiring entering the Light Fitting.

8.1.14 There should be no electrical connections in ceiling void connection boxes or in inaccessible positions. All necessary 400 x 400 steel conduit termination boxes shall be included for as necessary for distribution of all lighting cabling within each Area, generally located in the Corridor Space or above an Access Hatch.

8.1.15 Cabling to Light Switches shall be carried out in, cable in conduit, flush mounted as necessary in all internal areas.

8.1.16 The circuits shall be arranged to minimise voltage drop and provide the correct operating voltage for each Luminaire.

8.1.17 All cables shall be installed in such a manner as they are fully accessible and suitable for additional wiring and re-wiring without the need to dismantle other Services or Building Elements.

8.1.18 Energy Efficient LED Lighting shall be provided in all Areas as specified with energy conservation and minimisation of whole-life costs as a primary objective.

8.1.19 Luminaires shall be easily maintainable, with colour rendering selected in accordance with the requirements for the space.

8.2 Standards and Regulations.

8.2.1 The General Lighting Installation shall comply with the following Standards and Regulations:-

- 5th Edition National Rules for Electrical Installations, IS 10101: 2020;
- SLL 2 Lighting Guide (2019);
- SLL 7 Lighting Guide (2023);
- SLL 10 Lighting Guide (2014);
- SLL 11 Lighting Guide (2001);
- SLL 14 Lighting Guide (2023);
- SLL 16 Lighting Guide (2017);
- SLL 21 Lighting Guide (2021);
- EN 12665: 2024;
- EN 12464-1:2021;
- EN 61347-1: 2021;
- EN 61347-2-13 2014 +A1: 2021;
- EN 62722-2-1: 2023;
- EN 62717: 2017 + A2: 2019;
- EN 61995-1:2008 +A1: 2021;
- EN 61995-2:2009 +A1: 2017;

- EN 60669-1: 2018;
- CIE 97.2;
- CIE 117;
- CIBSE Commissioning Code L 2018;
- 2014/35/EU Low Voltage Directive (LVD);
- 2014/30/EC Electromagnetic Compatibility (EMC);
- CE Marking Directive;
- SEAI Accelerated Capital Allowance Programme / S.I. 151 of 2011.

8.3 Luminaires

8.3.1 Luminaire Manufacturers' shall be as indicated on the Schedule of Luminaires and Architects Room Data Sheets included under this Contract. All Luminaires shall be dimmable where specified in the Room Data Sheets.

8.3.2 All Luminaires and components shall comply with the requirements of all appropriate Irish Standards and Regulations and shall comply with the requirements of the Fire Certificate.

8.3.3 Luminaires shall carry an identification label giving Manufacturer's Name and Luminaire Model Reference.

8.3.4 Manufacturers photometric and energy efficiency data shall be presented to the Engineers/Client prior to installation of any Luminaire, and the Manufacturer's Data Sheets shall be retained in the Record Documents handed over to the Client upon completion. All Luminaires' photometric data shall comply with EN 13032-1: 2004 + A1: 2012, EN 13032-2: 2017, EN 13032-3: 2007 and EN 13032-4: 2015.

8.3.5 All Submissions must be accompanied by Dialux/Relux Lighting Calculations, to demonstrate compliance with LG2, LG5, LG7, LG9 or the Applicable Standard.

8.3.6 Supplier's Data shall be subject to checking by SEAI for Energy Efficiency, and the determination of SEAI shall be binding in any energy efficiency query.

8.3.7 The Electrical Contractor shall ensure that Luminaires specified of similar type have same photometric performance as published data within the tolerances defined by I.S. EN 13032 Parts 1, 2, 3 & 4.

8.3.8 Luminaires shall be in accordance with all parts of EN 60598-1: 2021 + A11: 2022.

8.3.9 All Luminaires on the Project shall utilise LED light sources throughout both in internal and external areas. Luminaires shall be equipped with either LED Drivers or LED Dimmable Drivers. The LEDs utilised in the Luminaires shall be from an internationally recognised leading Manufacturer in the field. The LEDs shall meet or exceed the standardised industry LED lifetime to L80 = minimum 70,000 hours and with the LED Lumen Maintenance measured to LM-80 and TM-21 Standards.

8.3.10 All LEDs shall be tested per IES LM-79, LM-80, and TM-21 parameters and test reports be submitted to the Engineer/Client for review and approval with the Technical Submission for the Luminaires.

8.3.11 All Luminaires used on the Project shall be a minimum colour rendering index greater than 80.

8.3.12 All Light Sources in a Room/Area should normally have the same colour temperature.

8.3.13 LEDs with a long burning time (70,000 hours minimum) shall be used on the Project.

8.3.14 All drivers to have a minimum nominal lifetime of 100,000 hours and a driver efficiency >92%.

8.3.15 All LED Luminaires and components shall have the CE Mark and shall be manufactured in accordance with all applicable current EN Regulations including EN 62471: 2008, EN 60598-1: 2021, EN 62722-2-1: 2023 and EN 62717: 2017 and with the requirements of all appropriate Irish Standards and Regulations and shall comply with the requirements of the Fire Certificate.

8.3.16 LED driver components should be DALI2, and include DALI parts 251, 252 and 253 for asset data, energy reporting and diagnostics allowing for proactive maintenance.

8.3.17 All Luminaires used on this Project shall have a minimum of 5 Years on-site Warranty.

8.3.18 Luminaires shall be installed complete with all necessary drivers, louvres and diffusers, including any necessary fixings and steel supports. All Luminaire components shall be as per the Luminaire Manufacturer.

8.3.19 Luminaires shall be cleaned prior to final handover, if necessary, with an anti-static cleaning agent, to provide clean, dust free lighting.

8.3.20 The metal work of all Luminaires and Equipment shall be effectively earthed to the Installation.

8.3.21 A cartridge fuse and terminal block shall be located adjacent to the cable entry of each Luminaire.

8.3.22 All drivers shall be produced by a company operating Quality Standards procedure complying with ISO 9001: 2015. All components shall be guaranteed for at least three years under the conditions of assembly and use.

8.3.23 Prismatic/opal luminaires where required, shall be provided with TPa fire rated diffusers in accordance with the Building Regulations.

8.3.24 All Lighting Diffusers shall comply with all of the requirements of Table 2.1 TGD-B and if there are any perforations of the fire-resistant structure they will sealed with adequate gaskets, pillows etc.

8.3.25 Luminaires shall be installed strictly in accordance with the Manufacturer's Instructions.

8.3.26 LED Lamp Colour Temperature shall be consistent in particular Areas.

8.3.27 Colour Temperature of Lighting proposed is 4000K.

8.3.28 The MacAdam of the LED's should be a minimum of 3 to ensure good binning.

8.3.29 A fully operational sample of each Luminaire specified shall be displayed for review by the Design Team and Client for comments or final approval. The Electrical Contractor shall include for all costs associated with the provision of all Luminaire Samples with the Tender Return and include for erecting and connection of all Sample Luminaires. Temporary power as required shall be supplied.

8.3.30 The Electrical Contractor shall demonstrate the operation of all Samples during the hours of darkness and shall arrange to have Electricians and other Operatives in attendance as required. The Electrical Contractor shall include for three separate lighting demonstrations.

8.4 Sustainable Energy Authority of Ireland Accelerated Capital Allowance Program/Triple E

8.4.1 All Luminaires installed shall meet the base criteria of the SEAI ACA program.

8.4.2 All Luminaires installed shall meet the minimum requirements for efficiency as outlines in Technical Guidance Document L of the Building Regulations.

8.4.3 Where sustainable credentials are available, Environmental Product Declarations for components and, for example, Cradle2Cradle Certification for electronic luminaire components should be used.

8.5 Wiring Requirements

8.5.1 The wiring for the general lighting installation shall be taken from dedicated section on the new Sub-Distribution Board.

8.5.2 The wiring shall be carried in steel trunking as appropriate with final connections to lighting points and switches, etc. taken in steel conduit, all as previously specified.

8.6 Presence Detectors

8.6.1 For motion control, 360-degree surface mounted motion detectors shall be provided with a typical detection range of 12m at 2.5m AFFL. When mounted at higher levels, the range is increased. It should be possible to blank out parts of detection areas if required.

8.6.2 Motion Detection Control shall be typically linked to a group of LED Luminaries, with detection of motion in the range being raised to the active state, if not already in this state and also commence a timed period, after which the timer has reached a specified limit, the lighting output shall be automatically returned to the default state.

8.6.3 The minimum ambient light level and time delay before switching Luminaires off shall be from 10s to **30min** adjustable via DIP switches.

8.7 External Light Fittings

8.7.1 The Electrical Contractor shall provide for the Supply, Installation, Commissioning and Handover of an External Lighting Installation for the Building. The External Luminaires shall be as indicated on the Schedule of Luminaires included under this Contract.

8.7.2 External Luminaires listed in the Schedule have been selected on the basis of aesthetics and technical performance. Substitutions or alterations to any of the External Luminaires listed shall only be permitted on an equivalent basis.

8.7.3 External light fittings shall be weatherproof rated IP65 minimum. In the event of water damage or fault, the Contractor shall return the Fittings to the Supplier and ensure that replacements are correctly installed in a waterproof manner.

8.7.4 External fittings shall be a minimum of IK 10 vandal resistant.

8.7.5 External lighting points shall be wired from a RCBO in the Sub-Distribution Board. External fittings shall not be wired on the same circuit as internal fittings.

8.7.6 The switching of all External Luminaires shall be controlled via a Photo Cell Contactor. Hand-Off-Auto-Remote Switches for the External Lighting shall be included in the Courthouse and Bridewell

8.7.7 Photo Electrical Cell shall be normally open, close on low-light type, complete with conical plastic cover and shall be mounted at Roof Level away from all direct light sources. Photo-Electric Cell shall also be adjustable type, setting from 2 -800 lux, and complete with sixty seconds time delay On/Off.

8.7.8 A fully operational sample of the External Luminaires specified shall be displayed on Project for review by the Engineers for comments or final approval. The Electrical Contractor shall include for supplying, erecting and connection of all Sample Luminaires.

8.7.9 All External Sign Lighting shall be illuminated with LED technology, or other similar energy-efficient solution to provide clear visual sign recognition.

8.8 Testing and Commissioning

8.8.1 Commissioning of all General Lighting Systems shall be in accordance with CIBSE Commissioning Code L: 2018 and a Certificate of Commissioning shall be required in the format as per Appendix LA4 from CIBSE Commissioning Code L: 2018. All general Lighting Lux Levels must be recorded by the Specialist to verify that the installation is design compliant, with average lux levels measured recorded on "As Fitted" Installation Drawings, to be bound and handed over with Maintenance Manuals and Completion Certificates.

8.8.2 The Electrical Contractor shall include for the commissioning and demonstration of the Lighting Installations outside normal working hours i.e. after dark. The Electrical Contractor shall facilitate the Engineer by ensuring the full operation of the Lighting Installation in order that Lux Level readings can be verified.

8.9 Hand-Over

8.9.1 The Electrical Contractor shall include for the instructing of Tipperary Courthouse & Bridewell maintenance team, the operation of the Lighting Installation and shall obtain the Client's Signature stating that they are satisfied with the Instructions given.

8.9.2 The Instruction shall cover the Schedule of Maintenance required and any additional maintenance recommended by the Manufacturer.

8.9.3 The Electrical Contractor shall include in this Tender for twelve months Maintenance / Defects Liability Period for the Lighting Installation, which shall commence from the date of issue of the Certificate of Practical Completion for the Project.

8.10 Emergency Lighting Systems

General

8.10.1 The Electrical Contractor shall provide for a complete Emergency Lighting Installation, which shall comply in its entirety, and be certified upon completion, with the following National Standard, IS 3217: 2023 "Code of Practice for Emergency Lighting" as well as, and in conjunction with, the following European Norms/Standards:-

- EN 1838: 2013, "Lighting Applications, Emergency Lighting";
- EN 50172: 2004,"Emergency Escape Lighting Systems";
- EN 60598-2-22: 2014 + A1: 2020, "Luminaires, Particular Requirements, Luminaires for Emergency Lighting" ;
- EN 62034: 2012: Automatic Test Systems (ATS) for Battery Powered Emergency Escape Lighting";
- EN 62386-202: 2023: Digital addressable lighting interface. Particular requirements for control gear. Self-contained emergency lighting (device type 1).

8.10.2 All Emergency Lighting Equipment utilised within the Emergency Lighting System must individually comply with the Standards listed above.

8.10.3 A fully Addressable Emergency Lighting System, with a scheduled Automatic Testing and Fault Testing shall be provided in line with and certified to EN 62034: 2012.

8.10.4 All Self-Contained Emergency Luminaires shall be provided with both DALI control gear and a DALI emergency inverter and secondary cell battery sets.

8.10.5 The DALI Emergency Lighting Inverter and Battery Unit is designed to give total control and access for the Emergency Lighting Testing and Reporting Functions of the Automatic Testing System Head End.

8.11 Central Test Unit

8.11.1 The entire Emergency Lighting System shall be installed such that a Central Test System is capable of testing each Emergency Luminaire and/or circuit in a manner as defined by IS 3217: 2023 as well as in conjunction with E.N. 62034: 2012.

8.11.2 The Addressable Emergency Lighting System shall be capable of providing:-

- Constant communication with the Luminaires to prove System Integrity;
- Reporting Charger or Mains Supply Failure within 60 seconds of the Event;
- Luminaires to be capable of being disabled to carry out maintenance work;
- System to carry out daily, weekly, quarterly and annual tests - fully automatically - or to Clients Requirements;
- Full System and Luminaires testing to be manually activated at any time;
- Reporting of Luminaire number, location and nature of the fault detected;
- On-board Power Supplies on the Panel to maintain memory if power fails;
- Designed to fail safe whatever event occurs;
- Multi Panel Networking, Modem Communications and Report and Control;
- Complies with the requirements of E.N. 62034: 2012.

8.11.3 Emergency Lighting shall operate in the same way as all other Lighting except under manual/scheduled test conditions and emergency conditions. The Emergency Lighting Testing System shall report in real time Driver, Inverter, Battery and Light failures for all Luminaires with DALI Ballasts.

8.11.4 Using the DALI Emergency Protocol an automated regime of self-testing for all Emergency Light Fittings shall be implemented. Commands shall be send out by the Emergency Lighting Testing System to initiate Emergency Tests on each Emergency Light Fitting and when a test is complete, information about the test shall be sent back and logged by the Automatic Emergency Lighting Test System. This information shall be archived and be reproduced in report format for all Emergency Light Fittings.

8.12 Cabling

8.12.1 All Emergency Lighting Circuits shall be 2-core cable, with separate earth installed in trunking/conduit with all cables colour coded to the 5th Edition National Rules for Electrical Installations, IS 10101: 2020. The supply to the Emergency Luminaires shall be taken from the Sub-Distribution Board.

8.12.2 Cabling for the monitoring of the Self-Contained Emergency Luminaires shall be carried out in a 2-wire DALI control cable and screened DALI control cable.

8.13 Emergency Luminaires

8.13.1 All Exit Luminaires shall be High-Intensity White LED and of the maintained self-contained type. The Exit Decal shall be a running man motif, silk-screen negative printing in green background with white symbols upon the diffuser and operated from a three-hour Inverter & Battery Set with automatic re-charging. All Exit Luminaires shall comply with the Safety Signs Directive 2014/27/EU, I.S. 3217: 2023 and I.S. E.N. 1838: 2013 and show a Running Man, Arrow and Door Pictogram format only.

8.13.2 Exit signs shall be as indicated in the Schedule of Equipment and be of the maintained type and comply with the requirements of EN 1838.

8.13.3 All Emergency Lighting shall consist of stand-alone DALI LED Luminaires provided with 3-hour DALI Emergency Packs.

8.13.4 All Luminaires in the Building shall be suitable for application in the Areas they are installed and shall be as described in the Schedule of Luminaires.

8.13.5 All batteries utilised shall be high temperature (55°C), sintered plate, Nickel-Cadmium (NiCd) or high temperature (50°C) Nickel Metal Hydride (NiMh), secondary cell type, rechargeable. Self-Contained Emergency Luminaires shall be capable of reporting Luminaire Failure, Driver Failure and Battery Failure.

8.13.6 All Batteries shall be suitable sized to power the required load for a minimum period of 3 Hours with a 25% ampere-hour spare capacity to allow for capacity fall off with age over useful life (i.e. 4 years) yet still maintain 3 Hours duration. All Chargers shall be solid state, constant current format. Each charger unit shall come complete with LED warning/status/indicator light to indicate that all battery circuitry is complete and functioning correctly and that the batteries being charged. Batteries shall have a minimum recharge time of 24 hrs at 230V 50 Hz in line with I.S.3217: 2023.

8.13.7 The Emergency Lighting Luminaires/Equipment shall be to the approval of the Engineers and Client and comply with the requirements of EN 60598-2-22. All chargers and changeover controls shall be fully automatic and fail-safe upon power failure or resumption of supply.

8.14 Testing and Commissioning

8.14.1 The Emergency Lighting Specialist shall include for Testing, Commissioning and Certification of the completed Emergency Lighting System. The Electrical Contractor shall allow for attendance on the Emergency Lighting Specialist during the testing/commissioning/certification of the completed Emergency Lighting Installation.

8.14.2 All normal DALI and DALI inverters in the self-contained light fittings shall then be programmed by the Emergency Lighting Specialist following the secondary test to include:-

- Prolong Time = 0 (Zero);
- Test Execution Time Out = 7 Days;
- Function Test Interval = 7 Days;
- Duration Test Interval = 52 Weeks;
- Function Test and Duration Test Pending Flags" Reset".

8.14.3 The Emergency Lighting System shall not be deemed complete until a satisfactory Commissioning Certificate is submitted to the Engineer. Certificates shall be in exact accordance with the requirements of I.S. 3217: 2023.

8.14.4 An Independent Specialist Emergency Lighting Commissioning Engineer (shall be employed by the Electrical Contractor to perform a 3-hour duration test on the Emergency Luminaires and certify the Installation complies with IS 3217: 2023. The independent Specialist must have completed a FETAC and NSAI approved Emergency Lighting Commissioning Course.

8.14.5 All Emergency Lighting lux levels must be recorded by the Specialist to verify that the installation is design compliant, with average lux levels measured recorded on "As Fitted" Installation Drawings, to be bound and handed over with Maintenance Manuals and Completion Certificates.

8.14.6 A Test/Commissioning Certificate in the format of the IS 3217: 2023 Model Form, must be submitted to the Engineer for all Emergency Lighting.

8.14.7 The Commissioning Certificate must include a drawing indicating all measured lux levels at commissioning stage is required, to demonstrate compliance with IS 3217: 2023. This shall be a requirement for practical completion.

9 Information and Communication Technology Cabling (Element 64)

9.1 Scope of Works

General

9.1.1 The Electrical Contractor shall include for the complete Cabling, Supply, Delivery, Installation, Testing and Commissioning of the Cat 6A U/UTP Euroclass Cca Information and Communication Technology Cabling Installation as indicated on the JVT Electrical Layouts, Architects Room Data Sheets and specified herein.

9.1.2 The Electrical Contractor shall engage an ICT Systems Specialist and shall co-ordinate all elements of the Installation in order to provide a complete System in accordance with the intent of this Specification to the satisfaction of the Engineer and Tipperary Courthouse & Bridewell ICT Engineer/s.

9.1.3 The ICT Systems Installation shall be carried in a thorough and conscientious manner according to Industry Standards and shall be subject to Inspection and Acceptance.

9.1.4 All ICT cabling shall be installed on new ELV Cable Tray and terminated in the new Comms Cabinet. All Works outside of the scope shall be included for "Out of Hours".

9.1.5 An appropriate Construction Schedule shall be developed by the Electrical Contractor for the Project and shall be subject to approval by the Main Contractor.

9.1.6 Prior to starting the Installation, the ICT Specialist, shall participate in a walk-through of the Project with the Engineer and the Tipperary Courthouse & Bridewell ICT Engineer to review the Engineering/Installation Documentation, verify that all Construction necessary for the Installation has been completed and verify all Installation Methods and Cable Routes.

9.2 Specialist Contractor

9.2.1 The ICT Specialist shall comply with the following minimum requirements, in order to demonstrate that they are a legitimate ICT Systems Specialist with the necessary properly trained in-house permanent Staff required to build a proper high-speed standards-compliant network.

9.2.2 The choice of ICT Specialist shall be approved in advance of Tender Submissions, by the Engineer;

- The ICT Specialist shall be in the Structured Cabling business for a period of 5 years and have experience with Category 6A products;
- The ICT Specialist shall have the proper Employers Liability and Public Liability in accordance with the Contract Form of Tender & Preliminaries;
- All Field Staff should be part of the TEEU;
- The Product must be as specified and well represented in Ireland;
- The Product must be independently tested by UL;

- The Warranty must be complete, unambiguous and give the Client the appropriate assurances;
- The ICT Specialist shall offer 5 References, from work carried with the specified product in the last 2 years;
- The ICT Specialist shall be required to produce evidence from the Manufacturer, that they are certified to install the specified product;
- The ICT Specialist shall have a current C2 tax certificate;
- The ICT Specialist shall demonstrate that they will not sublet the labour and that they carry sufficient permanent Staff to complete this Installation.

9.2.3 The ICT Systems Installation shall:-

- Support Analogue and Digital Applications, Data, Local Area Networks (LAN), and Video on a common cabling platform.

9.2.4 The Systems that shall be supported include, but are not limited to:-

- Data Processing - IBM (3270 Type A, System 34/36/38 and AS/400), Wang, Unisys, DEC;
- Data Communications - EIA-232-D, RS-422, RS-423, Ethernet (10GBase-T), Token Ring, Fibre Distributed Data Interface (FDDI), Twisted Pair Physical Media Dependant (TPPMD), Fast Ethernet, 10GBase-T, 100VGAnyLAN, ATM at 155Mbps and transmission speeds of 622Mbps, Gigabit Ethernet and 10 Gbps Ethernet
- Voice Applications – Analogue and Digital Voice, basic rate and primary rate ISDN;
- Video - Analogue Video, Digital Video, Video Conferencing, RGB Video and 550MHz Broadband Video.

9.2.5 The System must cover its capacity and functionality with minimum components and be flexible and capable of including new facilities or technologies as they become required or available.

9.2.6 The ICT Systems shall specifically support the applications and associated transmission distances described in the Industry Standards.

9.2.7 The ICT Specialist shall include for the completion of the entire Works, as described herein and on the accompanying Drawings, in accordance with the Programming of Work. They shall include for liaising with the Contractors and Project Manager on the completion for the programming of Works.

9.2.8 The ICT Specialist shall include for co-ordinating the Work as described herein and shall have regard for all other Works in progress during the installation of the ICT Cabling System.

9.2.9 The Specialist Contractor shall not put in hand any work under this Section without written approval of the Engineer.

9.2.10 The entire ICT Networks System must be provided with an end-to-end 'Link Performance' to comply with the ISO Specification for at least five years for all of the Current Applications described in ISO/IEC DIS 11801-1. Full details of support arrangements during the Warranty Period must be included in the Tender Documentation.

9.2.11 The ICT Specialist shall be required to produce Warranties and Guarantees in this regard.

9.2.12 Warranties shall include for the following:-

- Compliance with IEEE 802.3ac, EIA/TIA 568B CAT.6A, IS 11801 Class Ea and EN 50173: 2018 Standards;
- Independent UL tested system, no other lab is acceptable;
- Products and labour for replacement of Products (in the event of a problem);
- The Products must be manufactured by a single Manufacturer. No mix/match shall be allowed;
- The Warranty must cover full ‘channel’ and not just the ‘permanent link’;
- The Warranty must be issued by a Manufacturer and not a Contractor or a Distributor;
- The Warranty must provide full application assurance.

9.3 Standards & Regulations

- ANSI/TIA-568.0-E, Generic Telecommunications Cabling for Customer Premises, Ed. E, 2020;
- ANSI/TIA-568.1-E, Commercial Building Telecommunications Cabling Standard, Ed. E, 2020;
- ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard, Ed. C, Err. 04-2014;
- EN 28877: 1994 Information technology. Telecommunications and information exchange between systems. Interface connector and contact assignments for ISDN Basic Access Interface located at reference points S and T;
- EN 50173-20: 2020 Information technology. Generic cabling systems. General requirements;
- EN 50288-11-1:2012 Multi-element metallic cables used in analogue and digital communication and control. Sectional specification for un-screened cables characterised up to 500 MHz Horizontal and building backbone cables;
- ISO/IEC 14763-2: 2019 Information technology -- Implementation and operation of customer premises cabling -- Part 2: Planning and installation;
- ISO/IEC 11801:2017 Information technology -- Generic cabling for customer premises;
- TIA/EIA 568C Commercial Building cabling for telecommunications products and service;
- TIA/EIA 569 Pathways & Spaces Standard.

9.3.1 All Data Cables shall also be in compliance with EN 50575: 2014 + A1: 2016, "Power, control and communication cables. Cables for general applications in construction works subject to reaction to fire requirements". Euroclass Cca Cabling shall be installed throughout the installation.

9.4 General

9.4.1 The ICT Specialist shall be certain that all Installation Work Areas are secure and made safe in accordance with Health and Safety Regulations.

9.4.2 The ICT Specialist shall supply a Statement of Compliance that the System proposed meets the requirements of the EU Directives on EMC. This Statement should be backed by Test Documentation showing the compliance of the cabling system under stated test conditions. The recommended test networks are 100 Mbps TPPMD, 16Mbps Token Ring and 10Mbps 10GBase-T. EMC compliance should be provided as part of the Applications Assurance Warranty.

9.4.3 The Cabling Installation shall comply with ISO/IEC 14763-2: 2019, EN 50174-3: 2013 + A1 2017 and TIA/EIA 569. It shall also comply with the channel performance of the latest editions of TIA/EIA 568D, ISO/IEC 11801 2017 and EN50173-1:2018 Standard (or the Standard itself if ratified before Installation commences).

System Channel Performance

9.4.4 The solutions must focus on the performance of the channel as a whole, rather than the performance of individual components. The System as a whole should meet or exceed the following guaranteed channel performance values:-

Channel Performance Specifications												
Frequency (MHz)	1	4	8	10	16	20	25	3F/F1 .25	62.5	100	200	250
Insertion Loss (dB)	2.0	3.8	5.4	6.0	7.6	8.6	9.6	10.8	15.6	20.2	30.0	34.1
NEXT (dB)	78.7	69.0	64.2	62.6	59.2	57.6	56.0	54.4	49.4	45.9	40.8	39.1
ACR (dB)	76.6	65.2	58.8	56.6	51.6	49.1	46.4	43.6	33.7	25.7	10.8	5.0
PSNEXT (dB)	77.8	68.0	63.1	61.5	58.1	56.5	54.8	53.2	48.1	44.6	39.4	37.7
PSACR (dB)	75.8	64.2	57.7	55.5	50.4	47.9	45.2	42.4	32.4	24.3	9.4	3.5
ELFEXT (dB)	69.3	57.2	51.2	49.3	45.2	43.2	41.3	39.4	33.3	29.3	23.2	21.3
PSELFEXT (dB)	68.3	56.2	50.2	48.3	44.2	42.2	40.3	38.4	32.3	28.3	22.2	20.3
Return Loss (dB)	23.0	23.0	23.0	23.0	22.0	21.5	21.0	20.5	18.0	16.0	13.0	12.0
Delay (ns)	580	562	557	555	553	552	551	550	549	548	547	546
Delay Skew (ns)	30	30	30	30	30	30	30	30	30	30	30	30

9.5 Equipment

General

9.5.1 The ICT Specialist shall provide any necessary screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the ICT Distribution System.

9.5.2 It shall be the responsibility of the ICT Specialist to furnish any special installation equipment or tools necessary to properly complete the installation. This may include tools for terminating cables, testing and splicing equipment for copper/fibre cables, communication devices, jack stands for cable reels, or cable winches.

9.5.3 The ICT Specialist shall not roll or store cable reels without an appropriate underlay.

9.5.4 The Horizontal Subsystem provides connections from the cross-connect to the information outlets (IOs) in the Building. It consists of the horizontal transmission media, the associated connecting hardware terminating this media and IOs in the work area.

9.5.5 The type of horizontal cables used shall be 4-pair unshielded twisted pair (U/UTP), Category 6A LSZH. The type of cable used must be Low Smoke Zero Halogen. The CPR should meet a minimum Euroclass of Cca s1b d2 a2.

9.5.6 The cable shall be designed and constructed to give optimal electrical performance to the following Standards:-

- ISO/IEC 11801 Class EA, IEC 61156-5;
- EN 50173-1 and EN 50288-11-1;
- ANSI/TIA 568.2-D.

9.5.7 The cable shall supports 10GBASE-T and meets the design requirements of 802.11ac wireless. Recommended for PoE standards:-

- IEEE 802.3bt PoE Type 1 (15.4 Watts) formerly 802.3af;
- IEEE 802.3bt PoE Type 2 (30 Watts) formerly 802.3at;
- IEEE 802.3bt PoE Type 1 (15.4 Watts) formerly 802.3af;
- IEEE 802.3bt PoE Type 2 (30 Watts) formerly 802.3at;
- IEEE 802.3bt PoE Type 3 (60 Watts);
- IEEE 802.3bt PoE Type 4 (100 Watts);
- Cisco UPoE (60 Watts) ;
- Cisco UPoE+ (90 Watts) ;
- Power over HDBaseT™ PoH (95 Watts).

9.5.8 The Cable shall be able to support voice and data, to at least 1Gbps and shall have electrical performance specified out to 550MHz.

9.5.9 The horizontal cables shall be 4-pair unshielded twisted pair (U/UTP) cables and shall be of 24 AWG (0.51mm) solid copper conductors. The cables shall be PowerSum NEXT rated.

9.5.10 The 4 pair cables should be at minimum Independently Verified to be Category 6A by Underwriters Laboratories (UL).

9.5.11 The 4-pair UTP cable shall be run using a star topology format from the RJ45 Patch Panels in the new Comms to every individual information outlet.

9.5.12 The length of each individual run of horizontal cable from the Comms Cabinet to the information outlet shall not exceed 90 metres.

9.5.13 The ICT Specialist shall observe the bending radius and pulling strength requirements, given below, of the 4-pair U/UTP, cable during handling and installation:-

- Bending radius - 4 times the cable diameter;
- Maximum pulling tension - 11N.

9.5.14 The ICT Specialist shall ensure that the maximum pulling tensions, band radius, compression and pair un-twisting of the data cables are not exceeded at any time during the placement of facilities. Failure to follow the appropriate guidelines may require the ICT Specialist to provide the additional material and labour necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the ICT Specialist during the implementation.

9.5.15 Each run of cable between the patch panel and the information outlet shall be continuous without any joints or splices. If cables are damaged along the run of cable then they must be removed and replaced with new cable.

9.5.16 The ICT Specialist must make every effort to physically protect the data cable, before, during and after installation. Particular attention to ensure that the cable is not snagged, knotted, kinked, stretched, walked upon, or damaged in any other way, either before or during installation. If any cables are snagged during the installation and the other sheaths are damaged, the ICT Specialist will be required to replace these cables in full, no cable joints are allowed on the cabling.

9.5.17 The incoming cables will have all 4-Pairs terminated at both patch panel and outlet in accordance with the TIA/EIA 568B specification. To maintain transmission performance of the cabling system the twists in the cabling must be maintained as close to the point of termination with a maximum untwist of 13mm from the point of termination. The Contractor should also ensure that if introducing twists back into the wiring then only one twist may be performed. The stripping of the cable sheath will be limited to the minimum amount required for a successful termination. Contractors shall design the system such that sufficient slack remains to enable re-termination of the outlets a minimum of twice and a limited scope for movement of the cabinets. Coils of excess cables are unacceptable.

9.5.18 The ICT Specialist shall place cabling in the newly installed, distribution media.

9.5.19 Pull boxes shall be used for the following purposes:-

- Fishing the conduit run;
- Pulling the cable to the box and then looping the cable to be pulled into the next length of conduit.

9.5.20 A pull box shall, therefore, be placed in a conduit run where:-

- The length exceeds 30m;
- There are more than two 90° bends;
- If there is a reverse bend in the run.

Information Outlet

9.5.21 All UTP Cat 6A Information Outlets shall be of EN 60603-7: 2020 and EN 28877: 1994, ISO/IEC 8877:1992 8-position modular MGS600 connectors and of the insulation displacement type. They shall be capable of receiving of 23 AWG solid and stranded wires.

9.5.22 The Information Outlet shall be flush mounted in appropriate face plate.

9.5.23 The RJ45 information outlet shall be multivendor supportive and shall be wired in an EIA/TIA 568D configuration.

9.5.24 The RJ45 information outlet shall meet or exceed the Category 6A requirements of the EIA/TIA 568-D, ISO/IEC 11801: 2017 and EN 50173 Standards.

RJ45 Patch Panels

9.5.25 New Patch Panels shall be installed in the new Comms Cabinet. New patch panels are to be approved by the Engineer/ICT Services Engineer prior to installation

9.5.26 The RJ45 Patch Panel shall be able to accommodate UTP 23 AWG (0.51 mm) stranded and solid cable conductors. The Panels shall meet or exceed the EIA/TIA 568-D, ISO/IEC 11801: 2017 and EN 50173 Category 6A standards. 24 port (1U) shall be selected.

9.5.27 The modular RJ45 patch panels must have patch cord routing incorporated (1 patch cord routing trough for every 24 ports).

9.5.28 Cables shall be terminated in RJ45 19" Patch Panels. Panels and terminations shall adhere to ISO/IEC 11801 Ed 2.1/TIA -568-C.2 and should be 48 way. A cable management system shall be installed for every patch panel inserted to ensure correct installation of the patch panel cable.

9.5.29 At a minimum the cable, connection components and installation techniques must adhere to ISO/IEC 11801. To ensure the maximum impedance compatibility between components all items such as Cable, Patch Leads, Faceplates and Patch Panels must be from the same Manufacturer.

9.5.30 Patch cables shall also adhere to ISO/IEC 11801 2017/TIA -568-C.2. Two patch cables should be supplied for each point installed.

9.5.31 200% 3m Category 6A patch cords must be provided for each port.

9.5.32 Method Statements for these Works must be submitted to ICT Engineer prior to any of these ICT Cabling Installation Works being carried.

9.5.33 The ICT Specialist shall also include in this Tender for all ICT Cable Terminations.

9.6 Patch Cords

9.6.1 The System shall be completed with high grade Patch Cords and Connectors to UTP Category 6A Standard.

9.6.2 Patch Cords shall support FDDI/TPDDI and Data Speeds of 1000Mb/Sec.

9.6.3 The ICT Specialist shall include for Patch Cords and device cables as follows:-

- 1 metre RJ45-RJ45 Category 6A 4-Pair Patch Cords – 400% of total points;
- 3 metre RJ45-RJ45 Category 6A 4-Pair Device Leads – 66% of total points.

9.7 Wiring & Installation

9.7.1 The Contractor shall maintain conductor polarity (tip and ring) identification at the Comms Cupboard, splice enclosures encapsulations and station connecting blocks in accordance with industry practices.

9.7.2 The ICT Specialist shall not place any distribution cabling immediately alongside power cables or share the same conduit or channel with any electrical apparatus.

9.7.3 To maintain transmission performance of the ICT Cabling System the twists in the Cabling must be maintained as close to the point of termination with a maximum untwist of 13mm from the point of termination. The ICT Specialist should also ensure that if introducing twists back into the wiring then only one twist may be performed.

9.7.4 The stripping of the Cable Sheath shall be limited to the minimum amount required for a successful termination.

9.7.5 The number of cables in each conduit shall be controlled to allow for future cable installation and to stay within the manufacturer's maximum allowable cable pulling tension.

9.7.6 The Contractor shall satisfy himself that the cable can be installed without excessive force on the cable. Cable pulling tension shall not exceed the manufacturer's limits. The cable pulling tension shall be applied smoothly without jerks and at no time shall it exceed the manufacturer's limits. The pulling equipment shall be arranged either to indicate the pulling tension, which shall be continually monitored during a pull, or shall be mechanically assured that the maximum permissible tension is not exceeded. Curvature of cables (bend radius) shall not exceed that permitted by the manufacturer. Usually this is 4 times the diameter of the cable, but the manufacturer's permitted tolerances should be followed.

9.7.7 The Electrical Contractor shall plug conduits and entrance holes where the cabling has been installed in the Comms Cabinet with re-ununtterable duct seal or flame retardant putty.

9.7.8 The Electrical Contractor shall be responsible for providing an approved ground at all newly installed distribution frames and protector locations insuring proper bonding to any existing facilities.

9.7.9 The Electrical Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate Cabling, Closures, Cabinets, Service Boxes and Framework.

9.7.10 All Grounds shall consist of appropriate gauge copper wire and shall be supplied from an approved Building Ground and bonded to the Main Electrical Ground.

9.7.11 The ICT Specialist shall include for fishing cables through conduits and trunking throughout. All cable trays and conduits shall be supplied and fixed by others prior to the installation of data cables.

9.8 Testing & Commissioning

General

9.8.1 The ICT Specialist shall be responsible for labelling all cables and cords, distribution frames and outlet locations, according to Industry Standards. Labels should be computer generated or typewritten.

9.8.2 All cable plant installed by the ICT Specialist shall be fully tested for continuity polarity reversals, wire transpositions, AC and DC Voltages open and shorts prior to acceptance. All cable pair faults (other than factory) shall be cleared by the ICT Specialist.

9.8.3 The ICT Specialist shall be responsible for testing all cable prior to the installation of the cable.

9.8.4 Testing of wiring shall be performed prior to any devices being connected to the network. 100 percent of the Cat6A cabling shall be tested for conformance to the specifications of TIA/EIA-568-B Category 6A using a level 3 test meter. The installer must provide copies of all test results in an electronic readable format, on a USB with the following details included, Site, Installation Technician and Date of Test. One full page of detailed test results per data outlet is required. It will not be sufficient to show a data outlet number and a test status of pass for that particular outlet. The ICT Specialist should supply two copies of the test results. As a minimum all UTP cable must be tested to assess conformance with the following:-

(i) Continuity
(ii) Wire map
(iii) Attenuation
(iv) Cable length
(v) NEXT
(vi) PSNEXT
(vii) ELFEXT
(viii) PSELFEXT
(ix) Return Loss

9.8.5 All cables must be tested using a Fluke DSP400 Digital Cable Analyser or an equivalent cable analyser. All test results must be recorded and supplied to the Client.

9.8.6 If the ICT Specialist fails to perform this testing operation, the ICT Specialist shall accept the cable as good and assume all liability for the replacement of the cable should it be found defective at a later date.

9.8.7 After completion of 100% of cabling shall be tested independently. The purpose of this testing will be to verify that the as installed cable meets all the requirements for CAT 6A cabling. A 100 % pass rate of all cabling is required before customer acceptance of the cabling system takes place. If at this stage a 100% pass rate is not achieved then the Installation Contractor will be instructed to retest the entire installation.

9.8.8 At the conclusion of the installation and final testing a preliminary walk through with the ICT Specialist will be performed to check for installation quality, accurate performance of the work, and to verify completed drawings. Any modifications to the documentation or the installation that may be required shall be accomplished within a two (2) week period. “Customer Acceptance” does not release the ICT Specialist from repairing any cabling errors or improperly labelled circuits, caused by the ICT Specialist, which may be discovered at a later date.

9.8.9 On completion of the cable installation, termination, labelling and testing, the Installation Contractor responsible for the Installation must provide the Floor Plans showing locations of all outlets with their outlet numbers. A final inspection will take place involving both ICT engineer and the Specialist, where this documentation can be handed over. This inspection does not release the Contractor from any cabling or labelling errors, caused by the Specialist which may be discovered at a later date.

Cable Identification and Labelling

9.8.10 All Labelling shall confirm to the agreed labelling and identification standards.

9.8.11 The ICT Specialist shall also include for slip-over ferrule type numbers to be fitted to each with the exception of cables terminating at rear of Information Outlets. Numbering will consist of a four-digit system.

9.8.12 Labelling of Information Outlets may be glued to the face of each plate using “super glue”. Labels shall be “traffolyte” or a similar engraved type.

Port Plans

9.8.13 The ICT Specialist shall include for maintaining an accurate detailed record of the Works as they progress.

9.8.14 The ICT Specialist shall include for supplying copies of ‘As-Installed’ Port Plans upon completio.

9.8.15 Drawings shall be in AutoCAD and dwf form and shall be submitted to the Engineer/ICT Services Engineer as directed.

Punchdown, Testing and Commissioning

9.8.16 The ICT Specialist shall be responsible for punch-down at each end of each the Data Cable, together with testing and commissioning to current requirements and for Warranty purposes. All cables shall be 100% continuity tested with results recorded on disc in Excel and pdf format.

9.8.17 All Circuits shall be tested with an approval proprietary tester and all results shall be recorded in tabular form for the Client.

9.8.18 The ICT Specialist shall provide the Engineer with three copies of Operating and Maintenance Manuals consisting generally of As-Installed Drawings, Hardware Manuals, Test Sheets, Port Plans, Certification and Warranty (hard and soft copy).

9.8.19 The Installation shall be fully tested (i.e. 100% of all cables) to comply with ISO/IEC 11801 Ed 2.1/TIA -568-C.2, TIA/EIA 568A IEEE 802.3an, EIA/TIA 568-C, IS 11801 Class Cca s1b d2 a2 and EN 50173 to Category 6A limits.

9.8.20 Cables that fail the test must be replaced. The Engineer reserves the right witness some or all of the testing

9.8.21 The ICT Specialist shall include for detailed hand-over Documentation to include:-

- Product Warranty – 2 Copies
- Test Results on USB – 2 Copies
- Test Results on Hard-Copy – 2 Copies
- Labelling Drawings and Details – 2 Copies
- As-Installed Drawings on USB – 2 Copies
- As-Installed Drawings on Hard Copy – 2 Copies
- Contact Telephone Numbers for Emergency Situations – 2 Copies.

9.9 Wi-Fi Wired Network Specification

9.9.1 A Wi-Fi network to provide resilient 802.11b/g/n/ac Wi-Fi connectivity shall be provided.

9.9.2 The Wi-Fi Network shall include for the full Cabling installation and commissioning acceptance testing and documentation.

9.9.3 The Wi-Fi solution shall conform to all industry Wi-Fi Standards up to and including 802.11ac support.

9.9.4 Roaming between Access Points shall be seamless and shall not cause any loss of session for Users who are moving within each of the Wi-Fi Network Zones.

9.10 Mandatory Minimum Structured Cabling Requirements

General

9.10.1 Before the commencement of a Project, a meeting MUST be convened between the Engineers/Client, the Building Contractor's Mechanical & Electrical Coordinator and the Electrical Contractor's appointed ICT Specialist at which all aspects of the installation shall be discussed and agreed.

9.10.2 In addition to work locations, the following locations should be cabled with a minimum of 2 RJ45 outlets – Entrance doors where magnetic locking systems will be deployed, locations where Camera Surveillance Cameras will be installed, central printing locations and wireless network access-point drop.

9.10.3 The installation workmanship MUST be guaranteed for at least 12 months after commissioning.

9.10.4 The installation MUST be certified by the ICT Specialist and/or the Systems Provider for at least 25 years. All details of such guarantees and certification ought to be sought from the Tenderers prior to the award of any Contract.

Cabling Standards

9.10.5 The cable length from faceplate outlet to patch-panel must not exceed 85m.

9.10.6 2m of slack should be provided where on all cabling terminations at the Cabinet/Rack

9.10.7 The bend radius of a cable must not be greater than 4 times the cable diameter.

9.10.8 The installer must be fully conversant with TIA/EIA 568B as improper handling of the cable at pulling-in stage can result in failure of the cable to meet the required specification. Written Confirmation in this regard shall be required.

9.10.9 Where cable is being installed into cabinets/racks, cable-tray should be fitted to the cabinet/rack to accommodate the cable which should be cable-tied in groups of twelve.

9.10.10 The cabling should be run along the side of the rack so as not to hinder subsequent installation of active network equipment.

9.10.11 Cabling should always be presented in a tidy manner.

9.10.12 Trunking and cableways must be sized to 2.5 times the requirement of the current installation, i.e. if current installation is 2 cables then cableways must be sized for 5 cables.

9.10.13 Cables must not be loomed in numbers greater than 25.

9.10.14 Cables must not be tied to power cables or run along the same conduits or ducts or run through the same connection box.

9.10.15 Cabling within structured desks must be separated from the power cabling as described in the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

9.10.16 Cables should be fixed in straight parallel runs and should be held in place by broad cable ties at not more than 600mm centres on horizontal trays and 300mm on vertical trays.

9.10.17 Each group of 12 cables should be fed through the cabinets/racks along cable-trays as described above before being brought out for termination at the rear of the passive patch-panels. All passive patch-panels should have strain relief bars fitted onto which the cables should be cable tied.

9.10.18 All terminations should be performed using tools approved by the vendor of the product being used. The ICT Specialist should provide details of the vendor name and the part numbers of the termination tools proposed before commencing termination of the cabling.

9.10.19 The maximum unsupported cable length shall be 300mm. Suitable unistrut, tray supports and tray bends should be installed as required. All support steelwork should be suitably earthed. Installed cable shall take the shortest route consistent with the usage of the containment system and defined routes, and shall not, unless specified, contain length in excess of the distance required. All cables on trays which cross service pipes carrying hot or refrigerant fluids shall be protected from excessive high or low temperatures or condensation. This may require separation and/or thermal insulation.

9.10.20 Cables shall be kept clear of fire suppression outlets, heat and smoke detectors and water detector strips.

9.10.21 Installed cables shall not be laid where they may be subject to vibration or movement.

9.10.22 Cable bundles shall not be run over hard or sharp edges such as the edges of trays. Particular care shall be taken that cables are not laid on tray bridges, or other features, that present sharp or small radius edges to the cables. Cables shall leave trays at right angles and shall be suitably cable tied and dressed. Where basket tray is installed, cables shall exit through the bottom or side of the tray. Cable exits shall be strictly controlled such that additional cables can be easily and neatly added to trays in the future. Cables shall be installed to use the minimum of the tray width. Cables shall not be stacked higher than 50mm on basket trays at any location. Cables shall not be stacked higher than 150mm on smooth surfaces. The manufacturer's recommendations are not to be exceeded.

9.10.23 Network cables shall be run in separate compartments of trunking, (i.e. this means either the top or bottom compartments of 3 way trunking when specified), the cable only enters the central compartment when entering the back-box where terminations take place. Trunking compartments shall be no more than 50% full to allow for future installation of cables. Cables shall enter and exit trunking via bridges to ensure complete separation between communications and power compartments.

9.10.24 If cables are damaged along the run of cable then they must be removed and replaced with new cable. Each patch panel and outlet will be labelled with black labels on a white background; each outlet will have an individual number with cabinet no., patch-panel no. and outlet number on it.

10 Protective Services (Element 67) Security Services

10.1 Extent of Works

10.1.1 The Works covered in this Section shall include the following:-

- Security IP Camera Surveillance System;
- Intrusion Alarm System Installation.

10.1.2 Structured Cabling Standards for all IP Systems as listed previously in this Document shall apply.

10.2 Camera Surveillance System

General

10.2.1 The Electrical Contractor shall include for the complete Supply, Delivery, Installation, Cabling, Commissioning, Testing and Setting to Work of an IP Camera Surveillance System to provide Camera Surveillance and Network Recording within and around the Tipperary Courthouse & Bridewell.

10.2.2 All Cabling Containment and Patch Panels shall be provided to cater for same. The existing Camera Surveillance Racks are located in Switchroom Two.

10.3 Surveillance Cameras

10.3.1 Internal Cameras shall be specified with all necessary hardware and data cable connections.

10.3.2 Dedicated Patch Panels and POE Switches within the existing Communications Room shall be provided for integration of the new Camera Surveillance System.

10.3.3 The entire Camera Surveillance System Installation shall comply with EN 62676 and EN 62676-4: 2015 Alarm Systems- CCTV Surveillance Systems for use in Security Applications.

10.3.4 All Cabling shall be installed in keeping with the best practices of the Trade and in accordance with the European Standards for Camera Surveillance (EN 62676).

10.3.5 The Camera shall be of Manufacturer's official product line, designed for commercial 24/7/365 use.

10.3.6 The Camera shall be based upon standard components and proven technology using open and published protocols.

10.3.7 Each Camera included in the design shall be selected to be appropriate for the specific location in which it is to be used and it shall be the Specialist's responsibility to ensure that the proposed cameras are able to operate to the required operational standard and in the prevailing lighting conditions on Site. The Camera proposed shall have sufficient dynamic range to be able to operate, producing the required images in the prevailing lighting conditions on Site and in all weather conditions.

10.3.8 The Camera Lens shall have sufficient focal length adjustment to enable the Client's precise field of view requirement to be attained at the time of commissioning.

10.3.9 The Camera Lens shall be of sufficient quality to provide undistorted, in-focus images of the entire scene both in daylight and at night.

10.3.10 The Camera shall operate with sufficient shutter speed at low light to ensure that motion blur is minimized under typical lighting conditions.

10.3.11 The Camera shall be manufactured in accordance with ISO 14001: 2015.

10.3.12 The Camera Surveillance Equipment shall be compliant with the EU Directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).

10.3.13 The Camera Surveillance Equipment shall be compliant with the EU Regulation 1907/2006 (REACH).

10.3.14 The Camera shall be PVC free in accordance with IEC 61249-2-21: 2003.

10.3.15 The Camera Surveillance System shall consist of the following components:-

- Internal Static IP Cameras;
- External Static IP Cameras;
- Patch Panels;
- POE Switches;
- 3 years Parts and Labour Guarantee on all Equipment.

10.3.16 The Camera shall carry the following EMC Approvals:-

- EN 55032: 2015 Class A, EN 55035: 2017, EN 61000-6-1: 2017, EN 61000-6-2: 2005;
- FCC Part 15 - Subpart B Class A;
- VCCI Class A;
- RCM AS/NZS CISPR 32 Class A;
- ICES-003 Class A;
- KCC KN32 Class A, KN35.

10.3.17 The Camera shall meet the IEC/EN/UL 62368-1: 2014 and IEC/EN/UL 60950-22: 2016 Product Safety Standards.

10.3.18 The Camera shall meet relevant parts of SMPTE 296M (HDTV 720p) and SMPTE 274M (HDTV 1080p) Video Standards.

10.3.19 The Camera shall meet the following Standards:-

- MPEG-4:

  a) ISO/IEC 14496-10 Advanced Video Coding (H.264).

- Networking:

  a) IEEE 802.3af/802.3at (Power over Ethernet);
  b) IEEE 802.1X (Authentication);
  c) IPv4 (RFC 791);
  d) IPv6 (RFC 2460);

e) QoS – DiffServ (RFC 2475).

- Mechanical Environment:

a) EN 60529:1992 + A2: 2013 IP66 for External Cameras;
b) EN 60529:1992 + A2: 2013 IP52 for Internal Cameras;
c) NEMA 250 Type 4X for External Camera;
d) IEC/EN 62262 IK10 for External Cameras and IK08 for Internal Cameras;
e) IEC 60068-2-6: 2007;
f) IEC 60068-2-27: 2008.

10.3.20 Cameras shall be IP-based and comply with established network and video standards.

10.3.21 Cameras shall be powered by the switch utilizing the network cable.

10.3.22 All Cameras shall be supplied by a single Camera Manufacturer Video Surveillance System.

10.3.23 The Camera shall support video resolutions including:-

- 1920x1080 (HDTV 1080p);
- 1280x720 (HDTV 720p).

10.3.24 The Camera shall provide both landscape format (4:3 and 16:9 aspect ratio) as well as corridor format (3:4 and 9:16 aspect ratio).

10.3.25 The Camera shall support the following video encoding algorithms:-

- Motion JPEG encoding in a selectable range from 1 up to 25/30 frames per second in all resolutions;
- Baseline Profile H.264 encoding with motion estimation in up to 25/30 frames per second;
- Main Profile H.264 encoding with motion estimation and context-adaptive binary arithmetic coding (CABAC) in up to 25/30 frames per second;
- Support High Profile H.264 encoding with motion estimation up to 25/30 frames per second and with automatic scene adaptive bitrate control in up to 25/30 frames per second.

10.3.26 The Camera shall provide independently configured simultaneous H.264 and Motion JPEG streams.

10.3.27 The Camera shall in H.264 support Variable Bit Rate (VBR) for video quality adapted to scene content. To protect the network from unexpected bit rate speaks the camera shall support Constant Bit Rate (CBR) or Maximum Bit Rate (MBR).

10.3.28 The Camera shall provide configurable compression levels.

10.3.29 The Camera shall support standard baseline profile H.264 with motion estimation.

10.3.30 The Camera shall support motion estimation in H.264/MPEG-4 Part 10/AVC.

10.3.31 The Camera shall allow for video to be transported over:-

- HTTP (Unicast);
- HTTPS (Unicast);
- RTP (Unicast & Multicast);
- RTP over RTSP (Unicast);
- RTP over RTSP over HTTP (Unicast).

10.3.32 The Camera shall support Quality of Service (QoS) to be able to prioritize traffic.

10.3.33 All External Cameras shall support two-way full duplex audio:-

- Input sources:-
  a) External microphone;
  b) External line device.
- Output sources:-
  a) External line device.

10.3.34 The Camera shall support:-

- AAC LC 8/16/32/48 kHz;
- G.711 PCM 8 kHz;
- G.726 ADPCM 8 kHz;
- Opus 8/16/48 kHz;
- LPCM 8/16/32/48 kHz.

10.3.35 The Camera shall contain a built-in web server making video and configuration available to multiple clients in a standard operating system and browser environment using HTTP, without the need for additional software.

10.3.36 The Camera shall support both fixed IP addresses and dynamically assigned IP addresses provided by a Dynamic Host Control Protocol (DHCP) Server.

10.3.37 The Camera shall allow for automatic detection of the Camera based on UPnP and Bonjour when using a PC with an operating system supporting this feature.

10.3.38 The Camera shall provide support for both IPv4 and IPv6.

10.3.39 The Camera shall be equipped with an integrated event functionality, which can be trigged by:-

- Video Motion Detection;
- Audio Detection;
- Live Stream Accessed;
- Camera Tampering;
- Manual Trigger/Virtual Inputs;
- Open Casing;
- External Input;
- Embedded Third Party Applications;
- Edge Storage Disruption Detection;
- Shock Detected.

10.3.40 The Response to a triggered event shall include:-

- Send notification, using HTTP, HTTPS, TCP, SNMP trap or email;
- Send images, using UTP, HTTP, HTTPS, network share or email;
- Send video clip, using UTP, HTTP, HTTPS, network share or email;
- Send SNMP trap message;
- Recording to local storage and/or network attached storage;
- Activating external output;
- Play audio clip;
- Wide Dynamic Range Mode.

10.3.41 The Camera shall provide memory for pre and post alarm recordings.

10.3.42 The Camera shall support continuous and event controlled recording to:-

- Local memory added to the cameras microSD-card slot;
- The Camera shall incorporate encryption functionality for the microSD card;
- Network attached storage, located on the local network.

10.3.43 The Camera shall be able to detect and notify Edge storage disruptions.

10.3.44 The Camera shall incorporate support for at least IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, TCP, ICMP, SNMPv1/v2c/v3 (MIB-II), RTSP, RTP, UDP, IGMP, RTCP, SMTP, UTP, DHCP, UPnP, ARP, DNS, DynDNS, SOCKS, SSH, NTP, CIFS/SMB, Bonjour.

10.3.45 The SMTP implementation shall include support for SMTP authentication.

10.3.46 The Camera shall:-

- Provide embedded on-screen text with support for date & time, and a customer-specific text, camera name, of at least 45 ASCII characters;
- Provide the ability to apply privacy masks to the image;
- Allow for the overlay of a graphical image, such as a logotype, into the image.

10.3.47 The Camera shall support the use of HTTPS and SSL/TLS, providing the ability to upload signed certificates to encrypt and secure authentication and communication of both administration data and video streams.

10.3.48 The Camera shall provide support for restricting access to pre-defined IP addresses only, so-called IP address filtering.

10.3.49 The Camera shall restrict access to the built-in web server by usernames and passwords at three different levels.

10.3.50 The Camera shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for the integration of functionality into third party applications.

10.3.51 The Camera shall conform to ONVIF profile G and ONVIF profile S as defined by the ONVIF Organization.

10.3.52 The Camera shall be supplied with Windows-based Management Software which allows the assignment of IP addresses, upgrade of firmware and backup of the Cameras' configuration.

10.3.53 The Camera shall support the use of SNMP-based management tools according to SNMP v1, 2c & 3 / MIB-II.

10.3.54 The Camera shall allow updates of the software (firmware) over the Network, using UTP or HTTP.

10.3.55 The Camera shall provide the ability to perform back focus adjustment remotely from the Product's Web Interface.

10.3.56 The Camera shall provide focus assistant functionality.

10.3.57 The Camera shall provide the ability to apply a rectangle of customer-defined number of pixels to the image, which can be used as a pixel counter identifying the size of objects in number of pixels.

10.3.58 The Camera shall accept external time synchronization from an NTP (Network Time Protocol) Server.

10.3.59 The Camera shall store all customer-specific settings in a non-volatile memory that shall not be lost during power cuts or soft reset.

10.3.60 The Camera shall provide a log file, containing information about all Users connecting to the unit since the unit's latest restart. The file shall include information about the connecting IP addresses and the time of connecting.

10.3.61 The Camera shall provide a connection list of all currently connected viewers. The file shall include information about connecting IP address, time of connecting and the type of stream accessed.

10.3.62 The Camera shall be equipped with LEDs, capable of providing visible status information. LEDs shall indicate the camera's operational status and provide information about power, communication with receiver, the network status and the Camera status.

10.3.63 The Camera shall be monitored by a Watchdog functionality, which shall automatically re-initiate processes or restart the unit if a malfunction is detected.

10.3.64 The Camera shall send a notification when the unit has re-booted and all services are initialized.

10.3.65 The Camera shall be equipped with one 100BASE-TX Fast Ethernet-port, using a standard male RJ45 connector and shall support auto negotiation of network speed (100 MBit/s and 10 MBit/s) and transfer mode (full and half duplex).

10.3.66 The Camera shall be equipped with one RS-485/422 serial port.

10.3.67 The Camera shall be equipped with two configurable I/O ports, accessible via a removable terminal block. These inputs/outputs shall be configurable to respond to normally open (NO) or normally closed (NC) dry contacts. The output shall be able to provide 12 V DC, 50 mA.

10.3.68 The Camera shall be equipped with one 3.5 mm jack for line/mic input and one 3.5 mm jack for line output.

10.3.69 All External Cameras shall be manufactured with an IP66 and NEMA 4X-rated, IK10 impact-resistant polymer enclosure.

10.3.70 The Camera shall be Power over Ethernet IEEE 802.3af/802.3at Type 1 Class 2.

10.3.71 All Cameras shall be suitable for day/night operation, capable of producing detection grade images of people standing/running/walking as well as vehicles – make, model, colour, direction- stationary/moving.

10.3.72 Internal Cameras installed in any Areas where Lighting PIRs are installed shall have wide dynamic range and work well in areas where there are fluctuations in lighting levels.

10.3.73 The Internal Cameras shall adopt HDTVI Technology, have OSD Menu, 3D DNR, Smart IR and be internal dome vandal resistant Cameras.

10.3.74 All fixings, fasteners, brackets, supports, columns and ancillary hardware shall be manufactured from non-corroding materials and shall be guaranteed against corrosion for a minimum of three years.

10.3.75 All Internal Cameras shall be a fixed Dome Network Camera providing HDTV 1080p video. The Camera shall have a varifocal lens with P-Iris control for optimal clarity and depth of field and day/night functionality. The Camera shall be equipped with wide dynamic range ensuring all details are captured in both dark and bright areas and handle scenes with strong light variations having exceptional light sensitivity to provide outstanding video quality in both strong and poor light conditions.

10.3.76 The Internal Camera shall be Progressive Scan RGB CMOS 1/3" with Varifocal, 3.0–10.5 mm, F1.4; Horizontal field of view: 92°–34°;Vertical field of view: 50°–20°and remote focus and zoom, P-Iris control, IR corrected.

10.3.77 The External Cameras shall adopt HDTVI Technology, have OSD Menu, 3D DNR, Smart IR and be External IP66 Static Vandal Resistant.

10.3.78 All External Cameras shall be a fixed Dome Network Camera providing HDTV 1080p video. The Camera shall have a varifocal lens and remote zoom and focus to eliminate the need for hands-on free tuning. The Camera shall be equipped with wide dynamic range ensuring all details are captured in both dark and bright areas and handle scenes with strong light variations having exceptional light sensitivity to provide outstanding video quality in both strong and poor light conditions.

10.3.79 The Camera Housings selected must be appropriate to the location, providing suitable protection against environmental conditions, as well as providing an appropriate level of resistance against vandalism. Aesthetic requirements shall be taken into account regarding the housing style and colour.

10.3.80 All External Cameras shall be Progressive Scan RGB CMOS 1/3", Varifocal, 3.0–10.5 mm, F1.4; Horizontal field of view: 92°–34°; Vertical field of view: 50°–20°and remote focus and zoom, P-Iris control, IR corrected.

10.3.81 All connections shall be mounted at high level to resist unwarranted interference.

10.4 Cyber Security

10.4.1 In order to support the lifetime Cyber Security Process for this Specification, only Cameras from the Supplier with the Firmware are allowed.

10.4.2 No OEM or ODM products shall be approved as part of the Installation of the Security System unless a detailed risk process is included to demonstrate how any critical vulnerabilities that may be identified in the future are addressed.

10.4.3 The Specialist shall follow Network Security best practices, based on a standardized framework (NIST, ISO, SANS) and the Manufacturer's cyber hardening recommendations.

10.4.4 Manufacturers/Vendors must be Cyber Essentials plus certified.

10.4.5 Manufacturers shall have a documented and communicated vulnerability policy detailing how it manages and responds to security vulnerabilities and how this is communicated to the Market.

10.4.6 Connected Devices must not communicate with any 3rd Party Server outside the Network, except for explicitly approved connections. Core network services (DHCP, DNS, NTP, etc.) shall be expected to be provided within the Network.

10.4.7 Connected Devices shall not include any hardcoded credentials ("backdoors").

10.4.8 Connected Devices shall support the use of HTTPS and SSL/TLS, providing the ability to upload signed certificates to encrypt and secure authentication and communication of both administration data and video streams.

10.4.9 Devices must be HTTPS from start, have a password strength indicator, password prompts.

10.4.10 Connected Devices must support individual Client Certificates (802.1X) and Server Certificates (HTTPS).

10.4.11 Connected Devices shall provide support for restricting access to pre-defined IP addresses only, i.e. IP address filtering.

10.4.12 Vendors and Manufacturers must provide a Security Advisors Policy/ Notification Service. This should be an opt-in facility that can sit outside of any existing Customer/Partner Programs etc.

10.4.13 The Manufacturer shall offer LTS (Long Term Support) Firmware, including only stability, performance and security patches. The LTS Firmware shall be maintained up to 10 years from when the device was introduced to the Market.

10.4.14 LTS Support should retain integrations with other third parties related to original firmware version.

10.4.15 The Device Manufacturer must have defined and transparent vulnerability management process including vulnerability policy, contact information, firmware patching, security advisory (vulnerability disclosure) and notification.

10.5 Security Specialist

10.5.1 The Security Specialist installing the Camera Surveillance System must meet with the following minimum requirements:-

- Hold a valid PSA Licence;
- Certified to PSA 2006_12 Requirements for Camera Surveillance Installations;
- Certified to S.R. 40:2005;
- Certified Quality Management System to I.S. EN ISO 9001:2015;
- Member of the Irish Security Industry Association;
- Platinum Partner Milestone.

10.5.2 All installation, configuration, setup, program and related work shall be performed by technicians thoroughly trained by the Manufacturer in the installation and service of the Equipment provided.

10.5.3 The Security Specialist shall submit credentials of completed Manufacturer Certification, verified by a third party organization, as proof of the knowledge.

10.6 Maintenance and Warranty

10.6.1 All Camera Surveillance components and labour furnished by the Specialist including wiring, software, hardware and custom parts shall be fully warranted for parts, materials, labour and travel expenses for a minimum of three years from date of the final acceptance of the Camera Surveillance System.

10.6.2 It will be the responsibility of each Tendering Company to allow onsite induction of all Staff undertaking Maintenance, Service and Installation Works at their own cost.

10.6.3 The Electrical Contractor/Camera Surveillance System Specialist shall be entirely responsible for the maintenance for the Camera Surveillance System during the Defects Liability Period.

10.7 Wiring and Installation

10.7.1 The Electrical Contractor shall include for all cabling to the internal and external cameras. Signal wiring must be RG-45 UTP shielded cable from the existing Security cabinet located in Switchroom Two.

10.7.2 All Equipment shall be tested and configured in accordance with instructions provided by the Manufacturer prior to installation.

10.7.3 All firmware found in Products shall be the latest and most up-to-date provided by the Manufacturer, or of a version as specified by the Provider of the Video Management Application (VMA).

10.7.4 All Equipment requiring Users to log on using a password shall be configured with user/site-specific password/passwords. No System/Product default passwords shall be allowed.

10.8 Testing and Commissioning

10.8.1 The Electrical Contractor shall include for the Camera Surveillance System to be supplied and installed and certified to Standard EN 62676-4: 2015.

10.8.2 2 No. separate 2 hour demonstrations shall be required, in addition to full system validation.

10.8.3 The Security Specialist shall include for set up and commissioning of all of the Equipment, and for demonstrating the completed system to the Maintenance Staff. The demonstration shall include a testing of the full functions of each of the Cameras, recording and playback of events and selecting of monitor inputs.

10.8.4 Cameras, Equipment and Monitors shall be clearly labelled using plastic traffolyte permanent labels, and the System shall be programmed and labelled on the Screens to match the component labels.

10.8.5 The Electrical Contractor shall include for 3 years warranty and 12 months maintenance of the completed System, to commence on the date of handover of the Camera Surveillance System to the Client. Maintenance shall include 3 visits per year to adjust camera and recorder settings. Record Documents for the Client shall include Floor Plans showing the location and reference number of each Camera.

10.9 Intrusion Alarm System Installation

Extent of Works

10.9.1 The Electrical Contractor shall include for the Supply, Installation, Connecting, Cabling, Testing, Commissioning and Handover of a complete Intruder Alarm System as indicated on the Electrical Drawings and as described in this Specification.

10.9.2 The Electrical Contactor shall include for this Work and all necessary Attendances, including but not limited to conduits and cable containments.

Description of Works

10.9.3 The proposed Intruder Works shall generally comprise of the following Intruder Alarm Equipment:-

- Modification of existing system;
- Magnetic Contacts;

10.9.4 All External Perimeter Doors shall be fitted with recessed magnetic reed contacts which shall be monitored by the Intruder Alarm System. All Intruder Alarm Equipment to be recessed in doors.

10.9.5 Monitored door alarms shall be required on all egress doors (as opposed to local alarms).

10.9.6 The Intruder Alarm Controller shall be capable of storing 10,000 Intruder Events in its internal log, these events shall be accessible via the web server.

10.9.7 It shall be possible to create specific function with Cause & Effects programming via triggers and mapping gates. Status changes of areas, users, outputs, doors, etc. can be used as trigger. Several triggers shall be combined in a mapping gate to be activated when all trigger conditions become true.

10.9.8 All System field expanders shall be automatically addressed by the Controller to prevent double addresses occurring on the System or manually set. The System Software has to detect double addresses if they occur. It shall be possible to locally or remotely upgrade the firmware of the Controller and Expanders.

10.9.9 The Controller and external Power Supplies shall be able to self-test the batteries to ensure that they are healthy on a regular basis.

10.9.10 Self-test for the detection of faults on the System shall occur when an Engineer exits from configuration mode.

10.9.11 The Controller shall support pluggable modules that allow additional communication paths in addition to the on-board IP facility, if provided.

10.9.12 The Controller should be able to send all alarms to the ARC/CMS via IP, PSTN or GSM modems. It must also be possible for the Controller to send its alarms to multiple monitoring stations. It must also be possible for the Controller to send its alarms to multiple End users via SMS for Text notification.

10.9.13 All Security System Alarms shall mute on any Fire Alarm System activation.

10.9.14 Magnetic Contacts shall be of the heavy duty magnetic inertia matching type as required by IS EN 50131-1: 2006 + A2: 2017 and shall have both open and circuit contacts and shall be suitable for recessed mounting.

10.10 Standards and Regulations

10.10.1 The Intruder Alarm System shall be supplied and installed to the Standard IS EN 50131-1: 2006 + A2: 2017 Alarm systems. Intrusion and hold-up systems. System requirements.

10.10.2 The Security Specialist undertaking the Intruder Alarm System installation shall be licensed by the statutory body Private Security Authority (PSA), and shall have their name listed on the NSAI Directory of Certified Intruder Alarm Installers. If monitored, upon completion of the System, the Licensee's Name shall be passed to An Garda Síochána. They in turn shall set up a System for responding to alarm activations from the monitored installation put in place by the Certified Installer. The Intruder Alarm System Installer shall obtain the Unique Reference Number issued by An Garda Síochána.

10.10.3 The System shall comply with the requirements of An Garda Síochána's policy on Monitored Intruder Alarms and B.S. 8243: 2010 + A1: 2014.

10.11 Equipment

Security Grading of System

10.11.1 All Equipment used that forms part of the Intruder Alarm System shall be no less than Security Grade 3 (Medium to High Risk) as described in IS EN 50131-1: 2006 + A2: 2017.

Environmental Grading of System

10.11.2 All Equipment used that forms part of the Intruder Alarm System shall be no less than Environmental Class II for Indoor use and Environmental Class IV for Outdoor use as described in I.S. IS EN 50131-1: 2006 + A2: 2017.

10.11.3 All components of the Intruder Alarm System must be Grade 3 or above.

Central Control Equipment

10.11.4 The Controller shall have a minimum of 8 on-board wired Inputs and 6 fully programmable outputs. The System shall be expandable up to 512 wired inputs and 512 outputs by the use field expansion devices, Combination of wired/wireless inputs shall be possible.

10.11.5 The Controller shall employ a high-speed expansion bus (BUS) that can be configured as in Loop and Spur topology. When the expansion bus is configured as a Loop topology a single or dual cable fault between the same two-expansion devices (short or open of data bus) shall allow all the System to remain fully operational with no loss of functionality (with cable faults reported). If additional cable faults were to occur, then only the field expansion devices that do not have a connection to the Controllers shall be lost.

10.11.6 The Controller shall provide an integrated Ethernet port to allow more than 10 parallel IP communications with connected applications such as Programming Software, Alarm Receiving Centres (CMS/ARC), Web Browsers, Danger Management Systems (DMS), 3rd party products, etc.

10.11.7 The Controller shall provide an integrated Web Server for system programming and operation. The Web server shall be accessible from any remote computer system running a web browser that can gain access to the panel through a LAN or WAN, serial, USB or modem. To allow access remotely, the communication shall be using a Secure Socket Layer (SLL), providing the user with the ability to login in using the same credentials (or separate web authentication credentials) and user rights for operation as if they were standing at the panel.

BUS Configurations (Installation)

Loop Configuration

10.11.8 The Loop (or ring), cabling method shall offer the highest security by providing fault tolerant communications on the BUS. All System Keypads and field expanders shall be supervised and in case of a cable fault or break, the system shall continue to operate and all input circuits shall be monitored.

Spur Configuration

10.11.9 The spur (or chain or open loop) cabling method shall offer a high level of fault tolerance and may be more convenient on certain installations. The controller shall support two spurs. In the case of a cable fault or break, all Expanders and detectors up to the fault shall be continue to be supervised.

Cables, distances and shielding

10.11.10 For normal installations a range of different common industry cables shall be able to be used (standard 4/6 core alarm cable / cat 5 / Belden etc.). Shielded cables should be used for sites with high electric field interference, e.g. Belden 9829, IYSTY 2 x 2 x 0.6 (min).

Power Supply

10.11.11 The power supply shall be Type A as defined under item 9.1 of IS EN 50131-1: 2006 + A2: 2017. The power supply shall comply with I.S. EN 50131-6: 2017.

10.11.12 The Power Supply and Re-Chargeable Batteries shall be capable of supporting the Intruder Alarm System in all conditions including when recharging storage devices (i.e. batteries) within a maximum of 24 hours. A changeover between the power source and the batteries and back again, shall not create an alarm condition or otherwise influence the status of the Intruder Alarm System.

10.11.13 The Power Source shall be taken from a 230V supplies provided by the Electrical Contractor as part of the Electrical Services Installation.

10.11.14 An Alternative Power Source shall be provided by the Intruder Alarm Installer as part of the Central Control and Indicating Equipment with 2 No. Sealed Lead Acid Rechargeable Batteries (Gel Type) concealed within the Steel Enclosure.

10.11.15 The Central Control shall have the following functions:-

- Detection of Loss of EPS;
- Detection of Storage Device-Low Voltage;
- Detection of Storage Device-Failure;
- Detection of Low Voltage Output;
- Detection of Power Unit Failure;
- Over-Voltage Protection;
- Short Circuit Protection;
- Overload Protection;

- SD Deep Discharge Protection (Where deep discharge will damage the SD);
- Tamper Security.

10.11.16 Documentation and Testing of the Intruder Alarm Power Supply shall be provided/carried out as per item 6 and 7 of I.S. EN 50131-6: 2017.

10.12 Wiring Requirements

Power Supplies

10.12.1 The Electrical Contractor shall include for the supply and installation of transformers and low-voltage power supplies, which shall be connected to 230V unswitched fused connection units.

10.12.2 The Central Control and Indicating Units for the Building shall be supplied with standby power units (type "A" power supply, as specified under I.S. IS EN 50131-1: 2006 + A2: 2017 to operate the Intruder Alarm Systems in the event of mains failure.

Wiring

10.12.3 The Electrical Contractor shall supply and install 6 core 0.5mm^2 LSZH/LSZH alarm cable, in steel conduit, to each of the intruder alarm device locations.

10.12.4 The Electrical Contractor shall liaise with the Security Specialist on Site to agree the exact positions and wiring details.

10.12.5 The Security Specialist shall be responsible for the erection and connection of all Equipment and all commissioning associated with the Installation.

10.12.6 The Wiring shall be installed in keeping with the best practices of the Trade and in accordance with the European Standards Specification of Intruder Alarm Systems (IS EN 50131-1: 2006 + A2: 2017).

10.12.7 The Electrical Contractor shall be responsible for the Supply and Installation of all cable tray/conduit containment, all necessary Attendances on the Security Specialist and all LV Power Supplies required for the System.

10.12.8 The Security Specialist shall co-ordinate with the Electrical Contractor and adhere to their Programme.

10.12.9 The Security Specialist shall be responsible for the correct operation of the System and all Components. Should a fault develop on any part of the System within the twelve months maintenance period, the Security Specialist shall replace the faulty section/component free of charge (no charge to be made for materials, labour and/or expenses).

10.12.10 Should any component in the System have repeated faults/failures the Security Specialist shall replace the component with a similar part of a difference manufacture, free of charge (no charge shall be made for materials, labour and/or expenses).

10.12.11 The Intruder Alarm Control and Indicating Equipment shall be capable of sending text messages to indicate the precise location of where a fault has occurred in the System and transmit alarm text messages to display pagers.

10.13 Testing And Commissioning

Testing and Certification

10.13.1 Documentation relating to the Intruder Alarm System shall be concise, complete and unambiguous. Information shall be provided sufficiently to install, put into operation, operate and maintain the Intruder Alarm System.

10.13.2 The complete Installation including Panel, Detectors and Warning Devices etc. shall conform to the European Standard Specification for Intruder Alarms I.S. EN 50131-1. A Certificate to this effect shall be issued by the Intruder Alarm Specialist on completion of the Installation.

10.13.3 Component Documentation shall include the following:-

- Name of Manufacturer or Supplier;
- Type;
- Description of Equipment;
- Standard to which component claims compliance;
- Mark of the Certification Body;
- Security Grade;
- Environmental Class.

10.13.4 All Intruder Alarm Components shall be marked with the following:-

- Name of Manufacturer or Supplier;
- Type;
- Date of Manufacture or Batch Number or Serial Number;
- Security Grade;
- Environmental Class.

Client Demonstration, Training and Instruction

10.13.5 The Security Specialist shall include for full demonstration of the completed Intruder Alarm System to Client. These demonstrations shall include the creation of full “Alarm Condition”, full system silence, reset and confirmation from the Monitoring Station that the alarm signal was received and correctly identified.

10.13.6 The Security Specialist shall issue a training booklet to each member trained, giving brief instructions on the operation of the System and trouble-shooting guide.

Warranty and Maintenance Charges

10.13.7 The Security Specialist, as part of their Tender shall include for 12 months warranty on the installed Systems from the date of commissioning and 12 months maintenance for the Intruder Alarm System.

11 Protective Services – Fire Detection (Element 68)

11.1 Fire Detection System Installation

11.1.1 The Electrical Contractor shall include for the Supply, Installation, Testing, Commissioning and Handover of the complete Intelligent Analogue Addressable Fire Detection and Alarm System.

11.2 Category of Fire Detection System

11.2.1 The Fire Detection System shall be categorised in accordance with I.S. 3218: 2024 and shall be a Category L1 type System.

11.3 Standards and Regulations

Fire Safety Certificate;

Building Regulations Technical Guidance Document B;

I.S. 3218: 2013 + A1 Amendment: 2019;

I.S. EN 54 All Parts;

BS 9999: 2017;

BS 6266: 2011;

5th Edition National Rules for Electrical Installations, IS 10101: 2020.

11.4 Equipment

General Overview

11.4.1 The Fire Detection System shall be analogue in operation, with each sensor device providing signal levels relative to the current operating environment.

11.4.2 All Life Safety System Equipment shall be arranged and programmed to provide the early detection of Fire, the notification of the Building Occupants, the automatic summoning of a Remote Monitoring Station and the activation of other Auxiliary Systems to inhibit the spread of smoke and fire, and to facilitate the safe evacuation of the Building Occupants.

11.4.3 The Fire Detection System shall be capable of 'double knock' operation.

11.4.4 All field devices connected to the existing Control Panel are to be wired directly via 2 core loop circuits. Loop cable types shall be selected in accordance with the Manufacturers Recommendations to ensure optimum performance.

11.4.5 The Fire Detection System shall be capable of providing fire, fault disablement and supervisory monitoring facilities as required by I.S. EN 54-2:1997+A1:2006.

11.4.6 Short or open circuit wiring fault isolation shall be provided within every device to protect the System.

11.4.7 Power supplies to the Ancillary Services shall be such that the power supply to the Fire Detection System is not prejudiced and only those ancillary systems which take power when there is a fire may be operated from the Fire Detection Supply. Any ancillary system which takes power in the non-fire state shall not be taken from the Fire Detection supply, but shall be derived from an alternative source.

11.4.8 All Maintenance Procedures, Engineering, Service and Maintenance Codes for the new Fire Detection System **must** be made available to the Client on handover of the Fire Detection System Installation.

11.4.9 The Electrical Contractor shall provide, from the acceptable Manufacturer current Product Lines, Equipment and Components, which comply, with the requirements of this Specification.

11.4.10 All Control Panel Assemblies and connected Field Appliances shall be provided by the same System Specialist, and shall be designed and tested to ensure that the System operates as specified.

11.4.11 All Fire Detection Cabling shall be carried out in accordance with Section 6.14 of IS 3218: 2013 + A1 Amendment: 2019.

11.4.12 The Control and Indicating Equipment shall be capable of sending alarm text messages to indicate the precise location of where a fault has occurred in the System.

11.5 Design Review

11.5.1 In accordance with IS 3218: 2013 + A1 Amendment: 2019 (Section 5.4.3), following appointment of the Electrical Works Specialist's Fire Detection Supplier, a design review meeting shall be undertaken to ensure all aspects of the Fire Detection and Alarm are understood by all parties and that the requirements of the Fire Cert can be achieved in full.

11.5.2 This meeting is a statutory requirement and shall be organised in co-ordination with the Engineer upon appointment of the Fire Detection Specialist Company.

11.5.3 Following successful design review in accordance with IS 3218: 2013 + A1 Amendment: 2019 (Section 5.4.3), a Design Certificate in accordance with IS3218: 2013 + A1 Amendment: 2019 (Annex C1) shall be issued by the Engineer.

11.5.4 The Fire Detection and Alarm System Specialist shall allow for re-programming the existing Fire Detection and Alarm Systems and include all ties-ins, loop cards and re-programming necessary to add the new System onto the existing Systems Infrastructure.

11.5.5 The requirements of I.S. 3218: 2013 + A1 Amendment: 2019 shall be adhered to in full, including all requirements pertaining to proving of operation of all 3rd Party Systems.

11.5.6 At least 2 No. Site visits shall be allowed for during final demonstration of the Cause and Effect, and witnessing of 3rd party device operations (such as Fire System activation, Access Control drop out, etc.).

11.5.7 In addition to the above, the Fire Detection System Specialist shall allow for re-programming the System with updated Room Names and final revisions of the Cause and Effect Strategy.

11.5.8 Following successful installation of the Fire Detection System, an Installation Certificate in accordance with IS3218: 2013 + A1 Amendment: 2019 (Annex C2) shall be issued by the Installer (Electrical Works Specialist).

11.5.9 Following successful commissioning of the Fire Detection System, a Commissioning Certificate in accordance with IS3218: 2013 + A1 Amendment: 2019 (Annex C3) shall be issued by the Commissioning Engineering Company (Fire Alarm Specialist).

11.5.10 A Handover Certificate in accordance with IS3218: 2013 + A1 Amendment: 2019 (Annex C6) shall be issued by the Electrical Contractor for the Works.

11.6 Fire Detection Control and Indicating Equipment

11.6.1 The Fire Detection and Control Equipment shall comply with EN54-13: 2017, EN-54-2: 1997/AC1999 + A1 2006/EN-54-4: 1998/AC1999 + A2 2006.

11.6.2 The Fire Detection System shall display information in compliance with EN54 to give a distinct visual indication of Alarm Events.

11.6.3 From individual command buttons the Operator shall be able to call up direct information on the following conditions:-

a) Fires;

b) Pre-Alarms;

c) Faults;

d) Disablements;

e) System Site Specific Menu Shortcut functions to indicate status and control I/O on the Fire Detection System.

11.6.4 The Fire Detection System must allow for intelligent automatic drift compensation in its processing of signals from smoke sensors.

11.6.5 Where appropriate it must also be able where required to differentiate between steam/dust contamination and an active smoke condition utilising Dual Wavelength Technology, these shall comply with EN54-5 and EN54-7.

11.6.6 The Fire Detection System must be capable of daily automatic testing of Sensors. The System shall list all Detectors that require cleaning.

11.6.7 The Fire Detection System shall have the functions if required to automatically reset (self-initiated) the entire System on an individual detector basis as required when the System has functionally determined smoke is no longer present from a detector(s) in alarm.

11.6.8 The System shall have a master log for events, with fire events separated and protected. Individual menus for fire, fault and disablements shall be present.

11.6.9 Fire Events shall be only reset on an individual basis, i.e. the Operator can only reset one fire condition at a time.

11.6.10 A Sensor Alarm that has registered a fire condition on the System shall not reset if communication is lost to that Sensor.

11.6.11 All Fire Events shall be individually reset by the Operator.

11.6.12 The Fire Detection System shall not allow the reset of a device in alarm if the System has lost communication with the device or the device is remaining in a fire alarm condition.

11.6.13 Contaminated Smoke Sensors must be automatically registered to the Main Fire Alarm System for immediate maintenance.

11.6.14 All System internal panel/module terminations shall be ferruled and marked with the relevant module address and input/output/circuit number by means of permanent machine derived sleeves/id tags.

11.7 Power Supply & Standby Batteries

11.7.1 The Fire Detection System shall comprise of an integral charger and two sets of individually monitored sealed lead acid cells. All Batteries shall be maintenance free. The charger shall be pre-set at a nominal DC output. The Batteries shall be provided to maintain a standby period of 24 hours (minimum) with a further 30 minutes under full alarm/control load conditions.

11.7.2 The charging current shall be automatically adjusted according to the Batteries ambient temperature.

11.7.3 Should a full discharge of the cells take place, then the System shall be capable of completely re-charging them within a 24 hour period.

11.7.4 If any form of malfunction is detected within the charger/cells unit then an appropriate fault message shall be displayed.

11.8 Analogue Sensors & Bases

11.8.1 All Analogue Sensors and Bases shall be provided by the Manufacturer of the Control System. No other make of Sensors will be permissible.

11.8.2 The Bases for interfacing between the loop wiring and the sensor head shall be manufactured by means of injection moulded ABS plastic with the base fixings suitable for industry standard BESA or conduit boxes and shall utilise robust cable terminations.

11.8.3 The Contractor shall include for the supply and installation of the following devices for the Building:-

- Combined Smoke Detector/Strobe/Sounder;
- Isolators which shall be addressable;
- Manual Call Points to be utilised at Exits;
- Interface Units, Input, Output, with feedback options;

11.8.4 Smoke Sensors where specified shall have the ability to determine the difference between smoke and steam/dust by utilising Dual Wavelength Technology.

11.8.5 Each Sensor shall possess an integral LED giving a constant LED indication for a Fire Alarm Signal and Pulse LED for Testing Mode.

11.8.6 Sensors shall be white in colour and manufactured from ABS plastic. All electronics and associated sensing elements shall be housed within this unit, these components being hermitically sealed to prevent their operation from being impaired by dust, dirt and humidity.

11.8.7 The sensitivity off all Sensors shall be adjustable from the Control Panel.

11.8.8 All Sensors shall be provided with a plastic removable dust cover for protection during Site Construction.

11.9 Manual Call Points (MCP's)

11.9.1 Manual Call Points shall be positioned at a minimum at every final exit and at all intervening distances not to exceed 25m.

11.9.2 The manual initiation devices shall be electrically compatible with all of the aforementioned sensor types. Each MCP shall contain its own microprocessor giving a 1s response time from initiation.

11.9.3 It shall also handle all communication to the existing Fire Alarm Control Panel. All electronic devices contained within the MCP shall be hermetically sealed so as to prevent damage from hostile environment conditions: i.e. dust, up to a rating of IP32.

11.9.4 The MCP shall be available for either semi-flush or surface fixing.

11.9.5 Upon operation of the Manual Call Point the integral LED shall denote operation (steady LED indication), this being cancelled upon the operation of a reset procedure. The System must not allow a "Fire" reset to take place until the MCP is reset properly with a key.

11.10 Sound Signals

11.10.1 All sounder devices shall comply with the requirements of IS EN 54-3: 2014 + A1:2019 grades A&B.

11.10.2 Alarm testing/Client drills to have different sounding sequence (not confused with real alarm).

11.10.3 All drills to be initiated by independent restricted function.

11.11 Electronic Strobe

11.11.1 Electronic Strobes shall have a matrix of high brightness LED's providing a light output equivalent to a 3W xenon strobe.

11.11.2 The frequency of the electronic strobe light output shall be 1Hz (Alert) and 1Hz (Evacuate) in compliance with EN54.

11.12 Positioning of Equipment

11.12.1 All Equipment shall be positioned in accordance with IS 3218: 2013 + A1 Amendment: 2019 and the Building Regulations, Part M.

11.12.2 All Equipment must be sited in the best position, taking into account all conditions. Any alteration from the Fire Detection System Design must be agreed in advance with the Engineer/Client.

11.12.3 Any possible problems must be pointed out prior to the final fixing. If the Installation is completed, a fault develops that could have been foreseen, the Electrical Contractor shall rectify the problem at their own expense.

11.13 Ancillary Equipment

11.13.1 Fire Detection Signals from the third party control systems i.e. Fire Shutter, etc. shall be normally closed contacts. Where normally open contacts are used the 3rd party system shall utilise a monitored cable connection and report a fault to the Fire Detection and Alarm System.

11.13.2 The Electrical Contractor shall include all Fire Alarm Interfaces with the following Equipment.

11.14 Wiring Requirements

11.14.1 The Electrical Contractor shall ensure that all Fire Alarm Cable Infrastructure shall comply with the requirements of I.S.3218: 2013 + A1 Amendment: 2019 and shall be installed in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

11.14.2 All Fire Safety Systems Cabling shall be rated and certified for a minimum of 120 minutes in accordance with BS-7629-1: 2015 + A1: 2019.

11.14.3 All Power Supplies associated with the Fire Safety Systems Installation shall be wired in armoured cabling with ratings in accordance with BS-8519: 2020.

11.14.4 All Manufacturer's Cable Certificates must be provided to the Engineer/Client for acceptance. The Electrical Contractor shall submit a sample of the proposed Fire Alarm Cable to the Client for approval, prior to ordering.

11.14.5 The wiring routes of detection circuits shall take account of fire compartment boundaries and the arrangement/construction of the Building.

11.14.6 Fire Rated Cabling shall include but not be limited to the following:-

- All Fire Alarm Devices referred to in this Specification;

11.14.7 All Fire Detection Cabling shall meet the following Specification:-

General Specification.	Cables should meet the performance requirements of BS 6387: 2013 Category CWZ, EN 50200: 2015 PH220, BS 8434-2 :2003 + A2: 2009 120 minutes, IS EN 60332-1-2 : 2004 + A11: 2016, IS EN 60332-3-24 : 2009, IS EN 61034-2 :2005 + A1: 2013 and produce less than 0.5% acidic gases when tested in accordance with IS EN 60754-1:2014.
Conductors.	Conductors shall consist of plain annealed copper and the circuit protective conductor of tinned annealed copper.
Insulation.	The insulation shall be of a robust cross-linked mineral filled type complying with BS 7655: 2006 type EI5.
Screen.	The screen shall consist of a longitudinally applied laminated aluminium tape securely bonded to the sheath.
Sheath.	The sheath shall be a robust mineral filled compound complying with BS 7655 Type LTS3. Red Outer Sheath, to match existing.
Voltage Rating	300/500V

11.15 Cable Containment/Terminations

11.15.1 The Electrical Contractor shall include for a dedicated Life Safety Containment System consisting of cable tray and or trunking or both.

11.15.2 Cable tray for Fire Detection and Alarm Cabling may NOT be inverted at any point.

11.15.3 All Cabling must have fire rated fixings in all areas (i.e. steel cable ties or fire rated clips are to be fitted). Where any cables are installed on vertical tray fire rated stainless steel cable clips must be used. Metal clips shall be used on any tray before and after any change in direction or orientation.

11.15.4 Strain relief methods approved by the Engineer/Client must be provided for all fire rated cables at the last point before cable termination. Only metal fire rated cable clips are to be used to fix fire alarm cabling where not run in trunking, tray or conduit.

11.15.5 Uni-strut supports and drop-rod supports for Fire Detection and Alarm Cable Trays shall be calculated in accordance with the requirements of BS 8519: 2020.

11.15.6 Where possible cable sleeves buried or inaccessible, shall be installed to allow the drawing in of new cables if required at a future date.

11.15.7 Conduit shall be a minimum of class 4 and have a minimum dimension of 25mm where used for any part of the Fire Alarm Installation.

11.15.8 Conduit shall only be utilised for a maximum of 3 meters on overhead containment.

11.15.9 A maximum of two cables shall be installed in each 25mm conduit.

11.15.10 All overhead materials shall be fixed to the fabric of the Building with suitable metallic fixtures.

11.15.11 All Interface Circuits shall be confined to the Electrical Cupboard/Vertical Riser for ease of access & maintenance.

11.15.12 All vertical wiring shall, where practically possible, be concealed in the Building Fabric. Horizontal wiring shall generally be run on dedicated Fire Detection and Alarm cable tray.

11.15.13 All cables shall be installed in such a manner that they are physically continuous throughout the length of each circuit other than where connection is made at the terminations of a system component or at a designated riser junction box. No other cable connections are to be used.

11.16 Fire Alarm Submittals

11.16.1 The Electrical Contractor shall purchase no Equipment for the System specified herein until the Engineer/Client has approved the Project Submittals in their entirety and has returned them.

11.16.2 It is the responsibility of the Contractor to meet the entire intent and functional performance detailed in this Specification.

11.17 Samples

11.17.1 A sample of each Detector, Intelligent Module, Manual Break Glass Unit etc., shall be provided to the Client/Architect/Engineer for Approval.

11.18 Quality Control and Reviews

11.18.1 The Electrical Contractor shall allow for regular quality control inspections and reviews of the Fire Alarm System Installation.

11.19 Testing and Commissioning.

Working Drawings

11.19.1 Prior to commencement of the Fire Installation full proposal Drawings, both Layout and Schematic, with all relevant Technical Specification details, the intended cable routes etc., shall be provided to the Engineer for approval or comment.

11.19.2 These Drawings must be prepared in conjunction with the Specialist System Supplier and outline any additional detection requirements required by the specific System Specialist to allow full certification of the System.

11.19.3 If there are any unsatisfactory proposals the Fire Alarm Specialist shall re-submit their revised proposals to the Engineer's comments for approval at the expense of the Contractor.

As-Built Record Drawings

11.19.4 The Specialist Contractor shall issue a complete set of the Fire Alarm and Detection Drawings in AutoCAD dwf & PDF format. Drawings shall be issued for the following:-

a) As installed point to point wiring diagrams, including routing information for all items of Equipment installed with directional arrows in orthogonal neat format;

b) Schematics for all Equipment installed;

c) Position and Tag No. of every Fire Alarm Device.

11.19.5 All Fire Alarm Devices shall be clearly identified using permanent labels, carrying the identification number corresponding with the Fire Alarm Panel Address and the Floor Plan Layout showing all the Fire Alarm Devices.

11.19.6 All Fire Detection Sensor Labels should be clearly visible with the naked eye from the Ground in an emergency. The font should be a minimum of 15mm high.

11.19.7 This information shall be passed to the Fire Detection Specialist Supplier before the commencement of the Fire Detection System addressing, programming or configuration.

11.19.8 It is the responsibility of the Electrical Contractor to indicate on the Drawings the zones, addresses/labels assigned by the Specialist Supplier of the Fire Detection System. The Specialist Supplier shall issue a compiled list of zone and address information required to the Contractor for inclusion in the As-Built Drawings.

11.19.9 The Specialist Systems Supplier shall terminate and label all final connections at the Fire Alarm Control Panel. Cables shall be prepared, stripped and labelled for inspection prior to this task by the Installation Specialist Contractor.

General Commissioning

11.19.10 The Electrical Contractor shall ensure that sufficient time is allowed in the Programme to carry out the testing, commissioning and handing over of the Installation and setting to work.

11.19.11 Fire Alarm Detectors shall only be installed when the Building has been deep cleaned or at a stage approved in writing by the Client. As soon as detectors are installed, the Contractor shall require the Fire Systems Specialist Supplier to establish the condition of the detectors and shall have this value recorded. Any deviation from this reading prior to handover as a result of contamination or other shall result in the detector(s) being replaced at no additional cost to the Client or the Systems Supplier.

Final Commissioning

11.19.12 The Electrical Contractor shall ensure that all General Commissioning is completed and that all Documentation including accurate As-Built Drawings are forwarded to the Client and the System is unveiled in a clean environment.

11.19.13 The Electrical Contractor shall ensure that any Fire Alarm and associated Electrical Testing is carried out in accordance with IS 3218: 2013 + A1 Amendment: 2019 and the Wiring Regulations incorporated in the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

11.19.14 The Electrical Contractor shall also issue a letter/certificate confirming that the complete Fire Alarm Services and associated Electrical Installation has been installed in compliance with the 'Building Regulations 2014.

11.19.15 The Commissioning Engineer shall carry out final testing and commissioning in the presence of the Client.

11.19.16 A Commissioning Certificate shall be issued to the Client on the day of commissioning, and incorporated in the Maintenance Manuals. Equipment and Commissioning shall comply with IS 3218: 2013 + A1 Amendment: 2019. The Commissioning shall include certification of all network links.

11.19.17 Upon completion of the final testing and commissioning the Specialist shall issue the relevant Compliance Certificates and Documentation to the Electrical Contractor.

System Demonstration

11.19.18 The Specialist Contractor must ensure that the System is installed and commissioned as per the Specification. This shall include all final Documentation, As-Built Drawings and O&M Manuals.

11.19.19 Upon completion of the Installation and commissioning, the Specialist Systems Supplier shall carry out a complete co-ordinated demonstration of the System to the Engineer and Client.

11.19.20 The Electrical Contractor shall make available an Electrician familiar with the Fire Alarm System to assist the Manufacturer throughout the Commissioning Period.

11.19.21 The Specialist shall allow for a full walk down of the Fire Alarm and Cause and Effect Matrix which will be witnessed by the Client.

Workmanship, Installation and Commissioning

11.19.22 The Workmanship, Installation and Commissioning of the Fire Alarm System shall conform in all respects with I.S. 3218: 2013 + A1 Amendment: 2019, and in particular a Certificate of Installation and Commissioning as indicated I.S. 3218: 2013 + A1 Amendment: 2019.

Log Book for Fire Alarm Systems

11.19.23 A Log Book such as that indicated in I.S. 3218:2013 shall be handed to the Client against their signature.

11.20 Warranty

11.20.1 The Electrical Contractor shall warrant all Materials, Installation and Workmanship for One Year from the Date of Acceptance, unless otherwise specified. A copy of the Manufacturer's Warranty shall be provided with Hand-Over Documentation and included with the Operation and Installation Manuals.

11.20.2 The Fire Alarm Specialist shall include 4 No. Maintenance Visits during the Defects Liability Period.

11.20.3 After the Defects Liability Period the Client reserves the right to appoint any Company to maintain the Fire Alarm System for the Building.

11.20.4 The Fire Alarm Specialist chosen to install the Fire Alarm System shall withdraw any conditions in their Contract that allows the Company to retain Ownership of the installed Equipment or gives it the exclusive right to maintain it in the future after completion of the Defects Liability Period.

11.20.5 The Fire Alarm Specialist shall maintain a Service Organisation with adequate spare parts stock. Any defects that render the System inoperative shall be repaired within 12 Months of the Owner notifying the Main Contractor.

12 Inspection, Testing and Commissioning

12.1 General

12.1.1 Certified Testing Specialist shall test and commission Systems resulting in proper operation of individual pieces of Equipment and also the proper operation of the overall Electrical Systems, in accordance with CIBSE Commissioning Codes, IS Standards or other applicable Guidelines and the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

12.1.2 The Electrical Contractor shall be responsible for commissioning the entire Electrical Services for the installation to the satisfaction of the Engineers. The Electrical Contractor shall produce for the approval of the Client's Design Team a detailed Specification for commissioning Procedures for the completed Installation.

12.1.3 The Commissioning Procedures Specification shall include the following: -

a) Detailed Operating Programme;

b) Bar Chart showing weekly analysis of Programme;

c) Data to be used for each stage of Commissioning;

d) Detailed Commissioning Schedules for each item of Plant and Equipment;

e) Requirements and involvement of the Engineers and Maintenance Staff;

f) Method of logging all performance data with processing and issuing to the Clients Representatives;

g) Method of issuing Certificates including Suppliers Certificates;

h) Instruments & method of measurement to be used in Commissioning;

12.1.4 The Electrical Contractor shall co-ordinate with the Project Supervisor in arranging a Seminar to present and explain the Commissioning Methods and Programme they propose for the Installation. They shall also arrange for all Specialist Suppliers/Installers involved in the Electrical Installation to be in attendance to outline their own Commissioning Procedures.

12.1.5 The Electrical Contractor shall ensure that sufficient time is allowed in the Main Contractor's Programme to carry out the testing, commissioning and hand-over of the Installation.

12.1.6 For the purposes of Practical Completion the Electrical Contractor shall allow for programming and commissioning the various Systems and the use of current Construction Drawings Room Number Systems. After PC, the Client will issue their Room Number System and the Electrical Contractor shall re-program the various systems to take account of the new names etc.

12.1.7 The Electrical Contractor shall include for the requisite man-hours for the demonstration, instruction and hand-over of the Electrical Services Installation to the Client and the Engineer.

12.1.8 They shall ensure that Record Documentation is handed over to the Engineer two weeks prior to demonstration.

12.2 Construction Site Inspections

12.2.1 The Client and their Design Team shall be given the opportunity to inspect the Mechanical and Electrical installations at the following periods of the Project:-

- First Fix;
- Second Fix;
- Final Fix;
- Prior to Ceiling Closures;
- Prior to Wall Closures;
- Prior to Commissioning Start Date and Plant Operation.

12.2.2 This process must be identified as line items on the Main Contractor's and Specialist's Programmes as appropriate and the Client and Design Team shall be given as a minimum 5 working days' notice for inspections. In addition, to the above both the Client and their Design Team will undertake interim inspections of the Mechanical and Electrical Installations at regular intervals.

12.3 Witness Testing

12.3.1 The Client and the Engineers shall be invited to witness the testing of all Mechanical and Electrical Services and Plant. The Electrical Contractor shall write to the Engineer 5 working days in advance of the Systems being tested.

12.4 Pat Testing

12.4.1 All Portable Equipment installed as part of this Project shall have PAT testing included, for the 3 years after Practical Completion.

12.5 Commissioning Procedures

12.5.1 When the Electrical Works are completed in each Section, the Electrical Contractor shall carry out such tests and provide apparatus, instruments and materials as the Engineers may consider necessary and as may be reasonably demanded to prove compliance with the Contract.

12.5.2 The Electrical Contractor shall be responsible for testing all Equipment to ensure that the Electrical Installation complies with all the necessary Statutory Regulations.

12.5.3 The Tests shall be carried out in accordance with the 5th Edition National Rules for Electrical Installations, IS 10101: 2020 and CER Common Procedures, by a technically competent permanently employed Member of the Electrical Contractors Staff (Qualified Certifier).

12.5.4 A copy of the 5th Edition National Rules for Electrical Installations, IS 10101: 2020 shall be kept on Site by the Contractor's Site Agent at all time.

12.5.5 The Electrical Contractor shall hand over to the Client the necessary Completion Certificates as laid down by the 5th Edition National Rules for Electrical Installations, IS 10101: 2020. The Qualified Certifier's Registration Number shall be noted on all Test Record Sheets, 5th Edition National Rules for Electrical Installations, IS 10101: 2020 Completion Certs and all relevant Testing and Commissioning Documentation.

12.5.6 The Electrical Contractor shall produce, for the approval of the Engineers, a detailed Specification for the Commissioning Procedures for the completed Installation. The Specification shall be provided well in advance of the Commissioning Programme and at a time agreed with the Main Contractor.

12.5.7 The Electrical Contractor shall co-ordinate with the Mechanical Contractors in arranging a Programme for the commissioning of all Mechanical Systems and Equipment. The Electrical Contractor shall also arrange for all Specialist Suppliers/Installers involved in the Electrical Installation to be in attendance at all commissioning.

12.6 Commissioning Sequence

12.6.1 The Commissioning Program shall be co-ordinated by the Mechanical Contractor with the Electrical Contractor and the Main Contractor, together with each of their Specialists.

12.6.2 For each System commissioned, a preliminary testing shall be undertaken by the Contractors/Specialists to verify operation, prior to inviting the Engineers/Client Representatives to attend for sign off.

12.6.3 All Client Tests and Witnessing shall be verified and recorded.

12.6.4 Completed Forms shall be retained by the Electrical Contractor for inclusion in the Record Documents, to verify the date of handover and commencement of the Warranty.

12.6.5 Commissioning Sequence shall include verification and handover of each of the Services installed under the Contract including: Switchgear, Power, Lighting, Communications, Protective Services, Security Services and Energy Metering and Monitoring Systems.

12.7 Sub-System Certification

12.7.1 Where an Electrical Installation contains a Sub-System provided by another Installer, a Sub-System Completion Certificate in accordance with CER Common Procedure No. 1 and the 5th Edition National Rules for Electrical Installations, IS 10101: 2020 shall be provided by that Installer.

12.7.2 Electrical Contractors shall also advise Clients that testing and certification of all Electrical Wiring is a statutory requirement.

12.7.3 Electrical Sub-Systems are defined as "any sub-system that will be connected to an Electrical Installation with the exception of appliances connected through a plug top that are designed and intended for such use".

12.7.4 Such Sub-Systems would include but are not limited to: -

- Amendments, Refurbishments or Extensions to an Existing
- Electrical Installation which do not require ESB Connection;
- Intruder Alarm Systems;
- Camera Surveillance System;
- Fire Detection and Alarm Systems;

12.7.5 The Electrical Installation shall be certified as having been installed, inspected and tested in full accordance with the current edition of the 5th Edition National Rules for Electrical Installations, IS 10101: 2020.

12.7.6 All Electrical Works (including Electrical Sub-Systems) shall be tested and certified. The 5th Edition National Rules for Electrical Installations, IS 10101: 2020 Sub-System Certificate along with the test results associated with same shall be included in the Project Safety File. All Sub-Systems Certs shall be appended to the overall 5th Edition National Rules for Electrical Installations, IS 10101: 2020 Cert.

12.8 Operations and Maintenance Manuals

12.8.1 On completion of the Contract, the Electrical Contractor shall hand over to the Client three sets of completed Record Documents.

12.8.2 The Drawings and Manuals shall be bound in durable covers. The Online Safety File (as referred to previously) shall have all hard copy Drawings and in soft copy version.

12.8.3 Each Hard and Soft Copy Set shall incorporate a description of each Installation, its operation and the regular Operating and Maintenance Routine to be adopted.

12.8.4 Hard Copy Drafts of all Operating and Maintenance Instructions shall be submitted to the Engineer for written approval at least 2 weeks prior to the production of the final sets.

12.8.5 Record Drawings shall include:-

- The Drawings issued for Contract, marked up “As-Installed” complete with all Circuit Referencing complete;
- Specialist Supplier Drawings for Equipment supplied;
- Control and Wiring Diagrams for Equipment installed;
- Co-ordination Drawings showing Installed Services routes.

12.8.6 An USB shall be enclosed in the Manuals containing Record Drawings in AutoCAD format, dwf and pdf, with a Drawing Issue List.

12.8.7 Record Manuals shall include:-

- Scope of Works
  Brief Plan of Description of Scope of Works and Equipment Installed;
- Plant and Equipment Installed
  Make / Model References;
- Supplier Contacts
  Names, Address, Contact Numbers and Information on how to dispose of Waste and Redundant Product with the Suppliers;

- How it Works
  Brief Description of how to start, stop and run the Systems;
- Maintenance and Repair Manuals
  How to replace parts, what maintenance is essential, recommended and required Maintenance Routines Intervals, Equipment Cleaning and Disinfection Procedure and Policy. The Manuals must be specific to the Model of Plant or Equipment installed under this Contract;
- Commissioning Certificates and Checklists
  For Sub-Distribution Boards, Fire Detection, Emergency Lighting, Security Systems, ICT Wiring, Energy Management and Metering Systems etc.

12.8.8 One copy of the Document shall be submitted to the Engineers for review and comment at least two weeks before Practical Completion, and three complete sets (incorporating the Engineers Comments) shall then be submitted to the Client at Practical Completion.

12.8.9 The following typical layout of O&M Manuals MUST be adhered to:-

SECTION 1: INTRODUCTION
Including an outline description of the Installation and Systems.

SECTION 2: ELECTRICAL CONTRACTOR, SPECIALIST SUB-CONTRACTOR AND SUPPLIERS INDEX
- Contact Name
- Address
- Telephone Number
- E-Mail Address

SECTION 3: UTILITIES RECORD INFORMATION
- Information including cable routes, incomer size and key/relevant correspondence from co-ordination.

SECTION 4: LOW VOLTAGE SWITCHGEAR,
- Supplier Details
- As Built Schematic
- General Arrangement Drawings.
- Busbar Details
- Component Schedule and Details
- Breaker Type
- Spare Parts List
- Commissioning Report
- Overload Settings
- Circuit charts
- Clear instructions and action to be taken upon activation of alarm
- Maintenance Schedule

SECTION 5: CABLE CONTAINMENT SYSTEMS,
- Suppliers' Details for Conduit and Trunking
- Tray & Ladder
- Cleats
- Bracket Support System

SECTION 6: CABLES

- Suppliers Details for all Cable Types
- Cable types include XLPE, SWA, Fire Rated Cables, Control Voice/Data, Security cabling etc.
- Manufacturer Technical Details for all cable types

SECTION 7: GENERAL AND EMERGENCY LIGHTING,

- Luminaire Schedule
- Manufacturer's Technical Details for all Luminaire Types
- Health & Safety Information
- Spare Parts List
- Lighting Sensors
- Emergency Lighting Inspection and Test Certificate
- Emergency Lighting Completion Certificate (4-Part certificate)
- Emergency Lighting Maintenance Details
- Switch Manufacturer and Supplier Details

SECTION 8: SOCKET OUTLET & SMALL POWER SYSTEMS,

- Supplier Details for all Components
- Manufacturer Details of all Components
- Health & Safety Information
- Schedule of Components
- Spare Parts List
- Specialist Equipment
- Emergency Stop Button
- Isolator Details
- Maintenance Recommendations

SECTION 9: ICT,

- Termination Details
- Patch Panel Details
- Voice/Data Outlet Details
- Test & Commission Report
- Original copy of the 20 year end to end structured cabling warranty
- Certificate
- Schematics
- Port Plans
- Cable Details

SECTION 10: FIRE ALARM SYSTEM,

- Supplier Details
- Schedule of Components used
- Completion Certificates (4-Part Certificate, ensure Client Cert is included)
- Health & Safety Information
- Spare Parts List
- Schedule of Loops / Addresses used
- Details of Spare Loops / Addresses and Capacity
- Cable Details
- Junction Box Details and Schedules
- Heat Sealed Zone Chart
- Sounder DB Levels to be recorded for each area on the Drawings

- Event Log
- Fire Strategy & Cause and Effect
- Clear instructions and action to be taken upon activation of alarm

SECTION 11: SECURITY

INTRUDER ALARM SYSTEM,
- Supplier Details
- Operating Instructions
- Schedule of Components Used
- Completion Certificate
- Health & Safety Information
- Spare Parts List
- Device Details

CAMERA SURVEILLANCE SYSTEM
- Supplier Details
- Operating Instructions
- Schedule of Components Used
- Completion Certificate
- Health & Safety Information
- Spare Parts List
- Device Details

SECTION 12: MECHANICAL PLANT AND CONTROLS
- Supplier Details
- Component Schedule and Details
- Spare Parts List
- Commissioning Report

SECTION 13: ENERGY MONITORING AND METERING SYSTEMS
- Supplier Details
- Operating Instructions
- Schedule of Components Used
- Completion Certificate
- Device Details

SECTION 14: JUNCTION BOXES AND ISOLATORS
- Supplier Details
- Schedule of Components

SECTION 15: EARTHING & BONDING
- Earth Bars
- Earthing Units
- Earth Clamps
- Earthing Schematics

SECTION 16: TEST CERTIFICATES
- Insulation Resistance Tests on all Cables
- Phase Rotation

- Switchgear Pre and Post Power
- Fault Loop Impedance Tests
- RCD Trip Time Test
- Polarity & Earthing of all Outlets
- Loop Test Certificates
- 5th Edition National Rules for Electrical Installations, IS 10101: 2020 Pre and Post Connection Certificates
- Copies of 5th Edition National Rules for Electrical Installations, IS 10101: 2020 Test Record Sheets
- Specialist Systems Commissioning Certificates as applicable
- Sub-System Certification

SECTION 17: SCHEDULES

- MCB Board Circuit Identification Schedule
- Isolator Schedule
- Control Station Schedule
- Cable Schedule
- Luminaire Schedule

SECTION 18: RECORD DRAWINGS

SECTION 19: ELECTRONIC MEDIA

3 USBs with the following electronic information

- Drawings (AutoCAD)
- Schedules (Microsoft Excel)
- Luminaire Schedule
- Voice/Data Test Results
- Schedule of Suppliers & Sub-Contractors
- Cable Schedule

12.8.10 The Drawing Title Block must contain the following:-

- Contractors Name and Address;
- The text title “RECORD DRAWINGS” in large print;
- The Project and Client Names;
- Remove or amend all notes that are not relevant to the “As-Installed” Status of the Project, i.e. “Confirm with the Engineer on Site” or “Contractor to detail”, etc.
- Include Actual Circuit and Plant Labels;
- All Schedules must be complete and updated.

13 Health, Safety & Welfare at Work (Constructions) Regulations 2013

13.1 Project Supervisors

13.1.1 The Main Contractor shall be appointed by the Client under a Collateral Agreement to the Main Contract as Project Supervisor for the Construction Stage in respect of the Project pursuant to the Safety Health and Welfare at Work (Construction) Regulations 2006 & 2013 Amendments. The Electrical Contractor shall include all costs for the provision of the Services of Project Supervisor for the Construction Stage pursuant to Regulations 6 and 7 of the Regulations.

13.1.2 The Electrical Contractor shall include for providing all necessary information as requested by the Project Supervisor for the Construction Stage to enable the preparation and completion of the Safety File excluding Drawings and Specifications which shall be provided by the appropriate member of the Design Team and relevant Sub-Contractors.

13.1.3 The Electrical Contractor shall include for providing assistance to the appropriate member of the Design Team (and to relevant nominated Sub-Contractors) in preparing "As Built" Drawings for inclusion in the Safety File.

13.1.4 The Client shall appoint the Main Contractor as Project Supervisor for the Construction Stage of the Project, to carry out the duties set out in Article 6 of the Regulations.

13.1.5 The Electrical Contractor shall include in their Tender for complying fully with the Health, Safety & Welfare at Work Act and SI No 2 of 2020 Safety, Health and Welfare at Work (General Application) (Amendment) Regulations 2020.

13.2 Co-Ordination of Persons Engaged In the Design of the Project

13.2.1 In accordance with Article 4(1) (a) of the Regulations, it is the duty of the Project Supervisor for the Design Stage to co-ordinate the activities of persons engaged in the design of the Project.

13.3 Duties of Nominated Sub-Contractors as Designers

Preliminary Health & Safety Plan

13.3.1 To enable the Project Supervisor for the Construction Stage to develop the Health & Safety Plan for the Project, it is necessary for the Electrical Contractor to give the information which is relevant to the Requirements of the Regulations in relation to that part of the Works for which they are tendering.

- A General Description of the Works;
- The time in which it is intended that the Works will be completed;
- Work which will enable Particular Risks as defined in Schedule 2 of the Regulations.

13.4 General Duties as Designers

13.4.1 Where a Sub-Contractor designs any element of the Works as part of their Contract, the nominated Sub-Contractor has a statutory obligation to perform the duties set out in Article 5 of the Regulations in relation to those parts of the Works. These are:-

1. Take account of the general principles of prevention as specified in First Schedule of the Principle Regulations (S.I. 370 of 2016) and any relevant Safety & Health Plan or Safety File prepared in accordance with the Health, Safety and Welfare at Work (Construction) Regulations 2013.
2. Co-operate with the Project Supervisor appointed for the Design Stage or the Project Supervisor appointed for the Construction Stage, as appropriate, to enable that Project Supervisor to comply with these Regulations.
3. Promptly provide the Project Supervisor appointed for the Design Stage, or the Project Supervisor appointed for the Construction Stage as appropriate, with such information as is known to that person regarding particular risks to the Safety and Health of Persons at Work as referred to in the Second Schedule which may be associated with the Project and also with such information regarding the nature and scope of the Project to the extent necessary to enable the Project Supervisor to comply with these Regulations.
4. Take into account any directions from the Project Supervisor appointed for the Construction Stage as appropriate.

13.4.2 It should be noted that under (3) above, the Electrical Contractor is required to provide copies of the following documents to the Project Supervisor for the Constructions:-

- Drawings showing the Installation as constructed;
- Details of the construction or installation including Manufacturer's Instructions for the Installation of Proprietary Elements, Wiring Routes and Diagrams;
- Full instructions for the safe Maintenance of the Construction or Installation.

13.5 Electrical Contractor to Check All Matters

13.5.1 The Electrical Contractor is to examine the Site and the information supplied regarding the nature and extent of the proposed Works, so as to be satisfied as to what is required to be done to fulfil the duties in relation to the design and preparation of the Works and also what measures are required to be taken to meet the requirements of the Regulations in the execution of the Works.

13.5.2 All costs arising in respect of these obligations are to be included in the Tender Figure and the Client will not be liable for any such costs which are reasonably foreseeable and which are not so included.