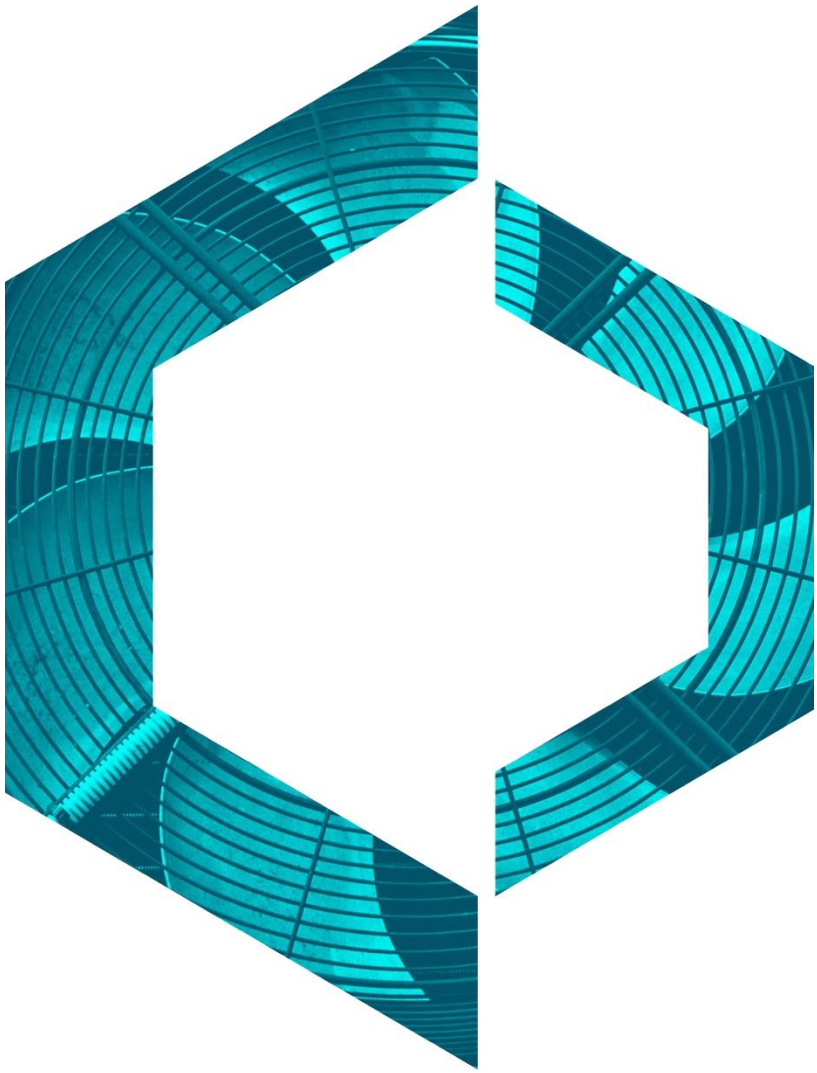


Portiuncula Univeristy Hospital
X-Ray Room Development

Technical Specifications
For the Electrical Services Installations

Date	28/07/2026
Revision	00
IN2 Project Ref:	A2608
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Specifications Register – Electrical Services

Project Name Portiuncula University Hoispital X-Ray Room Development
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Section	Specification	Rev	Date	Issue
E00	General Specification	00	28-07-2026	Tender Issue
E05	Existing Services	00	28-07-2026	Tender Issue
E10	General Lighting Installations	00	28-07-2026	Tender Issue
E12	Emergency Lighting Installations	00	28-07-2026	Tender Issue
E20	General Services Installations	00	28-07-2026	Tender Issue
E24	General Services Installations_ Ancillary Systems	00	28-07-2026	Tender Issue
E36	Mechanical Plant Wiring	00	28-07-2026	Tender Issue
E40	Fire Detection and Alarm System	00	28-07-2026	Tender Issue
E42	Access Control Systems	00	28-07-2026	Tender Issue
E50	IT & Structured Cabling Installations	00	28-07-2026	Tender Issue
E51	Nurse Call Services Installations	00	28-07-2026	Tender Issue
E56	AV Installations	00	28-07-2026	Tender Issue
E72	LV Distribution Installations	00	28-07-2026	Tender Issue
E73	Power Factor Correction / Harmonic Filtering	00	28-07-2026	Tender Issue
E75	LV Distribution Centre Switchgear	00	28-07-2026	Tender Issue
E80	Cable Containment Systems	00	28-07-2026	Tender Issue
E81	UPS Systems	00	28-07-2026	Tender Issue
E90	Earthing and Bonding	00	28-07-2026	Tender Issue
E93	Transient and Overvoltage Protection	00	28-07-2026	Tender Issue

Rev	Status	Date	Comment
00	Suitable for Tender	22nd July 2026	Issued for Tender

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00.1 General Information & Scope

00.1.1 All Electrical services documentation associated with the Portiuncula University Hospital (PUH) X-Ray Room Development, including layout drawings, schematics, schedules, and specifications are to be read in conjunction with all other Works Requirements documents including, architectural plans, sections and elevations, structural plans and details, mechanical services plans, details, schematics and plant schedules.

00.1.2 The Contractor shall be aware that whilst the existing PUH Ground Floor level Radiology Department shell and core space being utilised for this X-Ray Room development / fit out is to undergo substantial refurbishment that will result in rewiring, etc. the remainder of the existing Radiology Department will remain live and therefore all connections to these areas must be maintained. The Contractor shall be expected to apply their experience and understanding of requirements during tender site visits, making all necessary provision within their tender, or raising queries during the tender process. No claims relating to existing services etc. will be entertained post tender.

00.1.3 Construction Stage installation detailing and co-ordination detailing shall be a Contractor deliverable, with responsibility for BIM model development to LoD 500 and "as built" modelling being the responsibility of the Contractor.

00.1.4 IN2 has not included for development of construction models for the Contractor, and their obligations as set out in the specifications around installation detailing and co-ordination along with development of the BIM models shall remain. Production of Installation Models, As Built Models, as well as updates to the model during construction etc. shall be the responsibility of the Contractor.

00.1.5 The new X-Ray Room Radiology Department Portiuncula Hospital Refurbishment Project, The Contractor shall refer to and include for sequencing stages / phasing of works as contained within the architectural and structural drawings, documentation and works methodology.

00.1.6 The Contractor shall maintain a "clean as you go" policy, with the Contractor being responsible for cleaning of all works areas following their works. In the event that PUH / HSE are required to use their cleaners to make spaces usable for HSE operations, the HSE will contra charge the Contractor for all costs associated.

00.1.7 The Contractor shall be aware that the HSE / PUH may not be able to provide vacant possession of the entire area around the proposed X -Ray Room Development as PUH day-to-day operations will need be maintained throughout the works programme. The Contractor shall ensure that Risk Assessments and Method Statements provide for installations and works happening in a "live" healthcare environment where interaction with the public is a high possibility.

00.1.8 All the works described in this specification are to be carried out under the Electrical Sub Contract in accordance with the Employers Requirements, the Brief, this Specification, Drawings, Drawing Notes, HTM's, HBN's and I.S. EN standards as applicable to the works.

00.1.9 The scope of work for electrical services shall include but not be limited to the following:

- New Sub Distribution Board
- New Sub Mains Cabling
- New lighting with dimmable circuits as indicated
- New emergency lighting installations
- New general services installations
- Provision of supplies and control for mechanical plant items
- New intercom system
- New audio-visual supply & installation
- New nurse call supply & installation
- New fire alarm system installations
- New door access control supply & installation
- New cable containment services

00.2 Standards

00.2.1 All goods, products and materials shall be in accordance with the latest revision of Irish and EU Standards. All installations shall be in accordance with latest National Standard Authority of Ireland National Rules for Electrical Installations, Department of the Environment, Planning and Local Government, Building Regulations, and Technical Guidance Documents.

00.2.2 Where relevant and applicable, the following healthcare standards and guidelines should be fully complied with:

- National Standards for the Prevention and Control of Healthcare Associated Infections (HIQA)
- Health Technical Memoranda (HTM) Electrical Documents:
    - HTM 05-01 (Managing Healthcare Fire Safety)
    - HTM 05-02 Firecode (Fire Safety Design in Healthcare Premises)
    - HTM 05-03 (Fire Safety Measures for Healthcare Premises)
    - HTM 06-01 (Electrical Services Supply and Distribution)

- HTM 08-03 Specialist Services (Bedhead Services)

- Heath Building Notes (HBN's):
  - HBN 00-01 General Design Principles
  - HBN 00-06 Facilities for Diagnostic Imaging & Interventional Radiology
  - HBN 00-09 Infection Control in the Built Environment
- NSAI National Rules for Electrical Installations 5th Edition I.S. 10101:2020+AC2:2025 Part 710 – Medical Locations
- HSE – Specifications of Requirements for Design, Installation, Commissioning and Maintenance of Fire Detection and Alarm and Emergency Lighting Systems – Acute Hospitals

00.2.3 The complete installation shall comply with the latest codes of practice and any other legal requirements applicable to any element of materials, equipment and services provided under this works, even if an applicable code or legal requirement is not specifically referenced in the works documents.

00.2.4 The complete electrical installations shall comply with the Project Employer's Works Requirements documents.

00.2.5 The scope of work for the Contractor includes for the supply, delivery, positioning, erection, connection, testing, commissioning, and setting to work, of all plant and materials necessary to provide complete Electrical Services Installation to the satisfaction of the Engineer and in accordance with the various drawings, schedules conditions and contractual documents and the requirements of this specification.

00.2.6 Should the tenderer consider that there is any contradiction between documents, a query shall be raised during the tender process where clarification shall be made if required. Where queries are not raised the contractor shall assume costs for the most onerous condition. No claims will be entertained after contract award.

00.3 Construction Products Regulation

00.3.1 All products, materials and equipment used on this project shall comply with the Construction Products Regulations. All Construction Products covered by harmonised European Standards must carry a CE mark. The EU Construction Products Regulation (No. 305/2011 – CPR) shall apply in full to all products and materials proposed for use on this project.

00.3.2 Since the 31st of December 2020, manufacturers, distributors, importers, and authorised representatives must comply with their obligations and responsibilities under Regulation (EU) 305/2011 when placing a construction product on the EU market.

00.3.3 Both authorised representatives and importers must be established in the EU-27.

00.3.4 Manufacturers, distributors, importers and authorised representatives of construction products shall ensure that they hold certificates under the responsibility of an EU27 Notified Body to demonstrate compliance for products placed on the EU market.

00.3.5 The Contractor must follow the guidance and changes outlined above. The Contractor must all make sure that the CE Marking / Declaration of Performance and relevant product related documentation is appropriate to demonstrate and ensure compliance with the Building Regulations.

00.3.6 All products where applicable must comply with relevant Harmonised European Standards (HENs)

00.3.7 All products must be provided with a Declaration of Performance (DoP). The DoP must be provided by the manufacturers and must provide information relating to the characteristics of the product and confirm the conformity of the construction product with the declared performance. The CE mark attributed to the product must follow the DoP.

00.3.8 All technical submittals for products and equipment proposed by the Contractor must include all relevant DoP's and must in the first instance be verified by the Contractor before submitting to the Employers Representative or Engineer. The Contractor must verify that the products being proposed do comply with the DoP and are suitable for their intended use in construction works and suitable for the application intended.

00.3.9 The Contractor must also refer to National Standards to ensure that any National minimum standards for specific intended uses of the product in Ireland are complied with. Where such verifications and a DoP has not been provided as part of the technical submittal, the submittal will be deemed invalid and will not be considered. No claims for time lost, or cost increases owing to a potential change in the products or materials shall be considered by the Engineer or Employers Representative as a result.

00.3.10 The Contractor as part of his "Ancillary Certifiers" role under Building Control Amendment Regulations (BCAR), shall maintain a record of all DoP's and shall include same as part of his Inspection Plan records and reports.

00.3.11 The manufacturer's must fully comply with their obligations under the Construction Product Regulations, and shall if requested provide any additional, or supplementary information as may be requested by the Engineer or Employers Representative as may be considered necessary. In the event of such information not being forthcoming within a timely manner the Contractors proposal shall be rejected. No claims for time lost, or cost increases owing to a potential change in the products or materials shall be considered by the Engineer or Employers Representative as a result.

00.3.12 The Contractor must ensure compliance with Building Regulations and as such, all works must be carried out using proper materials that are fit for the use for which they are intended and for the conditions in which they are to be used.

00.3.13 The Contractor shall refer to the details within the Construction Products Regulation (CPR), and all annex's therein and shall ensure that all related elements are fully satisfied.

00.4 Materials

00.4.1 All products, materials and equipment shall comply with the project specification, as well as referenced standards and all applicable regulatory requirements.

00.4.2 Similar items of equipment and individual materials shall be selected from one manufacturer's range to standardise appearance, maintenance, and replacement.

00.4.3 Unless otherwise indicated, standard manufacturer's finishes and colours are to be provided.

00.4.4 All materials, products and equipment are to be transported, handled, lifted, hoisted and stored in accordance with the manufacturer's guidelines to prevent damage to equipment and injury to persons.

00.4.5 The manufacturer's installation recommendations shall be followed and adhered to in full including any requirements for additional or ancillary components not explicitly specified but recommended to complete the installations ensuring suitability for purpose.

00.4.6 In accordance with Article 42 of DIRECTIVE 2014/24/EU where technical specifications in these documents are defined by reference to a specific make or source, or a particular process, or to trademarks, patents, types or a specific origin or production it shall be deemed that the reference is followed by the words "or equivalent".

00.5 Co-ordination and Liaison with other Trades

00.5.1 The Contractor (Mechanical or Electrical) shall be responsible for co-ordination of his works with other specialists and Sub-Contractors and determine and advise of necessary builder's work and attendances by the Main Contractor.

00.5.2 The Contractor shall note that the works at Portiuncula University Hospital is considered to be part of a "live healthcare environment" which has adjoining and connected operations, with other activities being undertaken at the same time as the proposed works. The Contractor shall note that all other and existing operations, communications connections, power supplies etc., will be required to be maintained live. Connections may be required for interface to site services and power systems. The Contractor must survey all connections. Any communications or power connections that are identified must be maintained and where necessary the Contractor must allow for temporary works to ensure no disruption to neighbouring operations. The Contractor must also consider operations and be extremely mindful of all contractor's activities.

00.5.3 The Contractor shall be expected to develop liaison strategies, installation details and methodologies in conjunction with the various specialists, suppliers and client direct service providers. The Engineer shall not be responsible for any co-ordination between contractors, specialists, or suppliers.

00.5.4 The Contractor shall be responsible for the design and implementation of all temporary works associated with connections to existing services, or to maintain operational areas live during the works. Contractors' proposals shall be detailed on method statements and where necessary supplemented with drawings for review by the Engineer.

00.5.5 The Contractor shall co-ordinate space requirements with other services in accordance with routing shown on drawings and utilise space efficiently to maximise accessibility for other installations and for future access and maintenance.

00.5.6 The Contractor shall review all works requirements / project scope documentation with other sub-contractors and specialists prior to any installation. This shall include specialist supplier's information such as mechanical plant systems and installations, control systems, X Ray equipment and installations, door ironmongery equipment, etc. and any other specialist elements being provided by other trades or to which the Contractors works are to be interfaced with.

00.5.7 The Contractor shall review all mechanical and electrical layouts with other Contractors prior to any installation. Similarly, the Contractor must ensure that manufacturers recommendations in terms of installation details are followed, and all such details must be established at an early stage during the co-ordination process. This must include positioning in respect of access for future maintenance, and replacement of consumable, or system critical components. Access for maintenance shall include all recommended safety clearance zones. The Contractor shall be responsible for complete and detailed co-ordination. In the event of installations being carried out where effective co-ordination and all installation requirements have not been adequately considered, the Contractor shall be responsible for undoing works, along with re-installation to satisfactory detail. All costs and time implications shall be the responsibility of the Contractor.

00.5.8 The Contractor will make available the appropriate personnel for attendance at site co-ordination meetings. Technical Site Meeting frequency with attendance by the Engineers shall be fortnightly during the services installation phases, with weekly co-ordination and planning meetings to be held by the Contractors and chaired by the Main Contractors services coordinator. The Engineer does not have any role in the coordination of Contractors. (Note, the frequency of contractor site meetings shall be agreed between the contractors and these meeting shall not be attended by the Engineer)

00.5.9 The Contractor shall note the specific requirements associated with various specialist equipment, especially elements provided under this contract e.g. Kitchen/Catering, etc. The Contractor shall include for all liaison with specialists and shall establish all requirements not later than the first fix installation stage.

00.5.10 The Contractor shall be responsible for all liaison with the specialist contractors, to verify all requirements, cabling specifications and final positions for all equipment. The Contractor shall include for attendance at meetings and workshops where technical requirements are being discussed.

00.5.11 The Contractor shall "work with" and provide attendances to the specialists during their installation, commissioning and handover phases, providing completed and tested electrical installations in sufficient time for the specialists to complete their commissioning and set-up.

00.5.12 The Contractor shall establish and advise at an early stage, dates where materials and equipment being provided by the specialists will be required on site to enable erection and connection.

00.5.13 The Contractor shall include for the production at an early stage of co-ordinated services layout drawings including sectional details of all primary services routes. These drawings shall be fully co-ordinated between mechanical and electrical Contractors and shall be issued to the Main Contractor and Engineer for approval before the installation of any works proceeds.

00.5.14 The Contractor shall be responsible for detailing all primary electrical services and producing specific installation details and drawings which shall be provided to the Mechanical Contractor who as lead co-ordinator shall be responsible for presenting agreed co-ordinated mechanical and electrical layouts to the design team.

00.5.15 Any works undertaken resulting in critical dimensions not being achieved (for example ceiling voids) or requiring alterations of architectural finishes where co-ordinated drawings have not been produced and agreed with the design team will be removed and reinstated to design team satisfaction at the Contractor's expense.

00.5.16 Any installations undertaken by the Contractor resulting in less than satisfactory appearance or improper works in the opinion of the Engineer where insufficient coordination has taken place shall be fully removed and rectified at the Contractors expense. (E.g. pipework crossings or in proximity to electrical distribution or Comm's equipment, insufficient maintenance access etc.)

00.5.17 The Contractor will make available the appropriate personnel for attendance at site co-ordination meetings, technical meetings, and project progress meetings. Technical meetings shall be scheduled to occur fortnightly to be attended by the technical representatives of the contractor and their specialist sub-contractors. Project progress meetings shall be scheduled to occur fortnightly. In advance of each Progress meeting the contractor shall be expected to have issued a detailed progress report for review by all before the scheduled meeting.

00.6 Production of Information – Builders Works and Working drawings

00.6.1 The Contractor shall refer to preliminary Builders Works drawings prepared "for Information" by IN2 Engineering Design Partnership. The Contractor shall take ownership of and shall develop these drawings as the "Contractors" Builders Works Drawings incorporating all Builders Works required to be provided on behalf of the specialists by the Main Contractor. The Contractor's Builders Works Drawings shall contain all necessary information including dimensional and setting out details.

00.6.2 The drawings shall include 1:20 and 1:50 sections and details clearly identifying the Contractors requirements to provide a full working installation in compliance with this specification, manufacturers guidelines and industry good practice.

00.6.3 The Contractor shall provide detailed installation and working drawings to include sections and details, room data sheets with wall elevations. All drawings shall be produced in REVIT and shall be issued to the design team for comment prior to commencement of installations.

00.6.4 The Contractors drawings shall include 1:20 and 1:50 sections, elevations and details clearly identifying the Contractors proposals and requirements to provide a full working installation in compliance with this specification, manufacturer's guidelines and industry good practice.

00.7 Production of Information – Interfacing and Connections to Existing Services

00.7.1 The Contractor shall note that a permit to work system will be operated by Coillte and no works to existing services may be undertaken without approval.

00.7.2 Works involving tie-in, interfacing or connections to existing services such as, power networks, IT networks, and security systems shall only be carried out having obtained agreement and approval PUH management / HSE Estates to proceed.

00.7.3 In order to obtain approvals, the contractor must submit in good time detailed method statements and risk assessments, fully describing the tasks to be carried out, identifying any implications for the client in terms of temporary down time etc., Method statements shall be submitted at least 10 days before works are required to commence. The contractor shall note that connections to existing may be restricted to weekend work, or outside operational hours work.

00.7.4 A schedule of Method Statements will be required and shall be developed by the Contractor at an early stage of the works.

00.8 Production of Information - Procurement Details

00.8.1 The Contractor shall refer to individual sections of the specification and where requested, the Contractor shall provide full shop drawings and complete technical submittal documentation at an early stage to allow appropriate time for review and consideration of the information provided. The Engineer will endeavour to return comment or acceptance of proposals within 10 working days of receipt of full submittals, although the Contractor shall not expect a response for 10 working days. The Contractor shall note that the programme implications of inadequate notice or late provision of information regarding submittals shall be the responsibility of the Contractor.

00.8.2 The Contractor shall note that "alternative" proposals put forward by the Contractor shall not be accepted on the basis of delays to programme due to lead time of the specified products where it is deemed that the Contractor did not advance the technical submittal and procurement process in sufficient time. The Contractor shall be fully responsible for all programme implications and for any additional shipping costs for express freight delivery etc.

00.8.3 The Contractor shall in advance of ordering any equipment submit a full and complete procurement schedule listing all items being procured providing the following information to the Engineer.

- Plant Item including specific Reference Name or identification
- Manufacturer / Supplier Information
- Lead time for delivery
- Expected on site delivery dates

00.8.4 All technical submittals shall be issued in the following format.

- A full index of items, date & revision number of submittals shall be included on the submittal title page.
- All manufacturers / Supplier's schedules shall refer to IN2 item references.

- Sections of IN2 specification relevant to the submittal, shall be returned from the manufacturers / Suppliers with each line item labelled by supplier / manufacturer as follows:
- "Manufacturer / Supplier Initial" & "Compliant" or "Non-Compliant".
- Should a line item indicate non-compliant to spec, the manufacturer / supplier shall include details of proposed alternative and its credentials or potential suitability.
- Expected lead-in times shall be included for all items.
- Where applicable the contractor shall propose dates for reviewing / approving samples on site.
- Technical Submittals shall be on a full system basis in order that the Engineer can consider all aspects of the Contractors proposals. Submittal of individual components will be rejected where it is considered that these may form part of a wider system.
- Individual submittals shall be limited to related items of plant/equipment; to prevent re-submission of part-submittals under the same reference, should some items be rejected.

00.8.5 It is the contractor's responsibility to ensure that technical submittals are fully compliant, prior to submission. IN2 will review 2 No. iterations of the same submittal. Should the contractor continue to issue non-compliant submittals, IN2 will escalate the matter with the project team and will not review any further submittals from the contractor until an improvement plan is agreed. The Contractor shall be aware that additional costs incurred by the Engineer associated with technical reviews shall be submitted on an hourly rate basis to the client, who may seek reimbursement from the Contractor.

00.8.6 The Engineer shall provide a response using a Status A, Status B, or Status C format, with Status A to reflect acceptance of the proposal, Status B to mean acceptance on the condition of comments being addressed and Status C to mean outright rejection.

00.8.7 Status B comments must be addressed, and evidence of satisfactory resolution must be submitted to the Engineer within 10 days, or the Status will automatically revert to Status C. The Contractor shall note that progression on the basis of Status B comments is completely at the Contractors own risk and any works undertaken or materials ordered may be rejected pending the responses provided by the Contractor to the Engineers comments. Any costs or programme implications as a result of rejected materials or works undertaken shall be the responsibility of the Contractor.

00.8.8 Status C response will be as a result of incomplete information, or aspects identified as being not as per specifications, or works requirements. Status C response will require a complete resubmission by the Contractor and once resubmitted will commence a new 10 working day review period.

00.8.9 On receipt of the technical submittal information, the Engineer reserves the right to request further information including technical data sheets or shop drawings in order to be fully satisfied of the Contractor's intent.

00.8.10 In addition to technical submittals, the Contractor shall provide "Benchmark Mock-ups", of main supports and primary installation elements, containment etc. These shall be provided by the contractor and shall be based on technical information submitted.

00.8.11 Samples are to be provided and erected is a "samples area" for design team comment. All samples are to be operational and connected.

00.9 Production of Information – BIM (Building Information Model)

00.9.1 The Contractor shall note that a Level 2 BIM to "Level of Model Definition" LoMD 250, has been prepared by the Engineer and may be provided for use by the appointed M&E Specialists in developing their own co-ordinated installation drawings. Provision of the BIM model by IN2 is not included under the contract and would only be shared on the basis of agreement on terms of use. The Contractor shall allow for production of their own BIM and layouts.

00.9.2 The Engineers Model has been co-ordinated for major clashes with Architecture and Structure, however the Engineers Model is not proposed as "Clash Free" and outlines the design proposals for the purpose of demonstrating the design, for development of the BIM Model to Construction Installation Stage LoD by the Contractor.

00.9.3 The Engineers drawings shall be provided in 2D, with any provision of the 3D Model being provided for "Information" purposes only, with responsibility for installation detailing and co-ordination by the respective Contractors and Specialists.

00.9.4 The Contractors drawings shall include 1:20 and 1:50 sections, elevations and details clearly identifying the Contractors proposals and requirements to provide a full working installation in compliance with this specification, manufacturer's guidelines and industry good practice.

00.9.5 The Contractor shall refer the Works Requirements Architectural Volume A for details in respect of BIM requirements for this project.

00.9.6 The Contractor shall note layout drawings have been prepared by the Engineer and may be provided for use by the appointed Contractor in developing their own co-ordinated installation drawings.

00.9.7 The Engineers drawings shall be provided in 2D, for "Information" purposes only, with responsibility for installation detailing and co-ordination by the respective Contractors and Specialists.

00.9.8 The Contractors drawings shall include 1:20 and 1:50 sections, elevations and details clearly identifying the Contractors proposals and requirements to provide a full working installation in compliance with this specification, manufacturer's guidelines and industry good practice.

00.10 Production of Information – Detailed Installation Drawings

00.10.1 The Contractor shall survey and examine all existing installations indicating details where modifications to the existing systems may be required. The Contractor shall provide detailed "construction" drawings identifying "tie-in" locations, new wiring configurations and all necessary information to fully outline the Contractors works proposals.

00.10.2 The Contractor shall provide "as installed" and fully updated record layout drawings completed to reflect any modifications or changes made to the existing systems through the course of the project. As "as- builts" are not available, the Contractor shall be expected to reflect all installations (new and existing) in a complete set of record information documents including drawings.

00.10.3 The Contractor shall include for the production at an early stage of co-ordinated services layout drawings including sectional details of all primary services routes for all proposed cable containment systems. These drawings shall be fully co-ordinated and checked against architectural and structural elements along the proposed routes. All builders works' implications such as forming of opes must be clearly highlighted and submitted for approval before the installation of any works proceeds. The Contractor shall allow a period of not less than 2 weeks for review of initial drawings. The Contractor shall ensure that drawings are submitted with sufficient time for review of drawings and any necessary modification and re-review so as not to impact on proposed installation dates. The Engineer shall not be responsible for any programme delays because of sufficient time not being allowed.

00.10.4 The Contractor shall be responsible for providing detailed working drawings. These drawings shall include details of cable routes and circuiting. The Contractor shall be responsible for determining all necessary secondary cable containment to include trays, trunking, conduit, cast-in services etc., that are not shown on the Engineers Cable Containment drawings which are noted to be reflective of the Primary Cable Containment only. All Secondary cable containment determined by the Contractor with size greater than 50mm shall be represented on drawings by the Contractor. Conduits other than cast-in conduits do not need to be represented on drawings.

00.10.5 The Contractor shall be responsible for detailing all primary electrical services and producing specific installation details and drawings including fixings and supports for all of the works within the contract and for connections to items of plant or equipment not supplied under the contract but forming part of the works.

00.10.6 Any works undertaken resulting in critical dimensions not being achieved (for example ceiling voids) or requiring alterations of architectural finishes where co-ordinated drawings have not been produced and agreed with the design team will be removed and reinstated to design team satisfaction at the Contractor's expense.

00.10.7 Any installations undertaken by the Contractor resulting in less than satisfactory appearance or improper works in the opinion of the Engineer where insufficient coordination has taken place shall be fully removed and rectified at the Contractors expense.

00.10.8 The Contractors drawings shall include 1:100 plan layouts and 1:50 sections, elevations and details clearly identifying the Contractors proposals and requirements to provide a full working installation in compliance with this specification, manufacturer's guidelines and industry good practice.

00.11 Production of Information – Requests for Information

00.11.1 The Contractor shall initiate a trackable Request for Information (RFI) process, with RFI's to be submitted to the Engineer only in situations where technical clarification is needed, or where additional technical guidance from the Engineer is required.

00.11.2 RFI's related to site matters, or queries between contractors shall not be directed to and will not be responded to by the Engineers. All such Contractor queries shall be discussed between the Contractors during site planning meetings.

00.11.3 RFI's shall be based on the Contractors own appropriate forward planning and where they have already reviewed all provided drawings, specifications and general works requirements documents. RFI's submitted where the Contractor has not reviewed the information will be rejected.

00.11.4 The Contractor shall note the minimum period for response to RFI's is 10 working days and this may be longer if the Engineer requires further clarification from the Contractor, or where a site visit is required to assess the query. The Engineers site visits will be scheduled as per fortnightly site meetings. The Contractor shall be responsible for all programme implications for RFI periods and for any knock-on implications, especially where it is deemed that the RFI's have been generated on the back of poor forward planning and coordination by the Contractor.

00.11.5 Contractors RFI's shall be assigned with an appropriate priority reflective of importance of the information required in the context of the project programme. Unreasonable RFI priorities where the importance is being overstated will be rejected by the Engineer until reasonable positions are stated.

00.11.6 The Contractor shall note that IN2 has no obligation to utilise any Contractors Information Sharing portal system, and any arrangements to engage with such portals must be agreed with IN2 and will be based on reasonable boundaries, no reductions in response times, no spamming with information that is not specifically related etc. The use of portal systems shall not place any additional administrative burden on IN2, where this is considered to be impacting, necessary additional fees shall be sought. Any specific requests that may be high priority shall be communicated directly, and the contractor shall not assume that IN2 engineers are monitoring portal systems on a regular basis.

00.12 Quality Control and Workmanship

00.12.1 The Contractor shall be responsible for on-site installation quality control. As such the Contractor will implement and maintain high standards of quality control governing materials and equipment, project management, site conditions and workmanship to provide a complete working installation to the highest standards that can be reasonably expected or attained.

00.12.2 Evidence of quality control procedures being in place must be demonstrated in this regard. Details of the contractor's QA/QC procedures must be submitted to the Engineer and Client Representatives.

00.12.3 Only persons suitably trained with the necessary qualifications and experience appropriate to the task shall carry out installation works.

00.12.4 The Contractor shall refer to BS 8000 "Workmanship on Building Sites" and shall implement best practice in this regard.

00.12.5 In recognition of the requirement to effectively train apprentices in the trade skill, workmanship and experience and to ensure the highest standards of installations reasonably attainable, the Contractor shall ensure that a ratio of two apprentices to each qualified trade's person is not exceeded on site. Evidence will be requested to demonstrate compliance in this regard.

00.12.6 The Contractor shall execute his works in accordance with industry standards and any relevant guidelines offered by codes of practice or applicable regulations.

00.12.7 The Contractor shall establish and implement manufacturers' installation instructions and procedures in full.

00.12.8 The Consulting Engineers reserve the right to observe ongoing and completed work and comment there on, without prejudice, to the Contractor's responsibility for quality control.

00.12.9 Defective or sub-standard installations or workmanship shall be rectified at the expense of the Contractor.

00.12.10 Prior to commencement of installations the Contractor shall present to the Engineer detailed "benchmarking details", to include sketch proposals and reference photographs to clearly illustrate the Contractors proposed installation methods and providing details of the minimum standards of installation that are to be expected.

In addition, the Contractor shall be expected to construct "mocked up" sample installations fully reflective of the installation methods and proposals. These "mock-ups" once accepted shall be retained as "benchmark" samples on which the installations will be based. Mock-ups are required for elements such as:

- Cable Containment,
- Fire Alarm Cabling,
- Exposed Services Installations.

00.12.11 In addition to benchmarking, working samples shall be provided for elements such as general lighting, where samples are to be connected and erected in an environment reflective of the final application.

00.13 Building Control Regulations

00.13.1 The Contractor shall be responsible for ensuring full compliance with the Building Control Act 2007 and Building Control Regulations including the Building Control (Amendment) Regulations 2014.

00.13.2 The Contractor shall comply with the "Code of Practice for Inspecting and Certifying Buildings and Works" and shall co-operate with the Design Team and Assigned Certifier.

00.13.3 The Contractor shall be responsible as an "Ancillary Certifier", having design responsibility for particular aspects of the mechanical and electrical installations and as, "competent technical and trade persons that install products and/or test on completion", as such the Contractor shall participate fully and undertake all requirements as may be outlined by the Assigned Certifier.

00.13.4 The Contractor shall ensure that a competent person is assigned to oversee the Construction works and to ensure that all workmanship complies with the requirements of the Building Regulations.

00.13.5 The Contractor shall ensure that all materials which they select and for which they are responsible comply with the requirements of the Building Regulations.

00.13.6 The Contractor as "Ancillary Certifier" shall liaise with the Assigned Certifier in the development and implementation of the project Inspection Plan.

00.13.7 The Contractor shall provide Compliance Certificates and any other requested documents to the Assigned Certifier for the purposes of handover and certification, or as may be requested by the Building Control Authority.

00.13.8 The Contractor shall provide all Test and Compliance Certificates to the satisfaction of the Assigned Certifier and the Engineer. These certificates must be presented in sufficient time for review prior to issue of the Certificate Completion Stage.

00.13.9 Consideration must be given to the requirement for commissioning and certification together with the preparation and submission of "Ancillary Certification" in the project programme. The Contractor must schedule and detail all requirements in his works programme for incorporation in the Main Contractors master construction programme.

00.13.10 The Contractor shall be responsible for ensuring that Certification is issued in adequate time to allow the submission of the "Certificate of Compliance on Completion", lack of awareness, or programme constraints will not be acceptable for failure to allow sufficient time for completion of "Ancillary Certifiers" requirements, where the Contractor has not adequately made provision, or has not informed the Main Contractor of the minimum necessary task durations.

00.13.11 The Contractor shall note that failure to undertake any aspects relating to Building Control will result in the non-submittal of the "Certificate of Compliance on Completion". The Contractor shall note that the building cannot be opened, used or occupied until a valid Certificate of Compliance on Completion is accepted by the Building Control Authority.

00.13.12 The Contractor shall note that the Engineer will not provide their "Ancillary Certification" if there is any outstanding works, any outstanding defects, incomplete documentation, outstanding Contractors "Ancillary Certificates", or any other relevant documents on which the Engineer would rely. On this basis the Engineer will not be responsible for delays in submitting the "Certificate of Compliance on Completion", where information is outstanding.

00.13.13 The Contractor shall note requirements for a Phased Commissioning and Handover to enable the early Handover. The Contractor shall provide all necessary commissioning certification and "Ancillary Certification" to enable a phased handover.

00.13.14 The Contractor shall be responsible as an "Ancillary Certifier", having design responsibility for aspects of the electrical installations and as a "competent technical and trade persons that install products and/or test on completion", as such the Contractor shall participate fully and undertake all requirements as may be outlined by the Assigned Certifier.

00.13.15 Ancillary Certificates of Compliance are also required from the following "Specialist" contractors. The following is a non-exhaustive list:

- Fire Detection and Alarm System
- Emergency Lighting Systems
- Electrical Installations

00.13.16 These ancillary certificates must comply with the suite of certificates developed by RIAI, ACEI, Engineers Ireland and SCSI specifically:

- Ancillary Certificate Compliance: Design (Commencement / 7 Day Notice)
- Ancillary Certificate Compliance: Design (Completion)
- Ancillary Certificate Compliance on Completion

00.13.17 The Contractor shall be responsible for the Design, Selection and installation of the complete support & Bracketry systems (inc plinths & proprietary support systems), for all services included in the electrical package, including anchor systems and metal framing supports etc. The Contractor shall be responsible for determining the appropriate components, materials and methods of installation based on the fully loaded capacities +50% of proposed systems / equipment and the structure from which the systems / equipment is to be mounted.

00.13.18 The Contractor shall ensure that a competent person is assigned to oversee the Construction works and to ensure that all workmanship complies with the requirements of the Building Regulations.

00.13.19 The Contractor shall ensure that all installation supervisory staff are fully familiar with Building Regulation Technical Guidance Documents, especially in respect of installation details, dimensions for compliance etc. and shall ensure that all trades operatives under their supervision fully comply with Building Regulation requirements when carrying out installation works. The Contractor shall be fully responsible for all costs and programme implications that may be associated with remedial works that may be necessary where non-compliance has been identified by the Building Control Authority, Specialist Installers, or by the Engineer.

00.13.20 The Contractor as, "Ancillary Certifier", shall liaise with the Assigned Certifier in the development and implementation of the project Inspection Plan.

00.13.21 The Contractor shall be responsible for compliance inspections during ongoing works and shall maintain inspection records including sign off sheets and photographic evidentiary reports for all inspections. No services are to be concealed without contractors completion of inspection reports.

00.13.22 The Contractor shall ensure that all materials which they select and for which they are responsible comply with the requirements of the Building Regulations. The Contractor shall also ensure that only materials that adhere to the accepted technical submittals with relevant DoP's and CE markings are permitted to be installed on the site.

00.13.23 The Contractor shall provide written confirmation along with photographic evidence demonstrating that any required remedial measures identified by the Engineer during their site inspections have been actioned and closed. This confirmation must be received within 5 working days of the issues being raised, or sooner if the works programme dictates that the services may be required to be concealed within a shorter period. i.e. no services can be concealed without evidence that the contractor has rectified any issues of compliance, or workmanship.

00.13.24 The Contractor shall provide Compliance Certificates and any other requested documents to the Assigned Certifier for the purposes of handover and certification, or as may be requested by the Building Control Authority.

00.13.25 The Contractor shall provide all Test and Compliance Certificates to the satisfaction of the Assigned Certifier and the Engineer. These certificates must be presented in sufficient time for review prior to issue of the Certificate Completion Stage.

00.14 Firestopping

00.14.1 All electrical services penetrating fire walls shall be fire stopped. The Contractor shall refer to Architects drawings for details of fire compartment walls and associated fire rating.

00.14.2 The Contractor shall include for the provision, installation, labelling and certification of proprietary fire stopping materials, intumescent pillows etc., within electrical distribution containment systems.

00.14.3 The Contractor shall be responsible for the provision of Fire Stopping to services ope's, risers etc formed as part of these work. However, the specialists shall also ensure that all Fire Stopping deficiencies identified during the course of the works are brought to the attention of the Main Contractor. Once Fire Stopping has been installed the Contractor shall not disturb or modify the firestopping to facilitate any further installation. Any modifications to fire stopping shall be correctly repaired or reinstated by the Fire Stopping specialists.

00.14.4 The specialists shall bring to the attention of the Main Contractor any additional fire stopping requirements which may have been observed during the installation works, or where the Contractor has observed damage to installed fire stopping all such locations shall be advised for remedial action.

00.15 Testing & Inspections

00.15.1 The Contractor shall be responsible for ongoing Quality and Compliance inspections during ongoing works and shall maintain inspection records including sign off sheets and photographic evidentiary reports for all inspections.

00.15.2 Quality inspections are to be carried out by Contractors supervisory personnel to ensure that all installations are being undertaken in accordance with agreed benchmarks, industry best practices, manufacturers recommendations and requirements of the specifications. High levels of workmanship are minimum expectations. The Contractor shall develop installation workmanship check sheets, and these shall be presented to the Engineer during site visits.

00.15.3 The Contractor shall be responsible for a carrying out all commissioning, testing and inspections as required by the specification or by any governing regulations or codes of practice not specifically referenced in the documentation.

00.15.4 The Contractor shall note the requirements for Commissioning and Handover and shall develop the Testing and Commissioning Plan to demonstrate the commissioning of electrical systems, particularly mains distribution, fire detection and alarm systems, emergency lighting systems and any other electrical systems that are required to be complete before BCAR completion certificates are required to be submitted to the Building Control authority. The Contractor shall include all allowances for phased systems commissioning.

00.15.5 The Contractor shall maintain an accurate documented record of all commissioning and test results to include the type of test carried out, listing all observations and findings including defects and failures. The documentation shall also give details of proposed or instructed remedial actions taken to correct any defects or failures. A retest of all failures shall be documented.

00.15.6 The Contractor shall prepare a written schedule giving a minimum of a 10-working day notice period of proposed test dates for witnessing by the Engineer. Not less than 24 hrs prior to scheduled witness testing, the Contractor must provide written confirmation to the Engineer and ER that the Contractor has completed all their own testing and verifications and are satisfied that all systems are fully commissioned and are fully ready to offer to the Engineer. The Engineer will NOT attend scheduled witness testing unless the written confirmation is received in advance. Rescheduling will need to be agreed with the Engineer, and this may require a further 10-day notice period pending Engineer schedules and availability.

00.15.7 Should the Engineer attend for witness testing and determine that the systems are not commissioned, or suitable for witness testing, the Engineer will advise the ER and site management and may cancel witness testing until the Contractor has completed their works.

00.15.8 Following acceptance by the Engineer, the Contractor shall include for final demonstration to the Client stakeholders and their representatives. The Contractor shall allow for attendances of specialists and technical suppliers during witness testing by the Engineer and during demonstrations to the Client.

00.15.9 In developing their commissioning programme, the Contractor shall include all commissioning tasks and activities and shall include appropriate periods for witness testing and client demonstrations. Witness testing schedules shall be co-ordinated by the Contractor to maximise time efficiency allowing for a maximum of two days attendances by the Engineer. The Contractor shall note that the Engineer shall only notify the client of pending Contractor demonstrations after the Engineer is satisfied with witness testing and has reviewed all commissioning results. The Contractor shall allow for notice periods in their programme.

00.15.10 The Contractor shall provide the original Test and Compliance Certificates for inclusion in the O&M Manual. These certificates must be presented prior to Completion Stage, as failure to do so will delay completion and all costs for delays attributable will be borne by the Contractor.

00.15.11 Where required by the Specification the Contractor will be obliged to engage third party testing and commissioning specialists. The proposed third-party details together with the scope of their engagement shall be submitted to Engineer for comment or approval by the Contractor no less than two calendar months before the programmed pre-commissioning dates.

00.15.12 The Contractor shall note that final acceptance and submission of BCAR certification by the Engineers will follow client demonstrations and initial familiarisation training which is to be provided by the Contractor.

00.15.13 The Contractor shall be fully responsible for adherence to completion programmes, BCAR submissions and notice periods, and shall be solely responsible for any implications due to failed commissioning that would delay Engineer witness testing and client demonstrations.

00.15.14 The Contractor shall prepare a detailed schedule and commissioning programme identifying tasks, durations and sequence together with key dates for co-ordination with the Main Contract Programme. The Contractor shall ensure that sufficient time is allocated within the Main Contract programme for successful and complete testing commissioning and witness testing. The Commissioning Programme shall be developed to indicate separate commissioning and handover activities.

00.16 Site Facilities

00.16.1 The Contractor will provide secure covered storage facilities for all materials and equipment necessary for the proper execution of the contract. The Contractor shall allow for deliveries of materials and equipment commensurate to the space available. The Contractor shall co-ordinate site facility requirements in line with the contract documents. The Contractor shall take account of site constraints and make adequate provisions.

00.16.2 The Engineer may reject materials or equipment where it is considered that these materials are not being stored adequately and protected from damage and these will be replaced at the Contractor's own expense.

00.16.3 The Contractor shall provide site office facilities complete with telephone, and e-mail capabilities for receipt of design information. The Contractor shall also include for the provision of all CAD facilities complete with A1 colour plotting facilities. The Engineer will not be responsible for providing hard copy drawing prints and all information will be issued in electronic format for printing by the Contractor.

00.17 Site Supervision

00.17.1 The Contractor shall include for the provision of a full time, on site, suitably experienced Foreman for each shift operated, who's time and responsibility will be dedicated solely to the project for the supervision of trades persons under his control. The Foreman shall not be involved in installation works as a trades person. The Foreman shall be fully familiar with Building Regulation Technical Guidance Documents, in respect of installation details, dimensions and details for compliance etc. and shall ensure that all trades operatives under their supervision fully comply with Building Regulation requirements when carrying out installation works. The Contractor shall be fully responsible for all costs and programme implications that may be associated with remedial works that may be necessary where non-compliance has been identified by the Building Control Authority, Specialist Installers, or by the Engineer.

00.17.2 Chargehands with responsibility for separately identifiable elements of the installation shall also be provided as required.

00.17.3 The Contractor shall include for the provision of adequate supervision for the entire duration of the works. The Contractors supervisory staff shall be on site throughout the whole time of the works and at no stage shall Contractor's operatives be un-supervised.

00.17.4 The Contractor shall include for the provision of a suitably experienced Contracts Manager with overall responsibility of the project. The Contracts Manager will be expected to be present on site for a minimum of 1 day per week with additional attendance coinciding with site meetings and critical stages of the project.

00.17.5 As works progress the requirement may increase to full time attendance of the Contracts Manager and allowances shall be made for same.

00.18 Operation and Maintenance Manuals

00.18.1 Preparation of operating and maintenance manuals shall be based on the following documents: -

- EN IEC 82079-1:2020; Specification for Electrical Manuals
- BSRIA BG2/2004; Computer based operating and maintenance manuals – options and procurement guidance.
- BSRIA BG79/2020; Handover, Operating and Maintenance manuals and project feedback
- BSRIA Technical Note TN 12/86; Fault finding procedures in the building services industry

00.18.2 At an early stage of the contract, the Contractor shall submit a preliminary draft set of Operation and Maintenance Manuals, to the Engineer for comment.

00.18.3 The Contractor shall obtain preferred O&M structures and formats at an early stage, which shall form the basis of the Contractors O&M. The draft formats shall be presented to and agreed with the PSDP. Note an electronic and hard copy format O&M / Safety File is required. The electronic Safety File shall be constructed by specialists.

00.18.4 The O&M shall be developed throughout the project and shall be submitted in final draft four weeks before the date for Substantial Completion of the project, at which time it will be agreed that only information to be added to the files will relate to final commissioning and certification. The Contractor shall note that provision of O&M expected meantime between failures, maintenance company, contact details, etc. and all other information pertinent to the installation information is a requirement under BCAR, and delayed provision of the O&M will delay BCAR.

00.18.5 After final approval from the Engineer and before making application for final payments, the Contractor shall present the following:

- 2 No. Paper Copy (Colour Print, bound in A4 Size folders, Drawings folded to suit (sizes to be agreed with Employers' Representative)
- 2 No. USB (".doc" and ".pdf" formats generally) submitted electronically in original format and as well as pdf format.

00.18.6 The Operation and Maintenance Manual shall contain the following as a minimum:

- A detailed asset management register to the Employer's template outlining element, cost, warranty period, maintenance schedules and requirements,:
- A list of the 'As Built' Drawings.
- A description of the general works and of each service installation and fittings.
- A description of the method of operation of each service/installation and fittings, including the independent method of operation of each item of plant and equipment.
- Detailed procedure for starting up each of the services/installations whether individually or as a whole.
- Detailed procedure for shutting down each of the services/installations whether individually or as a whole.
- A description of the maintenance methods and routine procedures and requirements for each service/installation and fitting, including each item of plant, equipment and fitting.
- A list of manufacturers, suppliers, installers, trade names, model and/or catalogue numbers, for all items of plant, equipment and fittings including complete with ordering references and all manufacturers' names and works addresses.
- Wiring diagrams for all items of plant and equipment.

- Copies of manufacturer's literature, including operating instructions and maintenance procedures for all items of plant, equipment and fittings.
- Copies of manufacturer's detailed drawings of all items of plant, equipment and fittings.
- Health & Safety procedures and guidelines & Project Safety File.
- Fault finding procedure.
- Emergency plant failure procedure.
- A list of spares to be stocked by the Employer.
- Original copies of all test certificates, data and results arising out of testing and commissioning the Works.
- Manufactures guarantees or warranties

00.18.7 The Contractor shall provide an electronic copy of the final and agreed O&M Manual including all technical literature and 'As Installed' drawing information etc. All text shall be presented on Microsoft Word (latest version) files or PDF. All manufacturers' literature, catalogue information etc shall be scanned and presented in PDF format. The electronic copy shall be submitted on USB format.

00.18.8 The Client shall reserve the right to engage the services of a specialist author to prepare the Operating and Maintenance manuals, should the contractor fail to provide a full set of complete comprehensive Operation and Maintenance Manuals to the satisfaction of the Client and Engineer. The cost of the specialist author shall be deducted from retention or monies outstanding.

00.19 Training and Familiarisation

00.19.1 The Contractor shall provide full training and familiarisation to the Client or persons nominated by the Client. The training and familiarisation shall be provided on all aspects of the installed systems and the use of the O&M Manuals. The Contractor shall ensure the attendance of all specialist suppliers who shall describe their systems, highlighting specific relevant items of note to include, maintenance requirements and client's responsibilities.

00.19.2 The training and familiarisation shall be expected to be provided on two occasions, at times to be scheduled and agreed with the client. At least one of the occasions must be completed before Handover with a further session to be held at the request of the client and within eight weeks of occupation.

00.19.3 The Contractor shall note that the client may refuse to accept handover of the building until such time as adequate training and familiarisation has been provided. It should also be noted that final BCAR acceptance and submission of completion certification cannot proceed until training in the use of the systems has been provided.

00.20 Handover

00.20.1 The Contractor shall be available for attendance at a formal handover and presentation of the O&M Manuals to the client.

00.20.2 As part of the familiarisation training the Contractor will be expected to demonstrate a working understanding of the installed systems to a level that can be conveyed to the client to enable him to operate the systems and installations to their full potential with confidence.

00.20.3 The Contractor shall note the following minimum requirements in order to achieve handover:

- Completed O&M's including "as built" drawings and commissioning records
- Completed system certification
- Completed Demonstrations to the Engineer
- Completed Client / Operator Training
- Completed Client Demonstrations
- Completed "snags"

00.20.4 Post-Handover and for an initial "run-in" period following occupation of no less than 2 weeks the Contractor shall maintain an on-site presence of appropriate persons to ensure the seamless transition and immediate response to any issues that arise.

00.20.5 Following handover, the Contractor shall attend bi-monthly review meetings on site to deal with any arising issues and ensure identified "snag" items are being actioned.

00.21 Defects Liability

00.21.1 During the Maintenance period any defect that arises in the Electrical Services Installations during this period shall be rectified and made good at the Contractor's own expense.

00.21.2 The term defect in shall be interpreted as: any item of plant, equipment or component thereof, accessory or fitting that shall be found defective, show signs of mechanical or electrical weakness or undue wear in consequence of faulty design, workmanship or material'.

00.21.3 In the event of the Contractor refusing to rectify such defects within a reasonable period, the Engineers will have the works carried out by others, and any charges arising there from shall be at the expense of the Contractor and deducted from retention monies.

00.22 Manufacturers Warranties

00.22.1 The commencement of Manufacturers warranties shall be from the date of Handover to the client and not from date of Contractors receipt to site. Any extension to manufacturers warranties that may be required to comply with the above must be included by the Contractor.

00.22.2 All warranty information shall be included in the Handover file.

00.23 Maintenance Period

00.23.1 The Contractor shall maintain all elements of the Electrical Services Installation for a period of twelve (12 No.) calendar months commencing from the date of acceptance of the Certificate of Compliance on Completion by the Building Control Authority.

00.23.2 The Contractor shall at Handover nominate a responsible person who shall liaise directly with the building operator on all matters associated with maintenance for the duration of this period.

00.23.3 Maintenance during the 12 months maintenance period shall be all inclusive and under the contractor's responsibility, shall include all statutory, planned preventative and reactive maintenance including call outs. Where necessary this shall include maintenance by specialists and or manufacturers agents, in order that all maintenance recommended by manufactures is complied with in full.

00.23.4 The Contractor shall include for 4 no. quarterly PPM (Planned Preventative Maintenance) visits during the maintenance period. Such visits shall include for checking the operation of electrical plant, equipment, accessories etc., making all necessary adjustments and carrying out all necessary replacement of any such faulty component, incidental to this Contract. All maintenance shall be undertaken in accordance with the recommendations as set out in the O&M Manuals. All visits shall be scheduled to occur at times suitable to the client.

00.23.5 In additional to the PPM visits, The Contractor shall also provide an Emergency Service during the whole of the Maintenance Period. The Contractor will be expected to provide a same-day response service (with a following-day service being acceptable for less critical issues in the mutual opinion of the operator and Contractor at the time). Where the cause for the call out was not a result of a defective component under the terms of the defects liability or manufacturer's warranty the Contractor will be entitled to seek costs for the call out. Call Out rates to be clearly identified and agreed at handover. Call out charges will be billed directly to the client.

00.23.6 Following each PPM visit (including those of any specialist) the Contractor shall issue a report to be signed by a representative of the building operator, before being submitted to the Engineer. The report shall include brief details of the visit, including, who attended site, the works undertaken, the time duration etc. The report shall identify the condition of plant and equipment, list the maintenance undertaken and highlight any issue that may require further remedial action but was not possible to address within the context of the PPM visit.

00.23.7 In the event of the Contractor failing to carry out the PPM within reasonable time frames, the Contractor will be advised that these works will be undertaken by others appointed by the client and all associated costs will be deducted from retention or other monies outstanding.

Rev	Status	Date	Comment
00	Suitable for Tender	22nd July 2026	Issued for Tender

05.1 Existing Services - General

The Contractor shall be fully responsible for identifying, making safe and stripping out of all existing services on completion new works. The Contractor shall set out a complete method statement for all stripping out and disconnection works. The Contractor is particularly advised to examine the site during the tender period and ascertain the full extent of these works. The Contractor will be required to liaise with the client's representative before commencing the strip-out works.

The Contractor is specifically advised and shall be deemed to have surveyed the full extent of strip–out and diversions, as well as items to be disconnected / reconnected, during the Tender period and all costs are deemed included in the Tender return. No future claims in this regard will be entertained. The Contractor shall refer to all survey reports and existing layout drawings provided as part of tender information and shall consult these during his own survey. Any discrepancies shall be advised by the Contractor and included in the tender.

The following photographs are provided as supplementary information only. Provision of these images shall not defer from the responsibility of the Contractor to undertake his own survey.

All work shall be carried out in an environmentally aware manner in order to minimise any adverse environmental impact caused by the works.

The Contractor shall take all due care when carrying out this project to carry out the works in an environmentally aware manner and dispose of all redundant materials in an environmentally responsible manner, including the use of recycling or specialist disposal methods to avoid the release of pollutants to the environment. Please note that useable redundant materials or valuables found during strip out works may be required to be presented to the client for review.

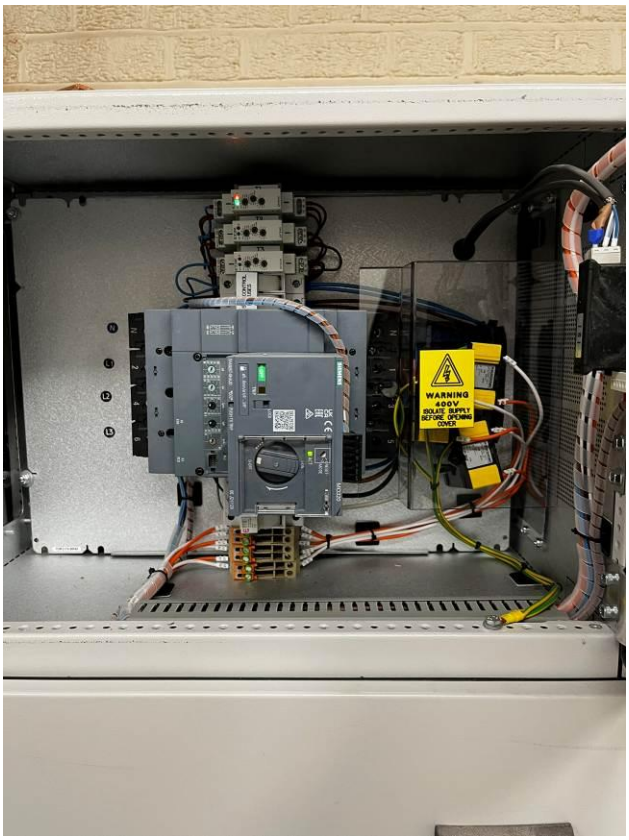
All redundant materials containing material classified under 'European Communities Waste Management Act, 1972' and 'S.I. No. 73/2000 – Waste Management (Hazardous Waste) (Amendment) Regulations, 2000' shall be considered as hazardous waste and shall be disposed of in accordance with legislative requirements. This includes fluorescent lamps, cathode ray tubes, batteries containing mercury, fire alarm detectors containing ionisation chambers (potential radiation exposure), etc.

The Contractor shall ensure that approved methods are strictly adhered to by the site installation team and no deviation from approved materials, or methods will be permitted.

In the event that the Contractor encounters an issue preventing them from proceeding with approved methods, they must stop work and must engage with the client's representative or IN2 Engineering Design Partnership until a resolution is found and works can proceed.

The Contractor shall make do provisions within his programme and allowances within his tender for elements of unforeseen works that may be required and for disruption that may be caused where resolutions require further engagement with, and the approval of the client's representative or IN2 Engineering Design Partnership.

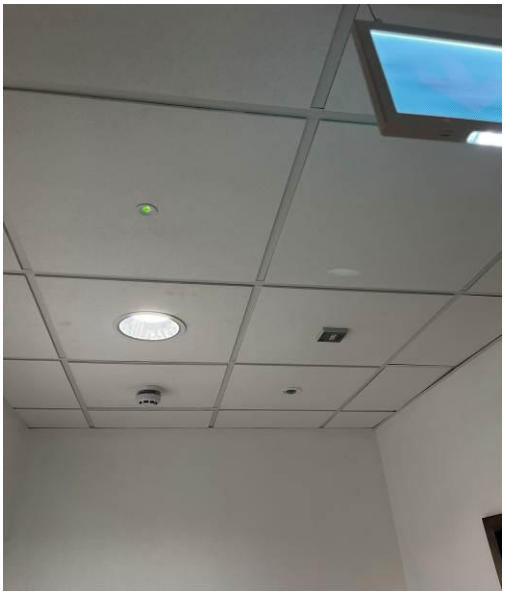
The Contractor shall be expected to form an opinion based on experience, during tender stage site visits and shall include any necessary costs within their tender sum. No claims shall be entertained in respect of delays, disruptions, or additional works as a result of restrictions or any other implications.

Survey Photograph	Notes
 	Figure 05.1.1 – Existing Undercroft Main LV Switchboard The existing Undercroft Main LV Switchboard (OLB-01) 200A MCCB Future CT cubicle shall be utilised for the new LV outgoing supply to the X-Ray Room SDB. The Contractor shall include for all the necessary testing by a switchgear specialists of the existing motorised MCCB to ensure all functional components are fit for use and if not, the necessary modifications or replacement are made to satisfy this requirements of this specification. The Contractor shall allow for the complete survey ,testing and documentation of all incoming/outgoing ways to OLB-01 to ensure all areas are maintained live for the duration of the works and if any downtime is required that the Contractor has included the necessary allowances for temporary power arrangements. Before any physical work begins, the following safety procedures are mandatory: Isolation: safely isolated using a full Lockout-Tagout (LOTO) procedure as per PUH requirements.

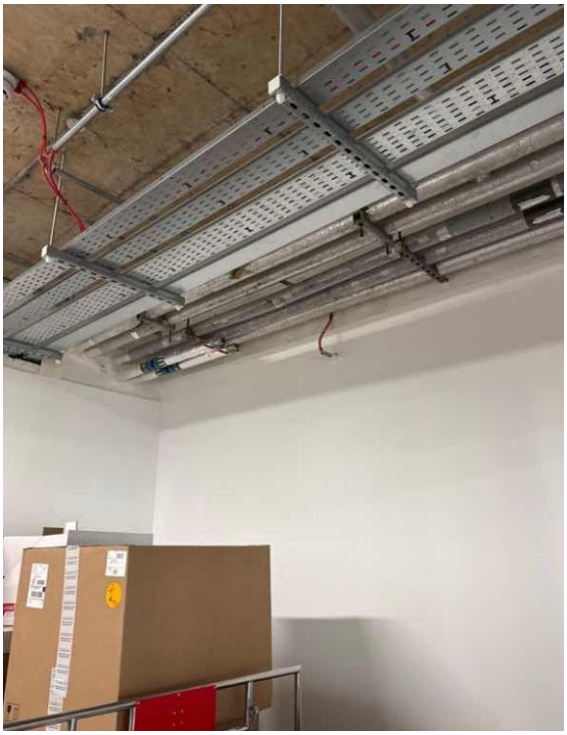
Survey Photograph	Notes
 	Figure 05.1.2 – Existing Undercroft Sub Distribution LV Switchboard The existing Undercroft Sub Distribution LV Switchboard (SDB-01) shall be utilised for all new lighting, general services and small power circuits serving the new X-Ray Room. The Contractor shall include for all the necessary testing by a switchgear specialists of the existing protective devices, etc to ensure all functional components are fit for use and if not, the necessary modifications or replacement are made to satisfy the requirements of this specification. The Contractor shall allow for the complete survey ,testing and documentation of all incoming/outgoing ways to SDB 0-01 to ensure all areas are maintained live for the duration of the works and if any downtime is required that the Contractor has included the necessary allowances for temporary power arrangements. Before any physical work begins, the following safety procedures are mandatory: Isolation: safely isolated using a full Lockout-Tagout (LOTO) procedure as per PUH requirements.

Survey Photograph	Notes
 	Figure 05.1.3 – Exiting Fire Alarm System Existing fire alarm panel installation is an addressable fire alarm panel within the CT Area at PUH. The contractor shall allow for the liaison and coordination with the PUH fire alarm term maintenance contractor, Messrs' Masterfire Ltd. to ensure that network links are maintained and that all necessary measures are put in place to prevent any false alarms during construction or modification works. All new fire alarm works shall comply with I.S. 3218:2024 fire detection and alarm standard. The Contractor whilst engaging with Messrs' Masterfire Ltd shall determine existing loop capacity on fire alarm Node serving this level/zone. The Contractor shall also allow in their tender return for the completed testing and commissioning of the new fire alarm devices onto the existing building system including any Cause & Effect updates required for overall system witnessing and handover to the Engineer and HSE

Survey Photograph	Notes
 	Figure 05.1.4 – Existing IT & Structured Cabling Networks Existing PUH IT & Structured cabling connections to be retained and protected throughout the new works in the X-Ray Room. Existing Comms cabinets located in the CT Area Main IT Core Room shall be utilised for all new Cat 6a cabling terminations associated with the X-Ray room project for services systems such as IT, BMS, Access Control, Nurse Call, etc. The Contractor shall allow in their tender return for the survey, testing and labelling of all existing IT cabling to be retained as part of these upgrade works. The Contractor shall allow in their tender return for the early engagement with HSE West IT Department representatives to obtain final cabinet / patch panel termination locations within the IT Core Room for the new IT Structured cabling installations as per of the X-Ray Room works.

Survey Photograph	Notes
  Existing DEXA Room Lobby	Figure 05.1.5 – Existing Electrical Services Installations The Contractor shall allow for the survey, identification and strip out of all existing electrical services in areas being refurbished as part of this project. Existing electrical services installations include but are not limited to lighting, emergency lighting, general services, small power, fire alarm, nurse call, data installations, LV containment, security systems, etc. The Contractor shall liaise with PUH Estates & maintenance staff personnel to determine if equipment stripped out is to be handed back to PUH for future use or disposed of in accordance with the procedures and regulations outlined at the start of this document.

Survey Photograph	Notes
 	Figure 05.1.6 – Existing Electrical Installations The Contractor shall allow for the survey, identification and strip out of all existing electrical services in areas being refurbished as part of this project. Existing electrical services installations include but are not limited to lighting, emergency lighting, general services, small power, fire alarm, nurse call, data installations, LV containment, security systems, etc. In the patient recovery area, the contractor shall allow for the relocation of the existing bedhead medical trunking along with associated Electrical services including GS wiring and outlets, Nurse Call modules and overhead indicators, lighting, etc to align with the new bed area layouts. The Contractor shall liaise with PUH Estates & maintenance staff personnel to determine if equipment stripped out is to be handed back to PUH for future use or disposed of in accordance with the procedures and regulations outlined at the start of this document.

Survey Photograph	Notes
 	Figure 05.1.7 – Existing Electrical Installations The Contractor shall allow for the survey, identification and strip out of all existing electrical services in areas being refurbished as part of this project. In the existing shell and core areas being utilised for this new X-Ray room development, the contractor shall allow for the connection of new containment installations into existing high level containment already traversing the space linked back to the Undercroft Main LV Switchroom and other CT Area plantrooms. The Contractor shall also allow for the disconnection and strip out of all existing electrical services within this room to include local DB, associated sub mains, local temporary GS socket outlets and Lighting installations. The Contractor shall liaise with PUH Estates & maintenance staff personnel to determine if equipment stripped out is to be handed back to PUH for future use or disposed of in accordance with the procedures and regulations outlined at the start of this document.

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10.1 Outline Description

10.1.1 The Contractor shall include for the complete lighting installation, including the provision and erection of all luminaires as detailed on IN2 Engineering drawings within the newly refurbished X-Ray Room, Changing Areas and Patient Recovery areas at Portiuncula University Hospital.

10.1.2 The Contractor shall carefully read the notes on the drawings and include for all associated costs in their tender.

10.1.3 The Contractor shall be responsible for the means of erection for all luminaires, handling, storing, and transportation to site and setting to work

10.1.4 Where the Contractor is proposing alternative luminaires to what is included in the luminaire schedule and on IN2 Engineering layouts, then detailed DIALux Evo software lighting calculations and layouts drawings are to be provided by the Contractor to demonstrate that the contractors proposals meet client requirements for technical submittal sign off.

10.1.5 The Contractor shall also be aware of Lead Code requirements e.g. Code 8, for lining of any services penetrations through the X Ray room walls and advise the Main Contractor of same prior to works commencing.

10.1.6 The Contractor shall include for any costs associated with Waste Equipment and Electronic Equipment (WEEE) Directive.

10.1.7 The All lighting selected for this project must be on the approved SEAI Triple E Register or if not on the register, must comply with the specific requirements of the Triple E Register.

10.2 Equipment

10.2.1 All luminaries, equipment and installations shall comply with the current provisions of the following standards.

- EMC Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU
- ErP Directive 2009/125/EC
- RoHS Directive 2011/65/EU
- Building Regulations Part M
- Building Regulations Part B
- CENELEC
- I.S. EN 12464-1:2021 - Light & Lighting – Lighting of Workplaces (Indoor)
- I.S EN 61347-1:2015+A1:2021 – Lamp Controlgear. General and Safety Requirements
- I.S EN 61347-2-9:2013 - Particular Requirements for Electromagnetic Controlgear for Discharge Lamps (excluding Fluorescent Lamps)

- I.S. EN 61347-2-13:2024 – Lamp Controlgear – Particular Requirements for d.c. or a.c Supplied Electronic Controlgear for LED Modules.
- I.S. EN 61995-2:2009+A1:2017 – Devices for The Connection of Luminaires for Household and Similar Purposes - Part 2: Standard Sheets For DCL.
- I.S. EN IEC 60598-1:2024 – Luminaires – General Requirements & Tests
- I.S. EN 61547:2009 -Equipment for General Lighting Purposes. EMC Immunity Requirements
- I.S EN 62031:2020 - LED Modules for General Lighting. Safety Specifications.
- I.S EN 60598-2-22:2022 - Luminaires - Particular requirements. Luminaires for Emergency Lighting
- I.S. 3217:2023 – Irish Emergency Lighting Standard
- SLL Lighting Guide LG2 - Lighting for Healthcare Premises

10.2.2 All electronic equipment and devices must have the CE mark of compliance. Any items without certification or compliance in this respect shall not be permitted and shall be removed and replaced at the Contractor's expense.

10.2.3 The system installation shall be in accordance with current NSAI National Rules for Electrical Installations 5th Edition, I.S. 10101:2020+AC2:2025, and by extension the Building Control Regulations.

10.2.4 The Contractor shall ensure that all internal lighting offered is specified in accordance with the appropriate maintained illuminance levels (in lux) as recommended by I.S. EN 12461-1.

10.2.5 Illuminance (lux) levels within the X-Ray Department are specified in accordance with I.S. EN 12464-1 and CIBSE Code for Lighting LG2 – Lighting for Healthcare Premises As well as principal functional areas, this includes all ancillary areas (as applicable) such as:

- Changing Areas
- Plant and control rooms
- Circulation areas, Lobbies corridors, and stairwells

10.2.6 Where applicable, All wiring accessories must comply with Part M of the Building Regulations and shall achieve the LVR as per "Building for Everyone" publication.

- Switched socket outlets and isolator switches etc must indicate visually whether they are on or off.
- All controls must visually contrast with their backgrounds to facilitate people with a vision impairment.
- Switches on sockets must be adequately separated to allow selection of one at a time and avoid the unintended selection of adjacent switches.

10.2.7 All electronic equipment and devices must have the CE mark of compliance. Any items without certification or compliance in this respect shall not be permitted and shall be removed and replaced at the Contractor's expense.

10.2.8 All lighting equipment supplied shall comply with the relevant requirements and be capable of installation in accordance with the manufacturers' instructions, the current edition of the local wiring regulations and all statutory and local authority requirements.

10.2.9 The technical specification of all luminaires shall be as detailed on the schedule of luminaires included within this specification.

10.2.10 The Contractor shall be deemed to have included for all proprietary fixing kits, suspensions and mounting arrangements required for each luminaire. All luminaire components shall be as per the luminaire manufacturer.

10.2.11 All luminaires shall be supplied complete with long life LED lamps and shall be by a reputable lamp manufacturer as per Osram, Philps Lighting or equivalent.

10.2.12 Light switches in all 'front of house' or publicly accessed areas shall be 20 Amp, inductively rated to BS 1363, and suitable for flush mounting. Light switches shall be finished in brushed stainless-steel finish with black inserts and stainless-steel rockers from the Click range or equivalent.

10.2.13 Light switches within plant rooms, store room areas shall be 20 Amp, inductively rated grid switch type as Metal clad range from MK or equivalent.

10.2.14 Light switches, where indicated as external or weatherproof, shall be IP54 surface mounted as Master Seal clad range from MK or equivalent. Switches are to surface mounted, MCO finish. The number of circuits is as indicated on drawings.

10.2.15 Where indicated, mains rated PIR's shall be utilised to switch the lighting circuit as a means of conserving energy. The mains PIRs shall be capable of switching the circuit load. Mains rated PIR's are to be suitable for recessed or surface mounting as appropriate and shall have a minimum range of 6 metres.

10.2.16 The PIR's shall be multisensory ultrasonic with the ability to hold the lights off in effective ambient conditions. PIRs shall have an inbuilt time delay adjustable to suit the zone. Mains PIR's shall have a maximum power consumption of 2 Watts per device. All Mains PIR's shall have a minimum 3-year manufacturer's warranty. PIR's shall be manufactured by Helvar or equivalent.

10.2.17 Luminaires listed have been selected based on technical and aesthetic performance. Substitutions or alterations to any of the luminaries listed shall only be submitted on an equal basis for approval by the engineer.

10.3 Installation

10.3.1 The Contractor shall instruct the building trades with regard to the supply and installation of grounds or supports behind all wall and ceiling mounted luminaires and any builder's work cast in boxes or openings in ceilings which may be required to accommodate fittings. The electrical contractor shall set out and clearly mark out the ground or ope's required.

10.3.2 The Contractor shall also instruct the building trades on the casting in of recessed wall or ground mounted luminaires within the structure of the building. The Contractor shall include for the early delivery of proprietary casting in boxes to facilitate the installation of luminaires later in the programme.

10.3.3 Where accessible ceilings are provided, or where access hatches are possible, the Contractor shall provide individual Klik connection, or Multigang Klik connections where final flex connections are less than 1.5m.

10.3.4 The final location of each luminaire and its integration with the building fabric shall be as detailed on the IN2 drawings.

10.3.5 All luminaires on escape routes or integrated into fire rating ceilings shall be F rated.

10.3.6 All necessary control gear and transformers shall be mounted within the luminaire unless indicated as located remotely. Control gear shall be deemed of good quality and shall comply with all relevant statutory regulations, shall be compatible with the lamps specified, and shall be mounted and wired in accordance with the manufacturers' instructions.

10.3.7 Transformers shall have a stable output voltage of 11.4V or 22.8V, under varying loads, where the output voltage is nominally quoted at 12V or 24V unless otherwise stated, all transformers shall be suitable for dimming on their primary side via a solid state controlled remote lighting control system. All luminaires specified to be dimmable should have full range of dimming and no flickering or shut off should occur during dimming.

10.3.8 Where gear or transformers are installed remotely, care should be taken to ensure that any audible sounds generated by control gear, or by lamp filaments via control gear are kept to a minimum. Where this is particularly crucial, detailed acoustic requirements are included in the acoustic consultant's report for further details.

10.3.9 All equipment shall be protected from unexpected mains failure, and mains borne interference.

10.3.10 All power, control and communication cables to be rated CPR Class minimum **Cca s1a, d0, a**1 in accordance with EN 50575: 2014 + A1:2016 and I.S. 10101:2020+AC2:2025.

10.3.11 The internal wiring shall be carried out in 2.5 sq. mm. LSZH insulated single cables, enclosed in galvanised steel trunking and conduit. Circuit loading shall not exceed 8 No. fittings per circuit.

Device Type	Protective Device and Rating	Cable Sizes
General lighting circuit max 8 No. fittings per circuit.	10 Amp SP&N MCB Type B	2.5mm sq c/w 2.5mmsq CPC. All cabling shall be LSZH Insulated

Toilet / Changing area lighting circuit max 8 No. fittings per circuit.	10 Amp SP&N RCBO 30mA	2.5mm sq. c/w 2.5mmsq CPC. All cabling shall be LSZH Insulated & sheathed

10.3.12 Circuit references and arrangements are as indicated on IN2 Engineering drawings and shall be agreed with the Engineers before commencing work on site.

10.3.13 Final connections to all wall or ceiling mounted luminaires where no void space is available shall be in flexible conduit and porcelain connectors fixed within to round conduit box. This termination arrangement shall be located directly behind the luminaire and shall finish flush with the wall or ceiling finish. Plug and socket connectors with flex shall not be accepted for surface mounted fittings. Where cables enter through the metal structure of a luminaire, the cable shall be protected by rubber grommet.

10.3.15 All lighting equipment shall be supplied with adequate means of protection to ensure its preservation during transport to site and any subsequent storage prior to installation.

10.3.16 All vulnerable finished parts liable to scratching or other abrasion during handling and installation shall be further protected by a removable film applied prior to dispatch.

10.3.17 Lighting in Back of House Areas, i.e. storerooms, plant rooms, switchrooms, etc shall be conventionally switched via local wall mounted switches. All storeroom switches shall be mounted outside the room, and the switch shall be fitted with a red LED/neon indicator to provide indication when the light is left on. The Contractor shall therefore ensure that the neutral is broken through the light switch to provide power to the indicator light.

10.3.18 All wall mounted light switches shall be positioned at a height of 1,100mm AFFL to the centre of the outlet unless otherwise indicated.

10.4 Control of Lighting

10.4.1 The control of the internal lighting shall be an Open protocol DALI 2 technology and shall consist of standalone manual switching and mains voltage occupancy sensors in the circulation areas and scene setting controls within the X Ray Room.

10.4.2 Control of Lighting within the circulation and corridor areas shall be by standalone 230V rated Ultrasonic Presence detection sensors. The Contractor shall select PIR sensors specific for lighting applications and shall be capable of switching the circuit load.

10.4.3 The lighting control shall maximise energy efficiency and where appropriate incorporate daylighting, dimming of LED luminaires within the building where extracting daylight is possible.

10.4.4 Corridor and circulation spaces are proposed to be provided with daylight and occupancy sensors, connected to time schedules whereby the lighting will dim when there is no movement on the corridors, with the light level to rise once movement is detected. DALI controllers are to be incorporated into switchgear to achieve this.

10.4.5 The X Ray Room Suite areas shall be provided with complete DALI 2 Lighting Control system to include central controllers, scene settings, dimming etc. and shall provide considerable flexibility with controls for pre-programmed scenes to comply with the requirements for diagnostic imaging (MRI/CT Scanning / PET / Ultrasound /X-Ray) departments. These requirements include a scene controller at the main entrance door and control desk to enable lighting to be dimmable from general use (500lux @1mAFFL) to 50lux during Scans.

10.4.6 Each of the locations listed above shall be provided with 4 button scene setting controller. The scene settings shall form the basis of the initial configuration by the Lighting Control Specialist. Exact settings will be determined and adjusted during on site commissioning with the attendance of the Engineer, End Users and Architect.

10.4.7 The X-Ray room shall also incorporate Radiation warning lights. outside both staff and trolley entrances to the room, preferably near eye-level. These ' CONTROLLED AREA DO NOT ENTER' or 'X-RAY IN USE' signs shall be linked to the X-Ray Pre-Exposure Circuit and supplied from the X-Ray isolator. All other warning lights should be coupled to the X-Ray machine control switch. The size, colour and style of this sign along with the average luminance level of the illuminated sign shall be at least twice as bright as the general background or the wall it is fixed to

10.5 Testing & Commissioning

10.5.1 On completion of system installation full testing and commissioning shall be carried out in line with manufacturer's guidelines and as defined under current NSAI National Rules for Electrical Installations 5th Edition, I.S. 10101:2020+AC2:2025.

10.5.2 Commissioning of internal / external lighting system 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 Contractor / Specialist to verify that the installation is design compliant, with average lux levels measured recorded on "As Built" drawings, to be included in the O&M manuals.

10.5.3 The Contractor shall include for the commissioning, demonstration, and programming of all lighting installations outside normal working hours i.e. (after dark). The contractor shall facilitate the Engineer by ensuring the full operation of all lighting installations in order that lux level readings can be verified. The Contractor shall record lux levels using a calibrated lux meter and levels shall be included as part of pre-commissioning information.

10.5.4 On completion of system installation full testing and commissioning of the detection sensors shall be carried out in line with manufacturer's guidelines by an approved manufacturer's representative.

10.5.5 The Contractor shall focus all adjustable light fixtures under the direction of the engineer. The contractor shall include for all works to be carried out during normal working hours, but where and as required, shall be carried out during the hours of darkness. The Contractor shall include for the provision of safe and secure access equipment for working at heights.

10.5.6 The Contractor shall provide and procure from the controls providers (general and specialist) full commissioning services of the systems. It is expected that the commissioning procedure will involve but not be limited to the following activities:

Pre-commissioning:

10.5.7 Prior to commissioning, the contractor shall ensure that all power and controls connections are fully complete, including luminaires, detectors, recall stations etc.

Pre-Handover:

10.5.8 Prior to hand-over to the client, the lighting systems shall be fully commissioned. All scene setting shall be completed according to controls / dimming schedules provided.

10.5.9 Commissioning of the complete lighting Installation shall be carried out in coordination with other relevant parties, not limited to the following:

- Lighting Controls Specialist
- Electrical Engineer
- Services Co-ordinator
- Electrical Contractor

10.5.10 The Contractor shall allow for attendance in both daylight and hours of darkness to correctly commission all types of scenes for general and hospitality settings.

Post-Handover:

10.5.11 Following practical completion, the scenes may require adjusting. This follows snagging and other remedial actions. Note that out of hours attendance will be required and all parties listed above may be required for this exercise.

Post-Occupancy:

10.5.12 For the commissioning activities, reference should be made to all of the relevant consultant's and contractor's requirements in terms of number, duration and time of activities. The lighting control systems provider is to include a minimum of 2 post occupancy site visits to carry out adjustments as may be requested by the Client, and to carry out further training in the operational use, and system adjustment functions of the system.

10.6 Warranties

10.6.1 All equipment and components supplied shall be guaranteed against failure due to poor workmanship, materials, or luminaire design, for a period of not less than 24 months (refer to luminaire schedule for specific luminaire warranties) from the date of Handover (not the date of delivery to the site).

10.6.2 All luminaires shall be sourced from local official suppliers and manufacturers. No sourcing of 'grey' imports shall be accepted. This is in the interest of quality, compatibility, delivery, warranty, and support.

10.7 Documentation

10.7.1 Upon project completion the contractor shall provide complete Operation and Maintenance instructions with 'As-Installed' drawings.

10.7.2 The O&M manuals shall include copies of lighting circuit schedules which shall provide details of every lighting circuit, location, phase, device rating, board reference etc. The lighting circuit references shall also be indicated on every circuit on the lighting installation drawings.

10.8 Samples & Technical Submittals

10.8.1 In advance of orders being placed for any luminaires the Contractor shall allow for the assembly, erection and electrical connection of sample luminaires as requested. 1 No. sample of each type of luminaire specified shall be presented for review by the design team comments or final approval.

10.8.2 The Contractor shall note the requirement for the construction of a sample room and shall be required to provide all necessary fittings to complete a fully working sample.

10.8.3 The Contractor shall include for all costs associated with the provision of all samples within his tender return. The contractor shall include for the provision of 1 No. working sample of every luminaire type used throughout the project. The luminaires shall be supplied in working order complete with lamp as specified, associated control gear where appropriate, and 5m flex outlet terminated in a plug suitable for connection to the local distribution system.

10.8.4 All samples are returnable and shall not be included in the fixture count for the permanent installation.

10.8.5 In advance of orders being placed for any equipment the contractor shall submit a full technical submittal including specific details of equipment dimensions, operational data, rated power, controls and wiring diagrams, materials specification.

10.8.6 The contractor shall include for the provision of 1 No. sample of each item as detailed. Samples to be erected and displayed for design team approval.

10.8.7 The contractor shall be responsible for determining quantities from IN2 Engineering Design Partnership drawings and specifications.

10.8.8 The contractor shall liaise with the various specialist suppliers to ensure that all necessary fixings kits, supports, connections, etc. are included.

10.8.9 The contractor shall refer to IN2 Engineering Electrical Specification, Section E00 General Specification, part 00.5 "Production of Information - Procurement Details".

10.9 Approved Manufacturers / Vendors

10.9.1 Luminaire manufacturers shall be as indicated on the Luminaire Schedule contained within the lighting layouts.

10.9.2 The Contractor should note the criteria for offering alternative luminaires are as follows:

- Proof of Optical performance i.e., light distribution, glare control etc.
- Physical dimensions of alternate luminaires i.e., cut-out size, trim/flange detail, finish, and quality.
- Construction material of alternate luminaires i.e., Extruded aluminium, pressed steel, Die cast etc.
- Details of lamp i.e., lumen output, colour temperature, lamp life.
- Details of lumen depreciation i.e., L90 B10, 75,000 hours, etc
- Luminaire Efficacy i.e. 130 LL/cw
- Control gear/transformer specification must be electronic and compatible with dimming sensors.

10.9.3 The Contractor may be requested to provide DIALux Ev0 (v14.0 or later) calculations and layouts demonstrating that any proposed alternative can satisfy the design requirements and can meet or exceed the performance of the specified luminaires.

10.9.4 In the event that a calculation is not provided when requested, the proposal will be rejected without further consideration. Where a calculation is required, the Contractor shall be provided with the detailed design criteria used by the Engineer.

10.9.5 Upon completion of the installation, the Contractor shall be requested to provide illuminance level readings using a calibrated lux meter, to demonstrate that the measured performance of the installed luminaires is equivalent to the calculations presented and the design criteria.

10.9.6 The Contractor shall be required to present working samples of all alternative luminaires proposed, together with a working sample of the specified item, for review by the design team prior to acceptance.

10.9.7 Along with meeting the criteria of the Triple E Register if the contractor is offering alternative internal luminaires, they shall include software lighting calculations to meet the minimum requirements of I.S. EN 12464-1 lighting standard and CIBSE SLL Lighting Handbook 2022.

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12.1 Outline Description

12.1.1 The Contractor shall be responsible for the supply, installation, commissioning and demonstration of a complete addressable emergency lighting system to include addressable emergency luminaries and escape route signage all monitored by an Addressable Automatic Testing system (ATS) with the newly refurbished X-Ray Room area including changing rooms, entrance lobbies and Patient Recovery Bays.

12.1.2 The Contractor shall engage with a specialist Emergency Lighting ATS system providers and 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.

12.1.3 The Contractor shall engage a specialist Emergency Lighting specialist and 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.

12.1.4 The Contractor shall include for a complete emergency lighting installation as indicated on IN2 Engineering Design Partnership drawings.

12.1.5 The system has been designed and shall be installed to provide cover to all areas. The Emergency Lighting system shall incorporate the following equipment.

- DALI Addressable Emergency Lighting Automatic Test and Monitoring System
- Central Test Units / Controllers
- Exit Signage
- Self-Contained Emergency Luminaires
- Maintained Emergency Luminaires

12.1.6 The Contractor shall be responsible for the supply, installation, commissioning and demonstration of a complete emergency luminaires and escape route signage system.

12.1.7 The Contractor shall engage a specialist Emergency Lighting Contractor and 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.

12.1.8 All general clauses in the Lighting section of this specification (installation, lamps, wiring, samples, spares etc.) shall apply to the emergency lighting system, equipment, and components.

12.1.9 The Contractor shall ensure the emergency lighting system within the Diagnostic Imaging Room area meets the requirement of I.S. 3217:2023, I.S. 10101 for Medical Locations and HTM06-01 for Grade B output. As this X-Ray room does not involve critical medical tasks i.e. Grade A standby lighting and it would be considered to be Grade B standby lighting with reference to HTM guidance which is between 30% and 50% of the general lighting output i.e. 500lux shall be between 150lux and 250lux in emergency lighting operation.

12.1.10 The Contractor shall include for provisions in existing LV distribution switchgear to ensure that local emergency lighting circuits are correctly monitored to engage the emergency lighting systems on local circuit failure. Monitoring MCB's are required to be fitted. Emergency lighting shall only be engaged by failure of local circuits and similarly the failure of a general lighting circuit shall engage the local emergency lighting only.

12.2 Standards

12.2.1 The system provided shall be installed, tested, commissioned, and certified to ensure the system and its respective components are in full compliance with, but not be limited to the following standards.

- IS 3217:2023 - Irish Standard for Emergency Lighting
- IS EN 62034:2012 - Automatic Test Systems for Emergency Lighting
- IS EN 1838: 2024 - Lighting Applications – Emergency Lighting
- I.S. EN 50171:2021 – Central Safety Power Supply Systems
- IS EN 50172: 2004 - Emergency Escape Lighting Systems
- IS EN IEC 60598-2-22 - Luminaires – Particular Requirements- Luminaires for Emergency Lighting
- I.S. EN 61347-2-7:2012+A2:2022 - Lamp Controlgear - Particular Requirements for Battery Supplied
- Electronic Controlgear for Emergency Lighting (self-contained).
- I.S. EN 61347-2-13:2014+A1:2017 - Lamp Controlgear - Particular Requirements for d.c. or a.c Supplied Electronic Controlgear for LED Modules.
- DALI Emergency Lighting Control system shall comply with EN IEC 62386-202.
- HTM06-01 – Electrical Services Supply and Distribution (2017 Edition)
- SLL Lighting Guide LG2 – Lighting for Healthcare Premises

12.2.2 In addition to the above installation standards, the equipment and installations shall comply with the current provisions of the following standards.

- EMC Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU
- ErP Directive 2009/125/EC
- RoHS Directive 2011/65/EC
- CENELEC

12.2.3 All electronic equipment and devices must have the CE mark of compliance.

12.2.4 All Signage must be in accordance with the European Signs Directive.

12.2.5 The complete system installations shall be in accordance with current NSAI I.S. 10101:2020+AC2:2025 Wiring Regulations.

12.3 Equipment

12.3.1 Automatic Test System:

12.3.1.1 The addressable test and monitoring system (ATS) shall be fully compliant with the requirements of EN 62034:2012. On loss of DALI network, all fittings shall revert to "self-test" and must comply with EN 62034.

12.3.1.2 The ATS shall be "Type PERC" as per Annex B of I.S. EN 62034:2012 and Annex J of I.S. 3217:2023.

12.3.1.3 The addressable test and monitoring system controllers are to be located adjacent to lighting distribution centres. Each addressable control unit shall be networkable via the TCP/IP network to be expandable to form an Emergency Lighting Network.

12.3.1.4 Each controller shall be capable of monitoring battery and lamp on a minimum of 128 luminaires as per DALI 2 standards. Each controller shall provide a user interface to view system status and reports locally without connection to a central system. Maximum loading per controller shall ensure min 20% spare capacity for future additional luminaires.

12.3.1.5 The system shall be supplied with system software to be configured on the client network such that the controllers can be viewed from a central monitoring location / PC, for viewing and printing of reports.

12.3.1.6 The controller shall maintain test records / logs for a period of not less than 3 years and shall be battery backed to ensure memory functions are not lost during mains failure.

12.3.1.7 System controllers and luminaire modules shall operate on a DALI or other "Open Protocol" communications platform. Closed protocol systems shall not be considered.

12.3.2 Central Test Unit:

12.3.2.1 A central Test Unit shall be provided in each of the lighting distribution centres.

12.3.2.2 The central test unit shall be capable of carrying out the following tests as per IS 3217:2023 (Clause 6.3) that are applicable to the emergency lighting system specified:

i) Functional test of 30min and 10min for 3 h and 1 h respectively (all facilities)

ii) Full duration test for 3h and 1h systems (all test facilities).

12.3.3 Conversion Kits:

12.3.3.1 Emergency lighting conversion kits were indicated as provided to general lighting luminaries shall be supplied, installed, tested and certified by the specified emergency lighting specialist and shall be integral to the general lighting luminaries.

12.3.3.2 All conversions shall provide 3hr operation under loss of mains power. Emergency conversion kits shall be fitted with High Temperature Lithium Iron Phosphate (LiFePO4) batteries rated at 55°C with a design life of minimum 6 years.

12.3.3.3 Emergency conversion packs shall be third party tested in accordance with IS EN 62386-101:2014+A1:2018, IS EN 60929 and IS EN 61347-1.

12.3.3.4 Conversions shall be carried out to ICEL 1004:2018 recommendations and shall include thermal profiling to ensure maximum operating temperatures of all components and shall be harmonised to 25oC in accordance with IS EN 60598. Safety labelling shall be provided to all luminaries indicating that the fitting may be live although the lamp may not be operating.

12.3.3.5 Mains charge lamps shall be green in colour and shall be secured to the body of the luminaries in a visible location for ease of inspection for daily and weekly checks.

12.3.3.6 The specialist emergency lighting supplier shall ensure that conversion packs are specifically designed for this purpose.

12.3.4 Self-Contained Emergency Luminaries: (as per schedule)

12.3.4.1 Self-contained emergency luminaries must be designed and constructed in accordance with IS EN 60598-2-22:2022.

12.3.4.2 Photometric data shall be provided by the manufacturer in accordance with IS EN 13032-3.

12.3.4.3 All luminaries to be of flame-retardant construction and diffusers shall be glow wire tested to 850°C in accordance with I.S. EN IEC 60695-2-11 and shall be suitable for use on defined escape routes.

12.3.4.4 All self-contained luminaries shall be complete with integral automatic self-test modules, to provide fault diagnostics indicating lamp, LiFePO4 battery, and charger/inverter failure. The luminaire shall operate in self -test mode if there is a communications failure with the central DALI 2 system.

12.3.4.5 Verified performance data for each emergency luminaire type must be provided by the contractor in advance of orders being placed.

12.3.4.6 In the event that the contractor wishes to propose an alternative to the specified luminaire the contractor must underwrite the alternative and ensure that the proposed luminaire satisfies this specification and all other applicable standards.

12.3.4.7 All Emergency Luminaires shall provide for ease of maintenance, with easy access to batteries, retainers on covers, retainers on screws and clip-in batteries. Luminaires with remote battery packs (“sausage packs” etc), shall not be acceptable.

12.3.4.8 All self-contained luminaires shall have batteries rated for a minimum 5 years of normal operation and shall be replaced when the luminaire no longer meets the required duration.

12.3.5 Exit Signage (as per schedule)

12.3.5.1 Exit Sign Legends as indicated on the drawings are representative of position only. Directional arrows indications as indicated may not necessarily be directed in the appropriate direction of escape.

12.3.5.2 The Contractor shall consult the engineer and shall allow for ad-hoc repositioning or replacements of exit sign legends as requested prior to handover.

12.3.5.3 All legends shall comply with European signs directive. All escape route signs shall be Type 1, as per Annex B of IS 3217:2023.

12.3.5.4 All Type 1 signs shall comply with ISO 7010: 2020/A5:2023.

12.3.5.5 Exit signs shall be sized for a maximum viewing distance of 26m and shall be positioned between 2.0m and 2.5m to the base of the sign.

12.3.5.6 The Contractor shall include for the provision of "supplementary" exit signage to ensure that all exit routes are clearly and unambiguously identified.

12.3.5.7 The Contractor shall provide supplementary (non-illuminated) exit signage as per Type 1 legends with signs to be fitted at intermittent levels in stairwells. Signs shall be positioned within 2m of an emergency luminaire and achieve the minimum lux requirements outlined in I.S. 3217:2023.

12.4 Approved Vendors & Manufacturers

12.4.1 The system provided shall be tested, commissioned, and certified by a registered Emergency Lighting Contractor, or a Qualified Emergency Lighting Commissioning Specialist. The minimum requirement of this specification is that the Qualification must be at least that of QQI Award Level 6. Evidence of such qualification must be provided to demonstrate competence.

12.4.2 The addressable emergency lighting system shall be commissioned by the OEM (Original Equipment Manufacturer) or by an OEM approved third party vendor. Confirmation of the approvals shall be provided as part of the contractor's technical submission

12.4.3 All Emergency luminaires and system components shall be manufacturer warranted for a minimum of 5 years. A project specific warranty shall be provided to PUH to commence on the date of handover. (not the date of supply to site). The warranty shall include all components including batteries, which shall be warranted for at least 5 years.

12.5 Testing & Commissioning

12.5.1 On completion of system installation full testing and commissioning is to be carried out in line with manufacturers guidelines and as defined under IS 3217:2023.

12.5.2 Testing and Commissioning shall be carried out by a Competent and Qualified Emergency Lighting Commissioning Specialist. The minimum requirement of this specification is that the Qualification must be at least that of QQI Award Level 6. The Commissioning specialists shall be fully responsible for installation checks for full compliance with all installation requirements of IS 3217. This shall include checks on the positioning of devices and briefing the electrical contractor during the installation stages on all requirements and expectations necessary to ensure that the Commissioning process will be as seamless as possible. Any relocation of fittings necessary to achieve the requisite level of illumination must have been considered before commissioning and the system shall not be offered to the Engineer for witness testing until the Commissioning specialist has verified the entire installation and is fully satisfied of its compliance with the requirements of IS 3217

12.5.3 The entire emergency lighting installation must be tested, commissioned, and certified by a third party, independent to the installing electrical contractor. The contractor shall allow for out of hours (after dark) testing. Once satisfied the contractor shall offer the system for demonstration to the engineer and shall also allow for out of hours attendances.

12.5.4 The addressable emergency lighting system shall be commissioned by the Original Equipment Manufacturer (OEM) or by an OEM approved third party vendor. Confirmation of the approvals shall be provided as part of the contractor's technical submission

12.5.5 The contractor shall ensure that the installed luminaires are fully charged for a period of not less than 72 hours before testing is undertaken. A second 3hr test is to be completed 24hrs following the first test. Only on successful completion of the second test shall commissioning certification be used and the Engineer invited to witness test the completed installation

12.5.6 The contractor shall ensure that all test instruments (lux meters etc,.) are fully calibrated with calibration certification details to be included within test record documentation. The calibration certificates must be dated within a period not to exceed six months before the commencement of the commissioning stage.

12.5.7 The ATS shall be fully commissioned in accordance with I.S. EN 62034:2012 and shall be certified as such by the installer.

12.5.8 The ATS shall be configured and commissioned for buildings which are designed to be occupied during the test and all necessary functions shall be programmed to ensure precautionary measures are inherent in the system. As a minimum this shall include configuration of the system for testing alternate luminaires.

12.5.9 The ATS shall be configured to ensure a full recharge of a luminaire prior to the testing of the next alternate luminaire

12.5.10 The Contractor shall ensure that sufficient time within the commissioning programme for the correct and thorough testing of the Emergency Lighting system in order for completion certification and all other commissioning information to be provided to satisfy handover requirements.

12.5.11 The illuminance levels identified within the standards are the minimum expected levels and are representative of the levels required to be maintained as the system ages and therefore higher levels would be expected at commissioning.

12.5.12 As part of system commissioning, the contractor shall document and record all achieved levels of illumination on emergency lighting layout drawings and test record sheets. These shall also form part of the contractors BCAR inspection report.

12.5.13 The Contractor shall submit Annex C3, C4 and C5 forms as per IS 3217:2023. Signatories of the forms shall only be persons who are responsible for and who have undertaken the works.

12.6 Documentation

12.6.1 The Contractor shall provide a complete and detailed Technical Submittal which shall provide details of all elements of the proposed systems and components to include proof of compliance with relevant standards.

12.6.2 In submitting proposals, the Contractor will be deemed to have verified the compatibility of all components and to have fully co-ordinated all elements with the Emergency Lighting Specialists The Engineer will not be responsible for verification of compatibility of component elements of the Contractors proposals.

12.6.3 As part of Technical Submittals, the Contractor shall present a detailed "functional description of operation", which shall set out in clear detail how the system operates, how the system will be configured, how the system reports are structured, etc.

12.6.4 The Contractor shall submit "naming and labelling" conventions for Engineer approval. The naming and labelling shall apply to all luminaires and system components, DALI buses, system controllers, device addresses etc., The Contractor shall review proposals with the Emergency Lighting specialists before submission to the Engineer.

12.6.5 As part of Technical submittals, the Contractor shall present sample test record templates for the ATS.

12.6.6 At practical completion stage the contractor shall provide a four-part certificate of completion in accordance with IS3217: 2023. The certificate shall be presented signed by relevant parties to the engineer.

12.6.7 The Contractor shall also provide a Certificate of commissioning for the ATS, to confirm the type of system (PERC) and to state compliance with I.S. EN 62034:2012

12.6.8 Upon project completion the contractor shall provide complete Operation and Maintenance instructions with as the 'As installed' drawings.

12.6.9 Proof of third-party product compliance testing to IS EN 60598-2-22 must be provided for each emergency luminaire type and shall be included in operation and maintenance manuals.

12.6.10 The Contractor and Emergency Lighting Specialist shall note the requirements under the Building Control (Amendment) Regulations 2014.The Contractor and Emergency Lighting specialists shall be responsible as "Ancillary Certifiers" as, "competent technical and trade persons that install products and/or test on completion", as such the Contractor shall participate fully and undertake all requirements as may be outlined by the Assigned Certifier. An Ancillary Certificate shall be provided by the Contractor and Emergency Lighting Specialist.

12.7 Samples & Technical Submittals

12.7.1 In advance of orders being placed for any equipment the contractor shall submit a full technical submittal including specific details of equipment dimensions, operational data, rated power, controls and wiring diagrams, materials specification.

12.7.2 The contractor shall include for the provision of 1 No. sample of each item as detailed. Samples to be erected and displayed for design team approval.

12.7.3 The contractor shall be responsible for determining quantities from IN2 Engineering Design Partnership drawings and specifications.

12.7.4 The contractor shall liaise with the various specialist suppliers to ensure that all necessary fixings kits, supports, connections, etc. are included.

12.7.5 The contractor shall refer to IN2 Engineering Electrical Specification, Section E00 General Specification, part 00.5 "Production of Information - Procurement Details".

12.7.6 All samples shall be checked by the Contractor for compatibility with the ATS and shall be erected and connected as working samples. Samples shall be complete with technical data literature to clearly demonstrate compliance with relevant standards and technical performance. Details of the manufacturer's warranty shall also be presented with the samples.

12.7.7 Samples shall be reviewed under the following criteria.

- Compliance with standards
- Technical Performance
- Ease of Maintenance
- Durability
- Energy Efficiency
- Aesthetics

12.8 Witness Testing

12.8.1 Following completion of the Contractors own testing and commissioning of the system; the Contractor shall invite the Engineer to witness test the completed installations. The Contractor shall include periods of witness testing on the works programme for each works zone and shall provide at least 2 weeks advanced notice to the Engineer for scheduled tests.

12.8.2 Tests shall only be offered to the Engineer once the Contractor is completely satisfied that all commissioning has been completed to their satisfaction and all "soak" periods have been allowed.

12.8.3 Witness testing shall include operational testing of the systems to be demonstrated by the Contractor with attendance by the Emergency lighting and ATS system specialists.

12.8.4 The Contractors witness testing to the Engineer of the completed system shall be expected to include random operations, staged failures of the general lighting, initiated functional tests, initiated duration tests. Tests shall be conducted after dark or at a time where the full performance of the system can be viewed. The Contractor shall provide all attendances, test instruments and tools to enable all reasonable tests to be performed. In the event of any failures being observed during witness testing, the Engineer shall reserve the right to cancel the test and the Contractor will be expected to reschedule the test following remedial actions followed by the Contractors own testing

12.8.5 In the event of any failures being observed during witness testing, the Engineer shall reserve the right to cancel the test, and the Contractor will be expected to reschedule the test following remedial actions followed by the Contractors own testing.

12.9 Training

12.9.1 In addition to attendances and brief system training at a client handover the contractor shall include for the provision of the training shall consist of system operation including instruction on the procedures for carrying out and logging the emergency lighting testing. The training shall demonstrate clearly to the client on his obligations under the IS3217 Standards for Emergency Lighting

12.9.2 The contractor shall include for the provision of formal training of client staff in the operation and use of systems. The training shall consist of detailed ATS system operation including instruction on the procedures for carrying out and logging the emergency lighting testing as well as production of system reports. As well as use of the systems, the training shall demonstrate clearly to the client their obligations under the I.S. 3217 Standards for Emergency Lighting, as well as all other relevant information for the maintenance and management of the systems and their components.

12.9.3 The Contractor shall propose a training course content however it shall be expected to provide attendees with a full operational understanding in the use of the installed ATS emergency lighting system and a full understanding of the "User Responsibilities" under I.S. 3217:2023.

12.9.4 The Contractor shall propose possible dates and a venue for training. Dates shall be advised for PUH/HSE representatives consideration; however, training is to be completed within two weeks of the proposed Handover demonstration.

12.10 Handover Demonstration

12.10.1 In addition to formal training and witness testing, the Contractor shall provide and brief system overview training at a client handover demonstration.

12.10.2 The handover demonstration shall be conducted after dark or at a time where the full performance of the system can be viewed. The Contractor shall provide all attendances, test instruments and tools to enable all elements of the system to be demonstrated to the client.

12.10.3 Demonstration tests shall be expected to follow similar format to witness testing.

12.10.4 In addition, the contractor shall include for the provision of formal handover information and training of staff in the operation and use of systems. The training shall consist of the operation of the installed systems and use of the Operation and Maintenance Manuals.

12.10.5 Upon satisfactory completion of all formal training, the handover demonstration and handover of the O&M information and Certification the Contractor may apply for Handover of the system. The Engineer and Client will require a period of at least five days to review completed Handover documentation.

12.11 Additional Luminaires

12.11.1 In addition to emergency lighting luminaires indicated on drawings the Contractor shall include within their tender for 2 No. luminaires to be installed in locations requiring additional illumination such as first aid points, first aid cabinets, assembly points, and other locations where increased levels of illumination are required but that are not currently determined for indication on drawings

12.11.2 The allowance shall be deemed to include the luminaire, DALI 2 controls, wiring, installation, testing, commissioning and incorporation onto system "as installed" layouts.

12.11.3 The Contractor shall include within their tender for 2 No. non-illuminated "supplementary" escape route signs, to be installed in locations requiring additional directional indication. Signs shall be mounted within 2m of an emergency luminaire

12.12 Maintenance

12.12.1 The Contractor / Emergency Lighting specialist shall include for 4 No. Service and Maintenance visits during the defect's liability period. Maintenance shall be carried out in full accordance with the requirements of IS3217:2023.

12.12.2 Service visits shall include complete system checks and replacement of defective components, as well 30min and 3hr duration tests and updating all maintenance record documentation and maintenance logs.

12.12.3 The 4 No. maintenance visits are deemed separate from the training days. A schedule of proposed maintenance visits shall be agreed with the client at commissioning stage.

12.12.4 Service and Maintenance shall be in compliance with the requirements of IS 3217:2023 and documented evidence of maintenance carried out shall be provided to the operator for inclusion in their records. The specialist shall provide the operator with a "Confirmation of Servicing/Testing" advising that the system has been maintained in accordance with IS 3217 and that in this regard the user's responsibilities have been satisfied.

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20.1 Outline Description

20.1.1 The Contractor shall be responsible for the supply, installation, testing, and commissioning of a complete system consisting of outlets equipment, cabling and devices in accordance with the drawings and specifications.

20.1.2 The Contractor shall include for a complete General Services installation as indicated on IN2 Engineering drawings. The Contractor shall carefully read the notes on the drawings and include for all associated costs in his tender.

20.1.3 All cables to be rated minimum Class Cca s1a, d0, a1 in accordance with EN50575: 2014 + A1:2016 and NSAI Wiring Regulations I.S. 10101:2020+AC2:2025 requirements.

20.1.4 All cabling, and flexes shall have LSZH (low smoke and zero halogen) type. No P.V.C. sheathed cabling flexes, glands, sheathing or terminals shall be permitted.

20.2 Standards

20.2.1 The general services installations shall be installed, tested, commissioned, and certified to ensure the installation and its respective components are in strict accordance with NSAI National Rules for Electrical Installations I.S.10101:2020+AC2:2025 Wiring Regulations in particular Part 710 Medical Locations.

20.2.2 All devices and components shall be compliant with the following and shall bare the CE mark of conformity. Any devices found to be non-compliant shall be replaced at the contractor's expense.

- EMC Directive 2014/30/EU
- Electromagnetic Compatibility Requirements
- CENELEC
- IS Standards
- Building Regulations Part M
- HTM 06-01 – Electrical Services Distribution

20.2.3 General Services socket outlets shall conform to BS 1363-2:2023 and I.S. 411 standards.

20.2.4 Connection units shall conform to BS 1363-4:2016+A1:2018.

20.2.5 All wiring accessories must comply with Part M of the Building Regulations and shall achieve the LVR as per "Building for Everyone" publication.

- Switched socket outlets and isolator switches etc must indicate visually whether they are on or off.
- All controls must visually contrast with their backgrounds to facilitate people with a vision impairment.
- Switches on sockets must be adequately separated to allow selection of one at a time and avoid the unintended selection of adjacent switches.

20.3 Equipment

20.3.1 Storage and Plant Areas

20.3.1.1 General Service socket outlets within plant spaces generally shall be twin outlet switched with neon indication and of 13 Amp rating, to BS 1363, and suitable for surface or flush mounting and shall be as per the MK Metal clad range or equivalent.

20.3.1.2 General Service socket outlets within sports activity spaces generally shall be twin outlet switched with neon indication and of 13 Amp rating, to BS 1363, and suitable for surface or flush mounting and shall be as per the MK Metal clad range, or equivalent.

20.3.2 X Ray Room Areas

20.3.2.1 General Service socket outlets within the X-Ray room areas shall be supplied from the local sub distribution board for the area (SDB1-0) however some outlets within the control room area shall be wired via a tertiary UPS supply. All socket outlets shall be twin outlet switched with neon indication and of 13 Amp rating, to BS 1363, and suitable for flush mounting, with concealed fixing screws. Visible devices shall be of Brushed Stainless Steel finish with black inserts and shall be as per the MK Healthcare range, or equivalent.

20.3.2.2 General Service socket outlets within the medical areas shall be complete with clean earth facility and engraved "Medical Equipment Only" and have a blue faceplate as per the MK Healthcare range, or equivalent.

20.3.3 Connection Units

20.3.3.1 Connection units shall be switched or un-switched as indicated on drawings. All devices shall be in accordance with BS 1363 and fused in accordance with BS 1362. All connection units shall be complete with neon indication. Connection units shall be selected from the same manufacturers range as other adjacent electrical accessories.

20.3.3.2 Connection units within plant rooms shall be switched or un-switched as indicated on drawings. All devices shall be in accordance with BS 1363 and fused in accordance with BS 1362. Connection units shall be complete with neon indication. Connection shall be suitable for surface mounting and shall be as per MK Albany Metal clad range, or equivalent.

20.3.3.3 Connection units to commercial / industrial portable devices shall be IP44 SPN or TPN as indicated on the IN2 Engineering drawing, angled type, suitable for surface mounting. All devices shall be in accordance with IS EN IEC 60309. Connection units within any stage areas shall be suitable for surface mounting and shall be as MK Commando range, or equivalent.

20.3.4 A pilot lamp shall be incorporated on the plate to indicate when the unit outgoing terminals are energized. This shall be long-life, low-consumption LED type only.

20.3.5 The trunking and all outlets shall be manufactured by a single manufacturer and shall include all trunking sections, cover plates, endplates, bends, tees, socket plates, earth links etc.

20.3.6 All compartment dividers shall be metallic and provide screening between LV and ELV cabling.

20.4 Installation

20.4.1 The complete installation shall be carried out in strict accordance with the NSAI National Rules for Electrical Installations I.S.10101:2020+AC2:2025.

20.4.2 Positioning of electrical accessories shall be in accordance with Building Regulations Part M where appropriate, e.g. positions in relation to corners, mounting heights, positions of Part M disabled persons alarms etc.

20.4.3 The wiring to all general services 13A sockets outlets shall be in 4 sq.mm LSZH sheathed single cables with separate 4.0 sq.mm LSZH sheathed CPC earth in conduit/trunking in radial circuits. Circuit references shall be as per drawings or agreed with the Engineers before commencing on site. Note: all conduits to be 25mm diameter.

20.4.4 A socket outlet having a rating of 16 Amps or greater shall be supplied by a dedicated circuit that does not supply any other item.

20.4.5 All wall fixed sockets unless otherwise stated shall be mounted at a minimum of 450mm above finished floor level.

20.4.6 Wall mounted general power outlets shall not be mounted back-to-back on either side of stud partition walls. Wall mounted outlets shall be spaced a minimum distance of one stud apart (i.e., 600mm). In the event that socket outlet boxes are less than the 600mm minimum spacing, the outlet recessing box shall be lined or wrapped with a "Hilti Putty Pad" or similar product.

20.4.7 All penetrations in constructions between sensitive locations must be treated to ensure that the sound insulation performance is not compromised. Refer to Architectural information for further details.

Device Type	**Protective Device and Rating**	**Cable Sizes**
General Socket Outlets (Radial circuits) max 4 No. Sockets per circuit.	20 Amp M9 SP&N RCBO Type B/C.	**Minimum 4.0mm sq**. LSZH cable c/w 4.0mmsq CPC. All cabling shall be LSZH Insulated & sheathed.
Fused Connection Units / Spurs. (Radial circuits)	20A M9 SP&N MCB Type C.	**Minimum 4.0mm sq.** < 70m of total circuit length **Minimum 6.0mm sq**. >70 < 130m of total circuit length. C.P.C.'s to be full phase conductor size. All cabling LSZH insulated & sheathed
45A Isolators SP&N (Radial Circuit):	Protective device and rating 45A M9 SP&N MCB Type C	**Minimum 6.0mm sq.** < 50m of total circuit length **Minimum 10mm sq.** >50 < 85m of total circuit length. C.P.C.'s to be full phase conductor size. All cabling LSZH insulated & sheathed.

20.4.8 All circuits shall be continuous in their length and under no circumstances shall the jointing of cables be permitted.

20.4.9 No more than 4 No. Twin socket outlets shall be installed on the same circuit. All fused connection units shall be installed on dedicated circuits.

20.4.10 Unless otherwise stated all circuits, which serve 13 A socket outlets shall have individual 30 mA rated RCBO's fitted within the respective distribution board serving that circuit, i.e., each circuit shall have a dedicated combined MCB/RCBO.

20.4.11 The Contractor shall determine all setting out from dimensioned drawings produced from the architect set out drawings only.

20.4.12 All boxes or sections of boxes for use with accessories must incorporate a suitably marked earth terminal. Accessory plates shall be secured to boxes by not less than two fixing screws. Where these screws do not provide adequate earth continuity to metal plates or plates including parts to be earthed then a bonding connection shall be provided from the earth terminal to the plate or part. The bonding shall be protected with a green/yellow insulated sleeve. The above requirement shall not apply to the earth socket on a socket outlet when directly connected to a protective conductor.

20.4.13 Socket outlets shall be 230V, 13A, 3-pin rectangular, single pole, single or twin, switched or unswitched outlets as shown on the drawings and detailed herein.

20.4.14 They shall conform to BS 1363-2 and I.S. 411.

20.4.15 General Service 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.

20.4.16 Where sockets are installed in an inaccessible location, a 20 Amp double pole isolating switch shall be installed in the nearest accessible area for isolation of the device in accordance with NSAI I.S. 10101:2020+AC2:2025 regulations. This switch shall be complete with neon indication and be pre-engraved as appropriate, in accordance with the unit being served.

20.4.17 Where sockets are installed in a Group 2 Medical location, several socket outlets (max 4No.) shall be separately supplied by a minimum of two circuits that supply outlets assigned to one place of treatment only e.g. X-Ray Room.

20.4.18 The Contractor shall also be aware of Lead Code requirements for lining of any services penetrations through the X-Ray room walls or for back box installations for general services and small power outlets and advise the Main Contractor of same prior to works commencing.

20.5 Testing & Commissioning

20.5.1 The Contractor shall include for the testing commissioning and provision of certification of the complete installations to NSAI National Rules for Electrical Installations I.S. 10101:2020+AC2:2025. The contractor shall include for witness testing and demonstration of the system functions to the client's representative.

20.6 Samples & Technical Submittals

20.6.1 In advance of orders being placed for any general services outlets by the Contractor shall allow for the assembly, erection and electrical connection of samples as requested. 1 No. sample of each type of specified wiring accessories shall be presented for review by the design team comments or final approval.

20.6.2 The Contractor shall note the requirement for the construction of a sample room / benchmark installation details and shall be required to provide all necessary fittings to complete a fully working sample.

20.6.3 The Contractor shall include for all costs associated with the provision of all samples within his tender return. The contractor shall include for the provision of 1 No. working sample of every wiring accessory type used throughout the project.

20.6.4 All samples are returnable and shall not be included in the fixture count for the permanent installation.

20.6.5 In advance of orders being placed for any equipment the contractor shall submit a full technical submittal including specific details of equipment dimensions, operational data, rated power, controls and wiring diagrams, materials specification.

20.6.6 The contractor shall include for the provision of 1 No. sample of each item as detailed. Samples to be erected and displayed for design team approval.

20.6.7 The contractor shall be responsible for determining quantities from IN2 Engineering Design Partnership drawings and specifications.

20.6.8 The contractor shall liaise with the various specialist suppliers to ensure that all necessary fixings kits, supports, connections, etc. are included.

20.6.9 The contractor shall refer to IN2 Engineering Electrical Specification, Section E00 General Specification, part 00.5 “Production of Information - Procurement Details”.

20.7 Labelling

20.7.1 The Contractor shall ensure that traffolyte labels are securely fixed and displayed to each device and component indicating their specific circuit references.

20.7.2 Socket and fused connection unit devices shall be provided with engraved traffolyte labels, black on white, with reference text to match those of the panel circuit charts.

20.8 Documentation

20.8.1 Full maintenance manuals including as installed drawings and commissioning certificates / safe electric test certification reports signed by all relevant parties shall be submitted to the Engineers at the practical completion stage. As installed drawings are to be dedicated to the general services installations and all devices shall be indicated complete with device circuit references.

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24.1 Outline Description

24.1.1 The Contractor shall be responsible for the supply, installation, testing and commissioning of the following sub-elements of the general services installations.

24.1.2 The Contractor shall include for a complete General Services installation as indicated on IN2 Engineering drawings. The Contractor shall carefully read the notes on the drawings and include for all associated costs in their tender.

24.2 Standards

24.2.1 All devices and components shall be compliant with the following and shall bare the CE mark of conformity. Any devices found to be non-compliant shall be replaced at the contractor's expense.

- European Union (EU)
- EMC Directive 2014/30/EU
- Electromagnetic Compatibility Requirements
- CENELEC

24.2.2 All devices shall be installed and tested commissioned to ensure the installation and its respective components are in strict accordance with the National Rules for Electrical Installations I.S. 10101:2020 +AC2:2025.

24.2.3 All wiring accessories must comply with Part M of the Building Regulations and shall achieve the LVR as per "Building for Everyone" publication.

- Switched socket outlets and isolator switches etc must indicate visually whether they are on or off.
- All controls must visually contrast with their backgrounds to facilitate people with a vision impairment.
- Switches on sockets must be adequately separated to allow selection of one at a time and avoid the unintended selection of adjacent switches

24.3 Warm Air Hand Dryers

24.3.1 Warm air hand dryers shall be provided as indicated on IN2 Engineering Design Partnership drawings E2000 series drawings.

24.3.1 The hand dryers shall be as SMARTdri type of World manufacture and finished in brushed stainless steel. Hand dryers must be adjustable with, flexible controls to allow adjustment of air flow, sound quality and heating options. The maximum dry time shall be 10 seconds. Intelligent on/off heating and 3-speed motor controls optimize energy efficiency and user comfort. The hand dryer shall have a minimum 5-year manufacturer's warranty.

24.3.2 Wiring to hand dryers shall be 6.0 sq.mm LSZH sheathed cables with separate 6.0 sq.mm LSZH sheathed earth continuity conductor, in conduit or trunking, with a separate radial circuit for each unit. Final connection shall be as above from a flush mounted, fused, switched connection unit D.P. to a round conduit box flush mounted behind the hand dryers and terminating in the hand dryer terminals.

24.3.3 Switched spurs shall be as manufactured by MK, or equivalent, and mounted at 2,100mm AFFL unless otherwise stated.

24.4 Disabled Persons Alarm

24.4.1 The Contractor shall include for the complete disabled person call system installation in all disabled W. Cs as indicated on the drawings. The Disabled area alarms shall be an integral function of the Disabled Refuge Alarm System or Nurse Call System and shall provide remote alarm indication primarily at the PUH CT Area Reception.

24.4.2 The wiring to all outlets shall be in 4.0 sq.mm LSZH sheathed cables with separate 4.0 sq.mm LSZH sheathed CPC earth in conduit/trunking.

24.4.3 The finished components for the complete installation shall be as manufactured by Baldwin Boxall Omnicare or equal and equivalent, and shall consist of power units, ceiling mounted pull cords, reset units and over door indicator

24.5 Dado Trunking

24.5.1 The Contractor shall include for the supply and installation of all dado trunking as detailed on the Tender drawings. Dado trunking shall be fabricated from PVC, specific to the location.

24.5.2 The dado trunking system shall provide correct segregation and space for CAT 6A cable standards. The dado trunking shall be installed complete with proprietary tee's bends and connection pieces with internal flanges to joints to provide a smooth finish to avoid dust traps and simplify cleaning. Outlets shall be disguisable from the dado with the use of charcoal straight covers behind devices.

24.5.3. PVC dado trunking shall be of pure white 3 – compartment type;

180mm (H) x 52mm (D) as, MK Prestige or equivalent. The dado trunking shall be installed complete with proprietary tee's bends and connection pieces.

24.5.4 Service drops to dado trunking shall be surface mounted vertical dado trunking from high level.

24.6 Medical Trunking

24.6.1 The Bedhead Services Trunking System (BSTS) shall be factory built and delivered to site as complete modules. Site fabrication will not be acceptable. Where required, each module shall be pre-wired and pre-piped for medical gas to HTM 02-01.

24.6.2 The trunking module shall be individually identifiable and shall be certified as being compliant with the relevant standards as noted at the rear of this document including but not limited to BS EN ISO 11197, HTM 02-01, HTM 08-03. The certification procedure agreed between the main contractor and the Trunking supplier shall be observed.

24.6.3 The trunking supplier shall allow for providing fully dimensioned working drawings for each area/room showing all services installed within the trunking. The manufacturer shall allow attending meetings with the Main Contractor and other trade contractors to ensure that all components are fully integrated within the confines of the trunking.

24.6.4 supplier shall be responsible for determining the exact length of each trunking by checking the respective general arrangement and room layout drawings and their specific application. This shall be approved by the Main Contractor prior to manufacture. In general, the BSTS shall be of an appropriate length to suit the room whilst also providing the layout and content of services outlets as required by the respective applications. The BSTS shall be fitted such that sufficient gap at each end is provided for cleaning e.g. 50mm minimum or as otherwise agreed with the Infestation and Bacteria Control Officer or equivalent on the project. Where ward areas require a bespoke semi recessed system this shall be designed in conjunction with the architect to ensure suitable integration between this unit and the bedroom carpentry works.

24.6.5 The supplier shall make due allowance for all necessary interface and co-ordination meetings with all relevant Sub-Contractors supplying services to the BSTS. This shall be inclusive of free issue of information in accordance with the Sub-Contract requirements.

24.6.6 The supplier shall demonstrate by test certificates or verification documents that the BSTS system as offered is compliant with all essential requirements of the relevant standards.

24.6.7 The system shall be provided as factory assembled modules for single or multi-bed configurations and shall supply direct from the manufacturer of the trunking system.

24.6.8 The BSTS shall comply with all applicable requirements defined within the latest HTM documentation, specifically HTM 08-03 and HTM 02-01. It shall fully comply with the requirements of the NSAI I.S. 10101 rules and HD 384.

24.6.9 The BSTS selected shall be from a 'family' of product with a similar appearance, that offers solutions of suitable size to accommodate services in all areas within the hospital e.g.; X-Ray Room.

24.6.10 There shall be no evidence of fixing screws or assembly components from the external view of the system.

24.6.11 In general the BSTS shall be manufactured from aluminium extrusions (Al MgS:0.5) of approximate wall thickness not less than 2mm. (Details to be confirmed pending final mock-up of ward supply unit.)

24.6.12 When assembled the system shall provide two separate chambers for cabled and piped services respectively.

24.6.13 The trunking lids shall be removable only by the use of the manufacturers specific tool which shall be demonstrated at the time of sample submission. The sub-contractor shall allow for the provision of these tools within their tender submission in such number as shall be considered appropriate for the initial installation of cabled and piped services by others and for the ongoing maintenance of the system by the hospital engineers.

24.6.14 All lid and base and lid sections shall be butt-jointed and no filler strips or ancillary joint covers will be acceptable.

24.6.15 Where not flush mounted the top surface of the BSTS shall be radiused or angled and shall slope downwards away from the wall to prevent the placement of items that are likely to cause a risk to the patient. The underside of the BSTS shall be similarly profiled.

24.6.16 The complete system shall be easily cleaned and shall provide minimal potential for the entrapment of dust and general contaminant, generally in a manner in keeping with other components in the same patient environment. A polymer infill strip fitted to the top rear edge of the BSTS shall not be acceptable so as to avoid the entrapment of dust, bacteria or contaminant. All wall deviations at the interface with the BSTS shall be mastic or caulk filled to seal the joint.

24.6.17 The trunking system shall be supported by a Manufacturers Product Guarantee for 25 years and the availability of all components within the manufacturers unique scope, guaranteed for that period. All ancillary components mounted therein shall similarly be supported by the respective Manufacturers Guarantees where applicable and the BSTS manufacturer shall be obligated to assign the benefits of all such product support.

24.6.18 The trunking system shall be designed, manufactured and assembled as an enclosure in such a manner that an Ingress Protection rating of at least IP50 can be achieved. This degree of protection must be maintained to cabled services when maintenance or installation of the MGPS is conducted and in this regard the degree of protection must be to at least IP2X.

24.6.19 Cables shall be retained within the trunking by means of manufactured polymer cable retainers used every metre, change of direction or behind a lid joint.

24.6.20 The BSTS shall have pre-formed apertures into the rear of the system that allows the entry of all services cabling and pipework via a flush mounted Interface Frame (IFF) located within the studwork partition (refer to section 9.0). All edges to such apertures shall be grommeted or suitably protected to prevent the chafing of cables on sharp edges formed in the BSTS.

24.6.21 It shall be possible to feed the BSTS from the rear, either end or from surface mounted riser trunking sections which shall be similar in constructional arrangement to the horizontal BSTS.

24.6.22 All aluminium sections of the trunking system shall have an extruded earthing and alignment detail to enable adjacent sections to be suitably aligned, and earth continuity maintained in accordance with BS EN 50 085 and NSAI I.S. 10101 National Wiring Regulations, applicable to all metal parts that comprise the complete BSTS system. All modules up to 5500mm in length shall be supplied in one continuous length and the sub-contractor shall satisfy himself as to the suitability of supply to site in such lengths, taking due account of site logistics.

24.6.23 The extruded aluminium profiled body section shall be sub-divided into three segregated compartments for LV, SELV and ELV cabled services. Each compartment when formed shall be screened on all sides by earthed metallic extrusions/dividers. It shall not be acceptable to have an open side or a side fitted with a polymer strip. Dividers shall not be removable without the use of a mechanical tool and shall provide compartments of suitable and adequate size for the relevant services cabling.

24.6.24 Each compartment shall be selected to satisfy the appropriate cabling capacities of each service, making due allowances for adequate space factors which shall be in accordance with NSAI National Wiring Regulations for mains power and a space allowance of 30% shall be provided for all other services.

24.6.25 The system must be designed so that screened segregation is maintained at all services interfaces and box assembly locations including the services entry points within the trunking. Where accessory outlet positions occur, segregation of services shall be maintained and 360 0 access (e.g. access to all compartments) shall be provided to the BS 4662 accessory box assembly at that location.

24.6.26 Unless otherwise indicated, accessory boxes used with the BSTS shall be metal with medium category of protection against corrosion. All boxes shall be manufactured to BS4662 and shall be of adequate depth to accommodate all accessories without causing compression of the cables. Generally, boxes shall be minimum 47mm deep or to a minimum depth for IM&T accessories which is to be confirmed by the supplier via the IM&T Sub-Contractor.

24.6.27 Earthing terminals shall be fixed inside each accessory box. All accessory boxes shall have a brass earth stud capable of accepting 2 x 4mm² cables and shall be earthed to the base section of the trunking system.

24.6.28 All accessories shall be flush mounted and the trunking lids shall overlap the boxes.

24.6.29 Accessories with their boxes and trunking lids shall provide a minimum degree of protection of IP41.

24.6.30 All metal parts forming the complete assembly of the BSTS shall be mechanically connected to the earthing system of the BSTS by means of a designed protective earth conductor. All sections that are externally presented on the BSTS e.g. lids, covers and base sections shall be bonded with a protective earth conductor. An integral earthing channel which is not dependent upon a welded stud shall be designed into each extruded metal component.

24.6.31 The earthing of the BSTS installation shall comply with the following requirements:-

(a) It shall be carried out in accordance with appropriate sections of the current edition of the Regulations for the Electrical Equipment of Buildings issued by the Institution of Electrical Engineers and the current British Standard Code of Practice for Earthing.

(b) Fixings shall be made using purpose made leads and fittings.

(c) All conductive parts of the BSTS, and parts which could become live in the event of a fault condition, shall be connected to the main earthing system within the BSTS.

(d) Each pipe of the MGPS shall have a minimum of one connection to the earthing system but this should not necessarily be within the BSTS.

(e) When connecting differing materials together, the required material transition plates shall, in general, be inserted in order to ensure that electrolytic action is avoided. All connecting materials shall be corrosion-proof and suitable for the conditions prevailing.

(f) Screws and terminals for any fixing of the earth lead shall be suitably designed to avoid corrosion

(g) All extraneous metal shall be bonded to the earth network.

24.6.32 Supplementary bonding for all systems shall be provided by the BSTS Contractor in accordance with NSAI I.S. 10101 National Wiring Regulations. Where appropriate the MEIGaN V2.0 document shall apply.

24.6.33 Supplementary bonding conductors shall be 6mm² green and yellow LSZH insulated. Generally, bonding lugs will not be available on extraneous conductive parts, and an extruded channel or detail shall be made to accept purpose-made earth leads. Drilling or utilising fixing or connecting bolts is not permissible.

24.6.34 An equipotential earth bonding point shall be provided at each bed position for connection of externally operated and located equipment. It shall be a recessed (female) fitting and shall be of the locking type. The bonding point shall be connected to a separate earth conductor within the BSTS with minimal cross-sectional area of 6mm2.

24.6.35 A range of pierced lid sections shall be available for all services outlets. All trunking lids shall be powder coated aluminium and generally the finish of various types of accessories in the same area shall match.

24.6.36 Accessory lids shall be secured into position by means of an semi-visible 'slug' device to prevent inadvertent opening of the system, which shall only be removed using the manufacturers recommended tool and procedure. The lid retention device shall not protrude foremost from the BSTS external surfaces.

24.6.37 All trunking lids shall have the respective apertures formed in them before the lid is powder coated so that no visible unfinished edges appear on the accessory lid opening or edges.

24.6.38 All socket outlets, switches and nurse call equipment shall be mounted onto the trunking in accordance with HTM 08-03, specifically that there shall be no visible evidence of the method of fixing. It shall not be acceptable to cover screws or fixings with a proprietary cover or cap. The removal of the trunking lid shall be by the use of a specific tool which will cause no damage to the powder coated finish of the BSTS when used.

24.6.39 All legends and other information to be provided on the trunking lids shall be engraved in lettering to a suitable and legible point size as defined within HTM 08-03. It shall not be acceptable to have legends or instructions screen printed.

24.6.40 All legends and text on or within the trunking system shall be in English.

24.6.41 The sub-contractor shall allow for liaison with the selected nurse call system manufacturer to ensure that all relevant trunking lids are produced in conjunction with their requirements. Manufactured trunking lids shall be sent to the nurse call system manufacturer who shall be responsible for populating the lids with the relevant components and sending back to the BSTS for inclusion into the module build or distributing direct to site. This element to be agreed prior to commencement of manufacture.

24.6.42 A metal box assembly shall be provided for the nurse call system components with all suitable mounting and location facilities as required by the nurse call system manufacturer.

24.6.43 The location of the nurse call circuitry and field wiring shall be remote from the integral lighting control equipment and shall be co-ordinated to ensure EMC compliance.

24.6.44 Each nurse call trunking lid shall be provided with an ESD earth bonding stud suitable for discharge tests of 4kV contact discharge and 8kV air discharge and generally in accordance with HTM 2017.

24.6.45 All electrical socket outlets shall be of the 3-pin configuration and shall be in manufactured and mounted in accordance with BS 1363.

24.6.46 Where indicated on the drawings Spur Outlets shall be provided. They shall be manufactured in accordance with BS 5733 be switched or unswitched, with or without flex outlets and with or without pilot lamps as detailed in the drawings. They shall be rated 13 amp and shall be fused to suit the appliance controlled.

24.6.47 All electrical accessories fitted to the trunking lid shall be panel mounted and shall not be grid mounted to the box assembly. There shall be no screws or visible means of the fixing device used to attach components to the panel, nor shall there be any obvious blemishes resulting from such fixings.

24.6.48 All power socket outlets shall be flush (panel) mounted directly onto the lid section and shall be fitted so as to be level with or protruding forward of the front face of the trunking lid. All socket outlets shall be supplied as an integral part of the BSTS.

24.6.49 Electrical accessories shall be from a full range of interiors available in various colours and configurations including switched double and single pole sockets, with neon indicators and red rockers, and also unswitched sockets. In some instances, as indicated within the design, dual earth sockets in accordance with NSAI National Wiring Regulations Part 701 Medical Locations will also be required and any of the above referenced configurations

24.6.50 All accessories shall be forward facing and shall not point downwards to the floor.

24.6.51 All electrical components shall be suitable for panel mounting.

24.6.52 The BSTS shall be so designed that it can accommodate the mounting of outlet sockets for data, voice and IM & T services.

24.6.53 Where a category 6a network is installed the trunking lids should be pierced to accept a Mod-Snap type outlet.

24.6.54 Surface mounted fascia plates shall not be acceptable.

24.6.55 The BSTS shall be supplied to site pre-wired.

24.6.56 With the possible exception of the bespoke ward unit all externally viewed surfaces of the BSTS shall be finished by a specialist in a durable polyester powder coated finish to a colour selected by the architect. A full standard range of colours shall be available for selection in both matt and gloss finishes and the powder coated finish shall be supported by applicators Guarantee, specific to the project, for 25 years from the date of application.

24.6.57 The supplier shall provide a purpose made pipe clip/support of suitable size and fit that is flame retardant and which can be fitted into position at any point along a trunking length without the need to drill the trunking or use a tool to fix or remove. Pipe clips shall be provided by the MGPS installer in such quantity to meet the pipeline support recommendations as set out in BS EN 737-2.

24.6.58 The trunking manufacturer is to provide the respective mounting provision within the BSTS for the MGPS Terminal Units to BS 5682 (BS EN 737-1) (as well as BS 6834 where AGSS is required) as shown on the drawings.

24.6.59 The BSTS shall be supplied CE marked in accordance the Medical Device Directive & BS EN ISO 11197.

24.6.60 All relevant EU Directives shall be complied with.

24.6.61 The Contractor shall ensure that all sockets within medical trunking have the appropriate earth jacks incorporated.

24.7 Multi Compartment Floor Boxes

24.7.1 Multi-compartment Floor Boxes suitable for flush mounting within the screed floors shall be provided as indicated on IN2 Engineering Design Partnership drawings E2000 and E7000 series.

24.7.2 The contractor shall be responsible for determining the overall depth of the floor box in accordance with the depth of floor screed. Claims for damaged cabling and boxes due to insufficient screed cover shall be at the contractor's expense.

24.7.3 The Contractor shall provide multi-compartment Floor Boxes c/w frame and floor tile cut-out kit suitable for floor tile thickness of 40mm.

24.7.4 The Floor Boxes lids shall be of 3mm thick sheet steel construction and shall be lockable to prevent against accidental disconnection of plugs.

24.7.5 All flush mounted floor boxes shall be as per Ackerman Onix or equal and equivalent. The Flush mounted floor boxes shall contain the following: -

Floor box Type 1 (FB1)

- 2 No. 13 AMP SWITCHED DOUBLE SOCKETS
- 2 No. RJ45 Cat 6A DATA POINTS

24.8 Other Equipment

24.8.1 The Contractor shall include for the provision of fused connection units, isolators and wiring to the following equipment:

- Smoke AOVs
- Natural Vent AOVs
- Automated Doors
- Access Controlled Doors
- AV Equipment

In addition, the contractor shall provide attendance to specialists during the course of their works to ensure that all electrical services requirements are correctly located and provided ready for systems commissioning.

24.9 Testing & Commissioning

24.9.1 The Contractor shall include for the testing commissioning and provision of certification of the complete installations. The contractor shall include for witness testing and demonstration of the system functions to the client's representative.

24.10 Samples

24.10.1 The Contractor shall provide for comment or approval a sample to be displayed on site of each device proposed for use on this project. Any costs associated with the provision of samples is to be included by the Contractor.

24.11 Labelling

24.11.1 The contractor shall provide adhesive labels to each device and component indicating circuit references.

24.12 Documentation

24.12.1 Full maintenance manuals including as installed drawings and commissioning certificates signed by all relevant parties shall be submitted to the Engineers at the practical completion stage. As installed drawings are to be dedicated to the general services installations and all devices shall be indicated complete with device circuit references.

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00	Suitable for Tender	22nd July 2026	Issued for Tender

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36.1 Outline Description

36.1.1 The Contractor shall include for the wiring and connection of all devices associated with the mechanical plant and building control & automation systems installations including LV power and ELV signal cable installations.

36.1.2 The Contractor shall include for the erection and connection of all free issue devices including control panels, cabling, sensors etc. and shall provide all necessary cable containment. The Electrical Contractor shall include for associated sub-mains cables.

36.1.3 The Contractor shall be responsible for the supply and installation of all mechanical services plant and equipment under the mechanical contract.

36.1.4 The Electrical Contractor shall carefully read the notes on the IN2 Engineering drawings and all relevant sections of the IN2 Engineering Mechanical specification and include for all associated works. The Electrical contractor shall refer to Mechanical schematics, Mechanical Plant schedules, and BMS Points lists included within the tender information. All costs are deemed to be included.

36.1.5 The Mechanical Contractor shall be responsible for the confirmation and identification of device positions and locations. The Electrical Contractor shall include for liaison and co-ordination with all other specialist contractors for the execution of the works.

36.1.6 The Electrical Contractor shall include for all wiring in connection with the Mechanical Services Plant and controls as detailed on the IN2 Engineering drawings and on the IN2 Engineering mechanical services drawings and schematics.

36.1.7 The Electrical Contractor shall work to detailed panel drawings prepared by the controls specialists and shall confirm all signal cable sizes & specifications with the appointed controls specialist.

36.1.8 The Electrical Contractor in submitting their tender costs will be deemed to have reviewed all mechanical plant schedules and schematics.

36.1.9 The Electrical Contractor shall include for the installation of all wiring associated with the Building Management System as detailed on the drawings. The Electrical Contractor is also responsible for the supply installation and wiring of all contactors and meters on electrical distribution boards which interface to the BMS and energy management system.

36.1.10 The BMS specialist shall be responsible for the design of the BMS cabling installation (i.e., determining the final control cable type and cable size).

36.1.11 All mechanical wiring cabling must comply with the Construction Products Regulations and with EN 50575:2014+A1:2016. All cables must bear the Euro Class standard and be a minimum **CPR class of Cca, s1a, d0, a0**.

36.2 Standards

36.2.1 The devices and components shall be compliant with the following and shall bare the CE mark of conformity. Any devices found to be non-compliant shall be replaced at the contractor's expense.

- EMC Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU
- Electromagnetic Compatibility Requirements
- CENELEC
- I.S. EN 61439-1

36.3 Equipment

36.3.1 Form 3B Motor Control Centre (MCC) panels shall be provided to contain all energy management controls and power supplies for all mechanical equipment and shall be manufactured to comply with I.S. EN 61439-1 switchgear assembly standards.

36.3.2 Isolators shall be of the MK Electric manufacture or equal and approved, IP 54 rated, type "Safety Switch" and suitably rated TPN or SPN as appropriate. Isolators must be installed within 1m of the plant location.

36.3.3 All external isolators shall be suitable for a marine/coastal type environment with stainless steel screws, enclosures, etc to be provided by the Contractor.

36.3.4 Isolators located in external Heat Pump compounds shall be suitably rated for an ATEX Zone 2 environment with all cabling glands and fixtures to also be ATEX rated.

36.3.5 The specification of all cable types is as detailed on the cable schedules as indicated on the drawings. Prior to installation the BMS Contractor shall confirm all ELV cable types and specifications.

36.3.6 Fused connection units shall be suitably rated as per IN2 Engineering drawings and be of MK Metalclad range or equal and approved.

36.4 Installation

36.4.1 The Contractor shall work to panel drawings prepared by the controls specialists and shall confirm all signal cable specifications with the appointed controls specialist. LV cable sizes shall be as indicated on IN2 Engineering drawings.

36.4.2 The Contractor shall include for erecting and connecting all control panels and all miscellaneous control devices including thermostats, sensors, speed controllers, etc, and for attendances on commissioning of the mechanical plant including heat pumps, boilers, etc.

36.4.3 The Contractor shall ensure that the BMS shall have the capacity to monitor and control all critical mechanical and electrical plant and distribution systems. Energy consumption, water usage, room temperatures, water and heating system flow and return temperatures shall be measured and recorded by the BMS.

36.4.4 Local isolators shall be provided for all motors, fans, and pumps, comprising of suitably rated TPN / SPN isolators for DOL motors and with 6-pole isolators and lock stop buttons in the case of star delta motors. Isolators are not all shown on design drawings but shall be required as described herein.

36.4.5 The final connections to all motive items of plant shall be in Kopex galvanised metal flexible conduit with separate earth continuity conductor.

36.4.6 The final connections to all sensors and actuators shall be in flexible Kopex. Exposed ELV control system cables shall not be permitted.

36.4.7 The mechanical plant LV wiring within the building shall be carried out in LSZH insulated cables on heavy duty galvanised steel cable tray or enclosed in two compartment trunking.

36.4.8 Where cables drop from the cable tray at high level to the motor control panel, the Contractor shall include for the supply and installation of steel galvanised cable tray and / or unistrut channel to support the cable.

36.4.9 Circuit references and arrangements shall be agreed with the Engineers before commencing work on site.

36.4.10 The Contractor shall include for providing engraved traffolyte labels for all isolators etc with the correct circuit references and the name of the mechanical plant item which it is supplying.

36.4.11 The Contractor shall include for all terminations within Motor Control Centres and to field devices under direction of the controls specialists and shall ensure that all testing has been completed before handover to the control's specialists.

36.4.12 The Electrical Contractor shall obtain manufacturers wiring schematics for all components or items of plant and satisfy himself of the correct wiring types and procedures before commencement.

36.5 Building Energy Management System

36.5.1 The BMS system shall be complete with outstations, relays, contactors, actuators, meters, monitors, sensors etc. (to be supplied under the mechanical contract).

36.5.2 Wiring on site shall be to the BMS suppliers wiring diagrams. The Electrical Contractor will include for all necessary attendances on the BMS supplier throughout the commissioning process.

36.5.3 The BMS shall interface with the following plant where applicable (for further details, refer to IN2 Schematics E-38 Series.

Plant/Equipment	Monitor	Alarm	Control
Comms Room AC Units	Yes	Yes	No
Supply & Return Air Temperature Sensors	Yes	Yes	No
Cold Water Storage Leak Detection	Yes	Yes	No
Extract Fans	Yes	Yes	Yes
Fire/Smoke Damper System	Yes	Yes	No
Air Conditioning System	Yes	Yes	Yes
Fire Alarm Control Panel Status	Yes	Yes	No
All Distribution Board Energy Meters (Main and Sub-Metering)	Yes	Yes	No
UPS Units	Yes	Yes	No
Electrical Surge Protection System Status	Yes	Yes	No
External Lighting Control	Yes	Yes	Yes

36.6 Extract Fans

Speed Controlled Fans

36.6.1 The Electrical Contractor shall include for providing power supplies for all mechanical ventilation extract fans as indicated IN2 Engineering drawings. The Mechanical Contractor will be responsible for suppling and installing the fans in the correct position.

36.6.2 Power supplies for speed-controlled fans shall be taken from the MCC Panels.

36.6.3 The Mechanical Contractor shall supply the speed control unit with the extract fan, and the Electrical Contractor shall include for installing the control unit and for liaising with the Mechanical Contractor to confirm final wiring. The Electrical Contractor shall allow for wiring from the speed control unit to the fan in conduit and trunking.

36.6.4 The cabling shall terminate in a 7-pole isolator switch (rated IP66 if mounted externally) at the fan, with final wiring in SWA cable in flexible conduit. Local electrical isolation shall be supplied and installed by the Electrical Contractor for all plant items, in accordance with NSAI IS 10101: 2020+A1:2024 Wiring Regulations.

36.6.5 Fans shall be supplied and installed by the Mechanical Contractor, as scheduled, and indicated on the drawings.

Run / Standby Fans

36.6.6 The Electrical Contractor shall include for wiring two separate power supplies from the fan control panel to each fan.

36.6.7 The changeover unit shall determine if a fan has failed and shall automatically change over the supply to the alternative fan and signal using a warning light.

36.6.8 The Electrical Contractor shall include for installing, within the fan control panel, the fan changeover control unit and changeover indicator light. Changeover units shall be supplied free issue from the Mechanical Contractor to the Electrical Contractor. Local electrical Isolation shall be supplied and installed by the Electrical Contractor for all plant items, in accordance with NSAI IS 10101: 2025 regulations.

36.7 Heat Recovery Units (HRU)

36.7.1 The Electrical Contractor shall include for providing power supplies for all heat recovery units as indicated IN2 Engineering drawings. The Mechanical Contractor will be responsible for suppling and installing the HRU in the correct position. Power, BMS links and Fire Alarm I/O's are to be provided to each HRU.

36.7.2 The cabling shall be a LSZH type to a wall mounted 13A switched fused connection unit with neon indicator for HRU. The final cabling from the fused connection unit to the HRU shall be in LSZH type cable.

36.8 Plant Wiring

36.8.1 The Electrical Contractor shall include for supplying and installing the power supplies and associated ancillary electrical components as indicated on IN2 Engineering drawings.

36.8.2 All pumps and controls shall be controlled are powered from the relevant MCC panel.

36.8.3 The Mechanical Contractor shall be responsible for the supply of the MCC panels.

36.8.4 The power cabling shall be XLPE/SWA/LSZH and the control cabling shall be Belden or equal and approved . Power and control cabling must be enclosed in steel galvanised cable trunking and /or steel galvanised cable tray, all branches to isolators etc are to be in steel galvanised conduit. All isolators etc are to be IP65 rated.

36.8.5 The Electrical Contractor shall obtain manufacturers wiring schematics for all components or items of plant and satisfy himself of the correct wiring types and procedures before commencement.

36.8.6 The Electrical Contractor shall include for the labelling of all isolators etc with the correct circuit reference and the name of the mechanical plant item which it is supplying.

36.8.7 On completion of system installation full testing and commissioning is to be carried out in line with NSAI IS 10101: 2020+A1:2024 Wiring Regulations.

36.9 Motorised Valves

36.9.1 The Electrical Contractor shall include for wiring to motorised valves on the LPHW heating/water services circuits as on IN2 Engineering drawings.

36.9.2 All valves shall be supplied and installed by the Mechanical Contractor and shall be wired in Belden screened cable in galvanised steel conduit and trunking to the nearest MCC panel as indicated on IN2 Engineering series drawings.

36.10 Cabling Responsibilities

Power Cabling

36.10.1 The Mechanical Contractor & BMS Specialist must confirm all power cabling requirements to the Electrical Contractor. The Electrical Contractor shall allow for the installation, glanding, termination, testing and labelling of all power cabling outlined by the Mechanical Contractor & BMS Specialist. The BMS Specialist supplier to verify termination requirements.

LV power cable sizes shall be as per IN2 schematics. Min 4.0mmsq cables shall be included to the isolators for any equipment item less than 20A.

36.10.2 **Control Cabling**

The Mechanical Contractor & BMS Specialist must confirm all control cabling requirements to the Electrical Contractor. The Electrical Contractor shall allow for the installation, glanding, termination, testing and labelling of all cabling outlined by the Mechanical Contractor & BMS Specialist. The BMS Specialist supplier to verify termination requirements.

36.10.3 **Control Devices**

The BMS Specialist shall be responsible for the supply and labelling of all control devices. The Mechanical Contractor shall be responsible for the installation of pipework and ductwork mounted devices. The Electrical Contractor shall be responsible for the installation of all room mounted devices.

36.10.4 **MCC's & Panels**

The BMS Specialist shall be responsible for supply, delivery, and commissioning of all MCC's & associated panels. The Mechanical Contractor shall be responsible for confirming the final locations all MCC's & associated panels. The Electrical Contractor shall be responsible for mounting and providing power supplies for all MCC's & associated panels.

36.11 Miscellaneous

36.11.1 The Electrical Contractor shall include for wiring to all sports equipment and sauna / ice recovery equipment.

36.11.2 All miscellaneous services such as utility meters and 3rd party equipment shall be provided with power and data connections, as required. This is a non-exhaustive list and can maybe added to.

36.12 Materials

36.12.1 All products, materials and equipment shall comply with the project specification, as well as referenced standards and all applicable regulatory requirements.

36.12.2 Similar items of equipment and individual materials shall be selected from one manufacturer's range to standardise appearance, maintenance, and replacement.

36.12.3 Unless otherwise indicated standard manufacturer's finishes and colours are to be provided.

36.12.4 All materials, products and equipment are to be transported, handled, lifted, hoisted, and stored in accordance with the manufacturers guidelines to prevent damage to equipment and injury to persons.

36.13 Co-ordination

36.13.1 The Contractor shall note his responsibility for co-ordination of his works with other contractors and sub-contractors ensure all necessary works and attendances by the main contractor and other sub-contractors is advanced in the accordance with the expectations and requirements of the controls specialist to complete his works.

36.13.2 The Contractor shall co-ordinate plant space requirements with other services following locations shown on drawings utilising space efficiently to maximise accessibility for other installations and for future access and maintenance.

36.13.3 The Contractor shall review mechanical and electrical layouts with other contractors prior to any installation.

36.13.4 The Contractor shall ensure regular on-site attendances of the controls specialist to verify all controls installations and the installations of associated mechanical and electrical services to ensure that all controls devices are installed in their correct and optimum locations. Failure to do so may result in adverse effects to the main contractor's programme and finishes, the costs of which may be directed to the responsible Contractor.

36.13.5 The Contractor will make available the appropriate qualified personnel for attendance at regular site co-ordination meetings.

36.14 Quality Control and Workmanship

36.14.1 The Contractor shall be responsible for on-site installation quality control. As such he will implement and maintain high standards of quality control governing materials and equipment, project management, site conditions and workmanship to provide a complete working installation to the highest standards that can be reasonably expected or attained.

36.14.2 Only persons suitably trained with the necessary qualifications and experience appropriate to the task shall carry out works associated with the control system installations.

36.14.3 The Contractor shall execute his works in accordance with industry standards, best practice and any relevant guidelines offered by codes of practice or applicable regulations.

36.14.4 The Contractor shall establish and implement manufacturer's installation instructions and procedures in full.

36.14.5 The Consulting engineer or his representative reserves the right to observe ongoing and completed work and comment there on without prejudice to the contractor's responsibility for quality control.

36.14.6 Defective or sub-standard installations or workmanship shall be rectified at the expense of the contractor.

36.15 Testing & Commissioning

36.15.1 The Contractor shall be responsible for the testing of all cable installations, including "point to point" testing and labelling at both ends, and shall include for liaison and attendance on the Mechanical Contractor and BMS Specialist for the testing and commissioning of electrical elements of the complete system.

36.15.2 The Contractor shall provide attendances to the BMS specialist during the testing and commissioning stage and shall ensure that all cabling installations are tested and complete prior to commissioning.

36.15.3 On completion of system installation full testing and commissioning is to be carried out in line with NSAI IS 10101:2020+AC2:2025 National Wiring Regulations.

36.15.4 Deep engraved plastic labels must be provided on all local isolators.

Rev	Status	Date	Comment
00	Suitable for Tender	22nd June 2026	Issued for Tender

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40.1 Outline Description

40.1.1 The Electrical Contractor shall be responsible for the supply, installation, commissioning, and demonstration of a complete Fire Detection system consisting of monitoring and detection equipment, audible alarms, and control equipment necessary to detect and annunciate a fire condition. The scope shall include the provision of a complete system to the entire building, with connection to the airport central control for monitoring.

40.1.2 The Building shall be provided with a fully connected analogue addressable detection system with loops to be configured to be within the separate designated areas and wiring shall be configured so as loops do not traverse fire compartments or building unit boundaries.

40.1.3 The existing system within the existing Portiuncula University Hospital CT Department is by Advanced Electronics with Hochiki detection devices. The system within the proposed X-Ray Room shell and core area is to be replaced with new wiring and new devices due to the extensive X-Ray Room refurbishment proposals.. The existing panel shall be recommissioned with full fire detection to be maintained live to the Hospital throughout the works.

40.1.4 The Contractor shall engage OEM approved Fire Alarm Systems Specialists and co-ordinate all elements of the installation in order to provide a complete system in accordance with the specification to the satisfaction of the Engineer.

40.1.5 The Contractor shall employ a fire alarm specialist with extensive experience in this field and with specific understanding knowledge and approval of HTM's and the HSE PUH hospital campus to carry out the installation of the complete new fire alarm systems. As the works will require interface with the existing systems, the contractor shall note that such interfaces shall only be carried out by the existing fire alarm maintenance contractor Messer's Masterfire Ltd. The Contractor shall within their tender submission state the names of the specialists proposed to undertake the installation, commissioning and certification of the systems

40.1.6 The Contractor shall include for a complete Fire Detection and Alarm system installation as indicated on IN2 Engineering drawings.

40.1.7 The mains electrical supply to the fire alarm panel shall be provided from a dedicated breaker labelled 'FIRE ALARM – DO NOT SWITCH OFF' and run-in fire-resistant cable to terminate as a 20-amp double pole key operated switch adjacent to the fire alarm panel.

40.1.8 Where an existing fire alarm is being modified or extended the existing loop shall be extended to include the new points as an addition to the loop by breaking into the loop and extending the loop wiring around all new points before completing the loop at the next device in order to maintain a loop arrangement to all devices. Loops shall not be extended by jointing cables at detectors.

40.1.9 The fire alarm system has been designed and shall be installed to provide L1 life cover with all areas of the new works covered. The fire alarm system shall incorporate analogue addressable control panels, repeater panels and shall utilize programmable smoke/heat detectors, aspiration detection air sampling, programmable multi-detectors, manual call points, input/output units and electronic sounders as indicated on the drawings. The system shall also incorporate fire alarm xenon strobe indicators for visual indication.

40.1.10 The system must be "open protocol" with components and devices being freely available from multiple authorised OEM supported vendors. "Managed" or "closed" protocol systems will not be permitted. The Contractor shall within their tender submission state the names of the specialists proposed to undertake the commissioning and certification of the systems who must be independent to the electrical contractor system installers.

40.1.11 The entire fire alarm installation including detection loops and sounder circuits shall be wired in **PH120 enhanced fire-retardant cabling**. This refers to all new cabling installed as part of these works under I.S. 3218:2024 standards.

40.1.12 Certification of works shall be to L1 level of coverage and to IS3218:2024, noting that the works are a "Modification to Existing Installation". All works shall comply fully with IS3218:2024.

40.1.13 The Contractor shall note that testing and commissioning shall be deemed to include, cable testing, 100% device testing using appropriate tools and test instruments, verification of device labels, verification of correct cause and effect actions, verification of correct position / locations of devices on "as built" drawings and on the Fire Alarm text descriptions. Records of all verifications and test logs shall be provided at Witness Testing stage.

40.1.14 The fire alarm system shall include laminated fire system drawings to be contained in a lockable "documents panel", which is to be located adjacent to each of the fire panels at each of the Fire Brigade entry points. The drawings must be clearly legible and accurately represent all zones and devices.

40.1.15 The fire alarm system shall include laminated fire system drawings to be contained in a lockable "documents panel", which is to be located adjacent to each of the fire panels at each of the Fire Brigade entry points. The drawings must be clearly legible and accurately represent all zones and devices.

40.1.16 Where the works are to be completed in phases, the contractor shall include for commissioning at each phase together with a final overall commissioning, including all cause & effect elements.

40.1.17 The Contractor must ensure that any detection loops and devices outside the works area are not interrupted without prior agreement. Also, the contractor shall ensure that no area is left without cover at any time and shall provide temporary coverage within the area of the works.

40.2 Standards

40.2.1 The system provided shall be installed, tested, commissioned, and certified to ensure the system and its respective components are in full compliance with, but not limited to the following standards: -

- IS 3218:2024: Irish Standard for Fire Detection & Alarm Systems for Buildings – System Design, Installation, Servicing and Maintenance.
- The Fire Alarm System shall also be in compliance with the recommendations of Health Technical Memoranda, HTM 00, HTM 05-02 and HTM -05-03. The Contractor shall also refer to HSE guidelines for Fire Alarm Systems.
- Building Regulations TGD – Part B

40.2.2 In addition to the IS3218, the equipment and installations shall comply with the current provisions of the following standards.

- IS EN 54
- Part 1 Introduction
- Part 2 Control & Indicating Equipment
- Part 4 Power Supplies
- Part 5, 6 & 8 Heat Sensitive Sensors
- Part 7 Smoke Sensors
- Part 11 Manual Call Points
- Part 12 Optical Light Beam Detectors
- Part 13 Compatibility assessment of system components
- Part 20 Aspirating smoke detectors
- Part 25 Components using radio links

40.2.3 European Union (EU)

- EMC Directive 2014/30/EU
- Electromagnetic Compatibility Requirements
- CENELEC

40.2.4 The system installation shall be in accordance with current NSAI I.S. 10101:2020+AC2:2025 Wiring Regulations.

40.3 Equipment

40.3.1 Control Panels:

40.3.1.1 The control panels shall be EN-54 Parts 2,4 and 13 approved, microprocessor controlled analogue addressable type of Modular system format and panel assembly. The panels shall be as per Advanced Electronics and configured as a fire alarm fault tolerant Fire Alarm Network.

40.3.1.2 Any new control panel shall be configured to include minimum 4 detection loop circuits and 2 sounder strobe circuits. The control panel shall be networkable and shall be designed so they can be seamlessly integrated as part a fire strategy network.

40.3.1.3 Fire Detection system shall display information to give a distinct audible and visual indication on a graphical screen.

40.3.1.4 The display shall permit the user to call up direct information on the following conditions.

- Fires
- Pre-Alarms
- Faults
- Disablements
- System Site Specific Menu Shortcut functions to indicate status and control I/O on the system.

40.3.1.5 In addition, the panel must provide the following functions and information.

a) The panel shall be capable of detecting and indicating changes in detector sensitivity.

b) Visual and audible indicators for 'FIRE' 'PRE-WARNING' and 'FAULT'.

c) LCD display indicating loop number, device number, zone number and minimum of 50 alpha numeric characters for indicating location with zone text and descriptive text.

d) The panels shall be complete with integral printers.

e) Push Button control facilities for alarm silence, system re-set and evacuate via authorised access code.

f) A facility to enable testing of sounders without activating any fire alarm interfaces shall be provided on the main panel via authorised access code.

g) The panel shall provide a dial out fault and event monitoring to a third-party monitoring station. This may be achieved via a dedicated digital dialler or via an open channel on a digital dialler provided for the intruder alarm system. The Fire Alarm system must not share communication channels with any other systems.

h) The panel shall be suitable for flush mounting and shall be supplied complete with recessing bezels.

i) Panel colours shall be any standard BS or RAL colour the exact details of which shall be advised later. The Contractor shall include for application of alternative finishes as may be required.

j) The fire alarm panel is to be complete with separate din rail mounted connection terminals for field wiring. Field wiring is not to be directly connected to PCB's within the panel.

k) The control panel shall be provided with an integral USB to enable system upgrades from local configuration to system low level firmware updates to be uploaded.

l) The control panel shall be capable of detecting and indicating changes in detector sensitivity and shall incorporate Intelligent drift compensation.

40.3.1.6 The control panel shall maintain an Integral event log to record at least the last 1000 events, with an additional 250 Fire specific log events and 250 disablement log events. The event log shall provide details on Fire and fault events as well as pre-alarm condition status of the detectors.

40.3.1.7 The fire alarm control panels shall be provided with standby batteries back up in the event of mains power failure to provide a minimum of **72 hours** of quiescent detection and a further 30 minute of full load alarms at the end of this quiescent period. The batteries shall be integral with the panels.

40.3.1.8 The Fire Alarm specialist shall provide battery sizing calculations demonstrating compliance with the above requirement as part of the technical submittal.

40.3.1.9 The main fire alarm control panel shall incorporate an integral event printer.

40.3.2 Repeater Panels

40.3.2.1 Repeater panels shall be full function type Fireman's Control panels, where all functions of the main fire alarm control panel can be performed.

40.3.2.2 The repeater panel shall be suitable for integration onto the "fault tolerant" network and shall be designed so they can be seamlessly integrated as part a fire strategy network.

40.3.2.3 Operation of the control panel in case of alarm or fault shall be achieved by simple guided instructions with visual indicators on the control buttons.

40.3.2.4 User operation shall be by clearly labelled buttons on the front of the panels. These shall provide audible and tactile feedback when operated.

40.3.2.5 Accidental operation shall be prevented using user passwords to access functions. Basic and advanced functions shall be protected by different level passwords.

40.3.2.6 Panels shall have an event log and shall store a minimum of the last 500 events and actions.

40.3.2.7 Panels shall be constructed entirely of metal with a minimum IP rating of IP32. The enclosures shall be capable of either surface or fully flush mounting. Access to the enclosures shall be achieved using a special tool.

40.3.2.8 The Contractor shall provide a 230V single phase supply to each control panel. These shall be unswitched fused connection units labelled 'Fire Alarm – Do Not Switch Off'.

40.3.3 Power Supply

40.3.3.1 Power supplies shall normally be obtained from the AC mains supply with a backup from an automatically connected battery powered standby supply in case of mains supply failure.

40.3.3.2 A fault alarm shall be raised if the battery voltage falls below 84% of the nominal specified voltage.

40.3.3.3 Upon restoration of the mains supply following an interruption, the power supply shall automatically revert to normal operation.

40.3.3.4 Batteries shall have a guaranteed minimum life expectancy of 10 years under the specified loading and environmental conditions and shall comply with the requirements set out elsewhere in this specification.

40.3.4 Manual Call Points

40.3.4.1 Manual Call Points shall be EN 54 compliant and shall incorporate dual line isolator functionality.

40.3.4.2 Manual Call Point (break glass units) shall be suitable for both surface or semi-flush mounting and are to be supplied complete with plastic box, test probe and a glass with plastic film covering. All fire alarm call points shall be individually addressed and shall contain an integral LED to signify the operational mode.

40.3.4.3 Manual Call Points shall be coloured red and shall be positioned to comply with IS 3218:2024. Unless otherwise indicated, call point units shall be mounted at 1100mm AFFL. Devices requiring replacement glass shall not be acceptable.

40.3.4.4 Manual Call Points located within plantrooms and those local to external roof plant access points shall be weatherproof type (IP66).

40.3.5 Sounders

40.3.5.1 Sounders, where indicated as being integral to the smoke / heat detector unit, shall be contained either within the detector base or within the detector head. The specialist contractor shall be responsible for undertaking field trials when locating the integral sounders to ensure that the minimum sound levels of 65 dB (A) or 5dB (A) above background noise is maintained. Electronic Sounders c/w adjustable volume control with a maximum sound level of (85 dB), at 1metre shall be provided.

40.3.5.2 In public and high risk / high background noise areas addressable Electronic Sounders c/w adjustable volume control with a maximum sound level of (100 dB), at 1metre shall be provided. These electronic sounders shall be Red in colour and shall be complete with integral RED LED flasher units. Unless otherwise indicated, sounder and strobe units shall be mounted at 2,200mm above finished floor level.

40.3.5.3 Electronic visual indication devices shall be EN54 compliant and shall be provided to all public areas and areas of high background noise. Electronic visual indicators shall be Red in colour and shall be complete with integral LED flasher units. Unless otherwise indicated, strobe units shall be mounted at 2,200mm above finished floor level and not within 150mm of the ceiling.

40.3.6 Smoke and Heat Detectors

40.3.6.1 Smoke and Heat detection devices EN54 compliant and shall be complete with a common base suitable for mounting onto a besa box. The detection devices shall have integral line isolators. The devices shall also incorporate an LED to indicate the condition of the device. Detection devices shall provide information to the control panel in the form of an analogue output for processing and interpretation.

40.3.6.2 All multisensory detectors shall incorporate a minimum of five programmable states and shall be programmable via the control panel, to adjust sensitivity and response mode of individual detectors. The configuration of heat detection and optical detection elements shall be configurable from the control panel and may include time related functions

40.3.6.3 All detectors shall incorporate 'drift compensation' to interpret the environment in which the detector is installed, thus reducing unwanted alarms. Detectors shall be able to differentiate between false alarm contamination (dust, steam etc.) and smoke conditions, using dual wavelength technology.

40.3.6.4 Detection devices have been selected on the basis of suitability for the application. Where multistate sensors are selected, it shall be the responsibility of the fire alarm system specialist to determine the most appropriate state programmed for the installed environment.

40.3.6.5 Remote indicators shall be provided where detectors are normally concealed from view. The indicators shall be labelled to show the location of the corresponding detector.

40.3.6.6 All concealed detectors such those within service voids, and ceiling voids shall have remote LED status indicators. The LED indicators shall be recessed and finished flush at approximately 2,200mm AFFL, in a serviceable location. The LED indicator shall be engraved with the location (address) of the detector served below the respective LED.

40.3.6.7 All detectors shall be multi-state type, with Optical detection devices to be used in all areas except where there may be a perceived risk of false alarm and in such case Multisensory devices shall be selected.

40.3.6.8 Detectors shall be assignable via a coded detector base. Detection devices that require programming tools to assign the device shall not be accepted.

40.3.7 Aspiration Detection System

40.3.7.1 Four Channel Laser Scanner Air Sampling Aspiration Detection system controllers shall be used as applicable or as noted on drawings. The Air Sampling Controllers shall incorporate fans and filters and shall be sensitivity adjustable.

The sampling controllers shall be low noise max 23dB(A) at 1 meter. The sampling detector shall be Optical Sensor type and shall have an obscuration sensitivity range of 0.0015% – 6% obscuration. The sensitivities shall be initially programmed as Class C " Normal".

The detector shall also indicate faults such as detector, airflow, Filter, System, Zone, Network, power urgent and minor faults.

The filter shall be a two stage disposable filter cartridge. The first stage shall be capable of filtering particles in excess of 20 microns from the air sample. The second stage shall be ultra fine, removing more than 99% of contaminant particles. Of 0.3microns or larger, to provide clean air barrier around the detectors optics, thus preventing contamination or and decreased service interval.

The Air Sampling Controllers shall incorporate fans and filters and shall be sensitivity adjustable.

40.3.7.2 The sampling pipe network shall be smooth bore 25mm diameter Red PVC tube with sampling holes positioned as determined by the Fire Detection Specialist.

40.3.7.3 In addition to the detection tubes, capillary sampling points shall be fitted flush within ceilings for air sampling within occupied spaces. All sampling points shall be fully monitored; an alarm shall be raised in the event of blocked holes etc.

40.3.7.4 The sampling controllers shall be low noise max 23dB(A) at 1 metre. The sampling detector shall be Optical Sensor type and shall have an obscuration sensitivity range of 0.0015% – 6% obscuration. The sensitivities shall be initially programmed as Class C "Normal".

40.3.7.5 The air sampling system shall be installed in accordance with the British Fire Protection Systems (BFPSA) Code of Practice for Category 1 Aspirating Detection Systems. The sampling pipe shall be purpose designed for Aspirating Smoke Detection Systems and be marked "Aspirating Smoke Detection Pipe – Do not paint or obstruct sampling holes". All sampling point holes shall be similarly marked.

40.3.7.6 The detector shall also indicate faults such as detector, airflow, Filter, System, Zone, Network, power urgent and minor faults.

40.3.7.7 The air sampling system installer shall provide evidence of flow / pressure calculations for the "As Installed" record documents, to ensure optimum sampling performance.

40.3.7.8 The filter shall be a two-stage disposable filter cartridge. The first stage shall be capable of filtering particles in excess of 20 microns from the air sample. The second stage shall be ultra-fine, removing more than 99% of contaminant particles. Of 0.3microns or larger, to provide clean air barrier around the detector's optics, thus preventing contamination or and decreased service interval.

40.3.7.9 The aspirator shall be a purpose designed rotary vane pump. The aspirator shall be capable of allowing for multiple sampling pipe runs to a maximum length of 200 metres (4 No. pipe runs per detector) with a transport time of less than 120 seconds.

40.3.7.10 The sampling pipe network shall be smooth bore 25mm diameter Red PVC tube with sampling holes positioned as determined by the Fire Detection Specialist. A maximum of 18 No. holes per permissible per detection zone. All joints shall be airtight and made using solvent cement.

40.3.7.11 The Aspiration detector shall comply with EN 54-20, ISO 7240-20, Four Pipe VEP

- Class A (40 holes / Fire 1 = 0.028% obs/m)
- Class B (80 holes / Fire 1 = 0.027% obs/m)
- Class C (100 holes / Fire 1 = 0.056% obs/m)

40.3.7.12 Each sampling system shall be configured for two stage alarms with a pre-alarm to be initiated, followed by confirmed alarm.

40.3.8 Sound and Visual Indicators

40.3.8.1 Sounders, where indicated as being integral to the smoke / heat detector unit, shall be contained either within the detector base or within the detector head. The specialist contractor shall be responsible for undertaking field trials when locating the integral sounders to ensure that the minimum sound levels of 115 dB (A) or 5dB (A) above background noise is maintained. Electronic Sounders c/w adjustable volume control with a maximum sound level of (85 dB), at 1metre shall be provided.

40.3.8.2 Sounders shall have a choice of at least four tones, set at the control panel. These shall be Continuous, Pulsed/Alert, Two Tone/Evacuation and Slow Whoop.

40.3.8.3 In public and high risk / high background noise areas addressable Electronic Sounders c/w adjustable volume control with a maximum sound level of (100 dB), at 1 metre shall be provided. These electronic sounders shall be Red in colour and shall be complete with integral RED LED flasher units. Unless otherwise indicated, sounder and strobe units shall be mounted at 2,200mm above finished floor level.

40.3.8.4 Electronic visual indication devices shall be EN54 compliant and shall be provided to all public areas and areas of high background noise. Electronic visual indicators shall be Red in colour and shall be complete with integral LED flasher units. Unless otherwise indicated, strobe units shall be mounted at 2,200mm above finished floor level and not within 150mm of the ceiling.

40.4 Approved Manufacturers and Vendors

40.4.1 The Electrical Sub-Contractor shall employ a specialist Fire Systems Vendor who can demonstrate "competence" for supply, commissioning and certification in accordance with IS 3218: 2024.

40.4.2 The System components including detection devices shall be selected from the manufacturer's specific range for compatibility with the specified control panel and operating protocol.

40.4.3 The System shall be as **Advanced Electronics** or equivalent.

40.4.4 The System components shall be selected from the following manufacturers, or equivalent.

- Detectors: Hochiki (ACD Range) or equivalent.
- Air Sampling: Xtralis, Vesda E VEU or equivalent.

40.4.5 The fire alarm system software and firmware shall be upgradeable and capable of being programmed by other fire alarm specialists at a later date, without operatives having to refer to the original supplier. A copy of the system software, including all associated engineers' codes and passwords shall be provided as part of the handover information.

40.5 Installation – Cabling and Wireways

40.5.1 The entire Fire Alarm System including detection and annunciation circuits as well as interfaces to any third-party systems shall be wired in Enhanced fire-resistant cabling to minimum Enhanced Grade 120-minute classification as tested in accordance with I.S EN 50200 and BS8434-2:2003+A2:2009. All cable shall be certified to comply with flame, shock, and water spray.

Please note that "standard grade" PH120 cable will not be acceptable.

40.5.2 All cabling and Installations must be carried out in strict accordance with IS3218: 2024.

40.5.3 All cabling shall be Low Smoke Zero Halogen type throughout. Cabling shall adhere to Euroclass standards and comply with EN 60332, EN 60754-1 and EN 61034-2 standards.

40.5.4 All cabling shall be of Solid Plain Annealed copper conductors to meet requirements of EN 60228 Class 1. Cable insulation shall be high performance, damage resistant enhanced material to comply with EN 50363-5.

40.5.5 Cables shall be complete with an overall metallic screen and laminated aluminium, or copper tape bonded to outer sheath to provide overall screen.

40.5.6 The Cable outer sheath shall be of robust thermoplastic low smoke, zero halogen and reduced flame propagation.

40.5.7 The Fire Alarm System shall be a two-wire system with detection loops wired in a cable size not less than 1.5 sq.mm enhanced PH120 flexible fire-retardant cable with LSZH sheathing. Fire Alarm network cables shall be wired in not less than 2.5 sq.mm PH120 flexible fire-retardant cable.

40.5.8 All cables must be continuous in their length with no jointing permitted. In submitting their tender, the contractor shall consult the Fire Alarm system manufacturer in determining the preferred cable selection, thus ensuring maximum system performance and appropriateness for speed of data transmission.

40.5.9 Cables shall be suitable for all indoor and outdoor application installations with exposure to normal daylight UV and environmental conditions between -20 and + 70°C, with ambient installation temperatures of 0-30°C.

40.5.10 Cabling for Fire Detection and Alarm installations shall be as per **Prysmian FP Plus Enhanced Fire-Resistant cable**, or equivalent.

40.5.11 All cables must be continuous in their length with no jointing permitted. In submitting his tender, the contractor shall consult the Fire Alarm system specialists in determining the preferred cable selection, thus ensuring maximum system performance and appropriateness for speed of data transmission.

40.5.12 An Insulation resistance test shall be carried out on all fire alarm cabling to a minimum of 500Vdc.

40.5.13 The Contractor shall agree locations of all I/O devices and where feasible shall locate I/O's in centralised locations with easy access for maintenance. Connections from the I/O's to the third-party equipment shall also be in fire retardant cabling and shall be labelled accordingly. I/O's shall not be positioned in inaccessible locations.

40.5.14 The Contractor shall be responsible for determining the CSA of all conductors required whilst taking into consideration circuit loading, length, volt drop and installation methods. The Contractor shall be responsible for determining the cable tray required to accomplish this requirement, depending on his preferred cable route.

40.5.15 In all areas where the cabling installation is not at risk of mechanical damage, the cable shall be clipped direct to the structure of the building using metal clips only. The spacing between clips shall be a maximum of 300mm, or as may be recommended by the cable manufacturers.

40.5.16 In all "visible" areas other than plant spaces all fire alarm cabling shall be concealed in conduit drops cast into walls or ceilings.

40.5.17 In all plant and service areas and where exposed the fire system cabling shall be fully mechanically protected by enclosing in galvanised steel conduit and trunking.

40.5.18 The system shall be installed such that it can be rewired without the need to chase walls or remove building elements.

40.5.19 Fire alarm system cabling shall not be inverted or fixed to the underside of cable tray systems. "Tie wraps" or other non-metal fixings or supports shall not be used on any part of the fire alarm cabling installation. Provision of metal tie wraps to all fire alarm cables or cables that rise vertically on cable trays or other supports as per I.S. 3218:2024 Clause 6.12.1.2 requirements. These metal ties may be permitted to supplement plastic tie wraps; however, metal ties shall be provided at min 0.5 metre spacings.

40.5.20 All cabling associated with the fire alarm installations shall be solely dedicated to the fire alarm system and shall be run in dedicated containment systems separate from all other services.

40.5.21 A free air spacing of 300mm shall be maintained between the fire alarm system cabling and cabling for any other service other than ELV.

40.5.22 All cable containment carrying Fire Detection and Alarm system cabling shall be suitably supported and fixed using metal anchors designed to remain in-situ during a fire. Plastic plugs and screws shall not be permitted. The contractor shall be expected to present proposals as part of his design selections of anchors and supports.

40.6 Cause and Effect Strategies

40.6.1 In advance of system software being configured all cause-and-effect scenarios shall be developed by the Fire Alarm Specialist and shall presented to the Engineer for submission to the Fire Consultant and Client.

40.6.2 It should be noted that the proposed Cause and Effect (C&E) strategy, is to align with the existing Hospital Fire Cert Compliance Report and C&E strategy, with the programming of the Fire Alarm System to provide for same.

40.6.3 The Contractor shall allow for the complete execution of the cause-and-effect programme for each evacuation zone and to ensure that the Cause-and-Effect programme is fully validated and uses common principles used elsewhere on the campus for all evacuation zones.

40.6.4 The Contractor shall provide a complete working test kit to include a programme simulator to fully validate and demonstrate the cause-and-effect strategy in a test environment before being downloaded to the Fire System.

40.6.5 The Electrical Contractor shall allow for the liaison between fire alarm specialists and other third parties and shall be responsible for ensuring that all elements interfaced with the fire alarm system to achieve the Cause and Effect (C&E) strategy are connected and fully tested in order that the C&E strategy can be verified and witnessed as operational before being offered to the engineer for witness testing. Examples include, AOV providers, smoke damper systems, access control systems, etc. Note the fire alarm system will NOT be accepted without a fully operational and demonstrated C&E strategy.

40.6.6 The Contractor shall be responsible for installation, wiring and electrical connections of third-party control panels and devices, some of which may be provided by other trades, e.g., smoke damper systems, automatic opening vent systems. The contractor shall note that the fire alarm system will not be deemed complete or accepted until all third-party elements connected to the fire alarm system are completed and connected.

40.6.7 The Contractor shall review all C&E matrixes in advance of commencement of installations. The building shall be treated as a single evacuation zone. The Contractor shall highlight any third-party equipment which requires remedial works in order to satisfy the C&E strategy, providing at least 14 days' notice to the Engineer and Client before final commissioning and demonstration of the C&E to the Engineer.

40.6.8 Following the Contractors testing and review of the proposed C&E matrix, the Contractor shall organise a C&E workshop to be attended by the fire alarm specialist and the Engineer. The workshop shall review all issues arising from contractors testing and review contractor's proposals for implementation of the new C&E strategy.

40.6.9 Miscellaneous Effects and Interfaces with other Systems

40.6.9.1 The fire alarm system shall interface with the following:

- Motor Control Enclosures
- Access Control Doors & Electronic Strike Locks
- Automatic Opening Vents
- Smoke Vents
- Fire Dampers
- Fire Shutters
- Hold Open Devices
- Intruder Alarm Systems / BMS Systems

40.6.9.2 This is a non-exhaustive list and can be added to at no expense to the Client.

40.6.10 Mechanical Plant

40.6.10.1 Under a fire condition all air handling and air conditioning plant shall be automatically signalled to shut down. Each individual air handling unit shall be provided with dedicated means shutdown in the event of fire condition. Additionally, each of the mechanical plant Motor Control Centres shall be provided with volt free interface units to perform plant shutdowns.

40.6.10.2 A terminal box shall be located beside each MCC to avoid the opening of the MCC panels during maintenance issues to access the shutdown circuit.

40.6.10.3 On reset of alarms the system must wait for confirmation of any dampers opening to restart the Mechanical Plant.

40.6.11 Automatic Opening Vents / Windows

40.6.11.1 Under a fire condition with detection within the respective stairwell, the associated automatic opening vent shall be automatically signalled to open. Each of the AOV Control Panel shall be provided with the necessary volt free interface units to achieve this. Additionally, confirmation signals shall be received by the Fire Alarm system to confirm the position of the AOV. Each of the AOV control panels shall also be monitored for fault by the Fire Alarm System

40.6.12 Automatic Doors / Power Assisted Doors

40.6.12.1 Under a fire condition all automatic doors shall be automatically released to permit egress for occupants. Each door control controller will be provided with the necessary volt free interface units to achieve this.

40.6.15 Access Control Systems

40.6.15.1 Under a fire condition all automatic doors shall be automatically released to permit egress for occupants. Each door control controller will be provided with the necessary volt free interface units to achieve this.

40.6.16 Interface to Other Systems

40.6.16.1 The Fire Alarm system shall provide signals to the Security and Building Management Systems. The Security system shall relay alarms to the third-party monitoring station via a dedicated communications channel reserved for Fire signals only.

40.7 Testing & Commissioning

40.7.1 The Contractor shall include for the testing commissioning and certification of the complete installations in full accordance with IS 3218:2024 and with NSAI National Rules for Electrical Installations I.S. 10101:2020+AC2:2025.

40.7.2 The Contractor shall include for witness testing and demonstration of the system functions to the Engineer.

40.7.3 Electrical testing of the cabling installation shall include insulation resistance testing to minimum 500Vdc, or 250Vdc for extra low voltage elements. The test duration shall not be less than 1 minute with all tests to be recorded. The Insulation Resistance must be ≥0.5 (MΩ) for 250Vdc, or ≥ 1.0 (MΩ) for up to 500Vdc.

40.7.4 The Contractor shall provide full commissioning data sheets and test records for all devices, including the provision of measured sound levels demonstrating compliance with the regulations. This information shall be submitted to the Engineer two days before the offered date for witness testing of the system.

40.7.5 The Contractor shall provide a log of all "events" and a log of all "pre alarms" conditions no later than handover. All contaminated devices shall be replaced at the expense of the contractor.

40.7.6 The Contractor shall ensure that sufficient time within the commissioning programme is allocated for the correct and thorough testing of the Fire Alarm systems in order for Completion Certification and all other commissioning information to be provided.

40.7.7 Handover of the system shall not be offered by the Contractor until all commissioning is completed and all dust caps have been removed. Once dust caps have been removed no works involving the generation of dust or dirt that may contaminate devices can be permitted on site. Should incidental once off elements of works that may generate dust be necessary the Contractor must follow all recommended procedures in accordance with IS 3218 to include all logging procedures to ensure that the devices are not at risk of contamination or generating false alarms. All such works must be co-ordinated with the Fire Alarm Specialists and confirmation must be provided following works that there has been no contamination of devices and that the system has been fully restored and also that the system log updated. Following Handover of the Fire Alarm system the Contractor shall note that a Permit to Work system will be implemented by the Client.

40.7.8 For the avoidance of doubt, the Contractor shall be the "handover company", with full responsibility for the handover of the system, including the compilation of all necessary documentation, obtaining of certification, completion of drawings and records etc.

40.8 Labelling

40.8.1 The Electrical Contractor shall provide adhesive labels to each device on the fire alarm system clearly indicating the Node reference device and loop numbers. Colour coded circular adhesive labels shall be provided to each device to correspond with the various zones and shall correspond to the Contractors "as built" drawings.

40.8.2 Device labels shall conform to Level 3 requirements as per IS 3218:2024 section 6.5.4.

40.8.3 Principle components, and power supplies shall be provided with engraved traffolite labels.

40.8.4 Cable ways shall be provided with engraved traffolite labels stating, "Life Safety Systems", with labels to be provided at regular intervals circa 3m, either side of wall intersections, and near junctions.

40.9 Witness Testing

40.9.1 Without prejudice to the Contractors own responsibilities for witness testing and verification, the Contractor shall advise the Engineer of a testing schedule and invite the Engineer to Observe ongoing tests and to witness between 15% and 20% of the testing of all devices. The Engineer shall require 10 days' notice to attend.

40.9.2 Following the Contractors' own testing and verification and once satisfied that all aspects of the Fire Detection and Alarm System are complete (including third party connections), the Contractor shall offer the system for witness testing by the Engineer. Witness testing shall be attended by the Fire Alarm system specialists and the Contractor, with the following aspects to be demonstrated by the Contractor to the Engineer.

- System Cause and Effect operation
- Sound Levels
- Device activation with verification of text / address
- System configuration

40.9.3 Witness testing shall be performed through random activation of devices that will include a sample of all devices, and each device type used on the system. The Contractor shall be required to provide all necessary tools, access equipment and test equipment to provide a complete system demonstration.

40.9.4 Final dates for demonstration and handover to the client shall be agreed upon satisfactory demonstration to the Engineer. Demonstrations to the client shall be provided by the Contractor and Fire Alarm Specialists, at which stage all Handover information and Handover Certification shall be made available.

40.10 Documentation

40.10.1 In advance of the commencement of any works related to the fire alarm installations, the Contractor shall submit a detailed Technical Submittal to the Engineer, providing full details of the proposed fire alarm system and all related components, including product information on the control panel, detection devices and the system cabling. The technical submittal shall demonstrate compliance with the specification requirements. The Contractor shall allow a 10-day review period by the Engineer of all technical submittals.

40.10.2 The technical submittal shall include Declarations of Performance and Notified Body Certification for all products and materials proposed for use on this project.

40.10.3 The Contractor shall be responsible for incorporating minor changes on drawings as may be agreed on site during technical workshops. Drawing revisions shall be issued to the Engineer for comment or approval.

40.10.4 At Completion stage and as part of Completion Certification documentation to be submitted to the Assigned Certifier, the Contractor shall provide a five-part certificate of completion in accordance with IS3218:2024. Under this Contract the Contractor shall be deemed to be the "Handover" company and shall provide the Fire Alarm System Confirmation of Acceptance as per Annex B4 of IS3218:2024.

40.10.5 The Contractor shall also be responsible for provision of the Confirmation of Installation and shall obtain the Confirmation of Commissioning from the Fire Detection and Alarm System Specialists. Note, it is a requirement of this specification that there must be independence and separation between the responsibilities for Installation and Commissioning confirmations and therefore there must be independence and separation between the organisations responsible for the Installation and for Commissioning.

40.10.6 The Contractor should note the minimum periods for local authority review of completion stage information and shall note that acceptance of the Completion Certificate is required before occupation of the building is permitted.

40.10.7 Full maintenance manuals including as installed drawings and original design, installation, and commissioning certificates (signed by all relevant parties) shall be submitted to the Engineers at the Completion stage. Dedicated "As Installed" fire alarm system drawings shall include all devices and shall denote all devices with addresses and loop numbers. The system logbook shall also be presented at that stage.

40.10.8 In addition to overall comprehensive documents, the Contractor shall provide the operator with a "fire and general register" to allow logging of all emergency events and procedures for all life safety systems.

40.10.9 The Contractor shall provide laminated copies of the "as installed" fire alarm system drawings which shall be clearly legible and indicate the device location and device details including device number, loop number and device type. These drawings shall use colour coding for evacuation zones or compartments and shall follow the same colour coding as labels used on devices. A fully Legible copy of all drawings shall be contained within a document's holder section located at the main fire panel location.

40.10.10 The Contractor shall provide laminated copies of the "as installed" fire alarm system drawings which shall be clearly legible and indicate the device location and device details including device number, loop number and device type. These drawings shall use colour coding for evacuation zones or compartments and shall follow the same colour coding as labels used on devices. A fully Legible copy of all drawings shall be contained within a documents holder section located at the main fire panel locations.

40.11 Demonstration and Training

40.11.1 In advance of project handover, the completed Fire Detection and Alarm system must be offered to the Engineer for demonstration testing, at which point the Contractor must demonstrate that the system is complete, cause and effect has been programmed and has been verified by the Contractor to comply with the agreed Fire Alarm Cause and Effect Strategy. All device labelling and "as built" information together with system certification must be completed before the system is offered to the Engineer for demonstration testing. Demonstration testing shall be expected to include a random selection of up to 10% of all devices with 100% of all C&E strategies. Should failures be noted during the demonstration testing the Engineer will reserve the right to cancel the test. The test shall not be rescheduled until remedial actions have been undertaken and confirmations have been received that the Contractor has fully checked and tested the complete C&E. Once the Contractor has demonstrated the system to the Engineer it shall be offered by the Contractor for Client demonstration and training.

40.11.2 Client demonstrations shall be expected to include a 100% demonstration of the C&E strategy and random testing of devices.

40.11.3 The Contractor shall ensure that all necessary tools (testing and measurement), are available to carry out any test during the demonstrations.

40.11.4 The Contractor shall ensure that adequate time is allowed within the commissioning programme for all demonstration testing and client handover demonstrations.

40.11.5 The Contractor shall allow for the complete system demonstration with system familiarisation training to the Client at a Client handover stage. The demonstration shall review all elements as per IS3218:2024 Annex B4; Confirmation of Acceptance. The Contractor shall be deemed to be the "handover company" as noted in the standard. All information referenced in Annex B4 must be in place and demonstrated before Handover of the System.

40.11.6 The Contractor shall provide 2 hours training on each of three sessions at times to be agreed with the client. The training is to include basic system operations and procedures including use of the logbook as per Annex F2 of IS 3218:2024. The training shall also include informing the client of his obligations under the IS 3218 Standard for Fire Detection and Alarm Systems. The contractor will allow training to be given to personnel nominated by the client at a time to be agreed with the client.

40.12 Samples & Technical Submittals

40.12.1 In advance of orders being placed for any equipment the contractor shall submit a full technical submittal including specific details of equipment dimensions, operational data, rated power, controls and wiring diagrams, materials specification.

40.12.2 The contractor shall include for the provision of 1 No. sample of each item as detailed. Samples to be erected and displayed for design team approval.

40.12.3 The contractor shall be responsible for determining quantities from IN2 Engineering Design Partnership drawings and specifications.

40.12.4 The contractor shall liaise with the various specialist suppliers to ensure that all necessary fixings kits, supports, connections, etc. are included.

40.12.5 The contractor shall refer to IN2 Engineering Electrical Specification, Section E00 General Specification, "Production of Information - Procurement Details".

40.13 Extra Materials

40.13.1 At practical completion and in addition to handover documentation the following spare parts and items of equipment shall be provided for use by the client:

- 2 No. Spare detectors, 1 No. spare sounders and manual call points of each type used on the project.
- Detector programming tool

40.13.2 These spares shall be retained on site and used during the maintenance period where replacement is required owing to non-warranty related reasons.

40.13.3 In addition to devices indicated on drawings the Contractor shall include within their tender for 3 No. smoke detectors c/w remote indicators to be installed in locations requiring additional detection that may not be apparent until mechanical services and other elements that may cause obstruction within ceiling voids have been installed.

40.14 Maintenance

40.14.1 The Fire Detection and alarm specialist shall include for 4 No. Service and Maintenance visits during the defect's liability period. These visits shall include complete system checks and replacement of defective components. The 4 No. maintenance visits are deemed separate from the training days.

40.14.2 Service and Maintenance shall be in compliance with the requirements of IS 3218:2024 and documented evidence of maintenance carried out shall be provided to the operator for inclusion in their records. The Fire Detection and Alarm specialist shall provide the operator with a "Schedule of Servicing/Testing" as per Annex F1 advising that the system has been maintained in accordance with IS 3218:2024 and that in this regard the user's responsibilities have been satisfied.

40.14.3 The Fire Alarm Specialist shall provide Schedule of Servicing/Testing" as per Annex F1. This schedule shall be contained in a suitable display folder located adjacent to the fire alarm control panel.

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00	Suitable for Tender	27th July 2026	Issued for Tender

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42.1 Outline Description

42.1.1 The Contractor shall be responsible for the supply, installation, commissioning and demonstration of a complete networked IP access control system consisting of door control devices and control equipment necessary to restrict entry to defined areas to unauthorised persons. The system shall detect and annunciate attempts at unauthorised entry as well as maintain a log of authorised users.

42.1.2 The Contractor shall engage a specialist Security Systems Contractor and 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. The system must be scalable and expandable. The system must be capable of being operated over a TCP/IP Network.

42.1.3 The system shall provide for fully wired Access Controlled Doors. (wireless systems are not acceptable)

42.1.4 The Access Control Specialists shall allow for system configuration and interface with user card technology (MIFARE 13.56MHZ, and DesFire).

42.1.5 Only Access Control Systems that have a proven reliability and have embedded high security credentials shall be considered. Controllers and system elements must be appropriate for Enterprise level systems.

42.1.6 The Access Systems shall be configured with all doors and all cards on a client software interface as part of the commissioning and handover of the system. The management software interface shall provide maximum control over access credentials and will be configured to allow time of day access and individual door access rights to be programmed.

42.1.7 The Access Systems shall be configured with all doors and all cards on a client software interface as part of the commissioning and handover of the system. The management software interface shall provide maximum control over access credentials and will be configured to allow time of day access and individual door access rights to be programmed.

42.1.8 The system shall be an enterprize level system have capacity for a minimum of 25,000 users, and capable of operating across a number of sites.

42.1.9 The Contractor shall include for a complete Access Control system installation as indicated on IN2 Engineering Design Partnership drawings.

42.1.10 Access Controlled Doors denoted by ACD on layout drawings shall be deemed to include and shall incorporate the following equipment's;

- Proximity Card Reader
- Electro Magnetic Lock (Non-Escape Route Doors)
- Electro Mechanical Strike Lock (Escape Route Doors)
- Press to Release Button
- Emergency Break Glass Unit (Green)
- Magnetic Read Contacts
- Local sounder/ strobe alarm indicator (emergency exit doors)

42.1.12 The system shall be capable of 50% expansion without the necessity to add further panels or control equipment.

42.1.13 The control panels associated with the system shall be networked such that all programming can take place at the central location. Standalone door systems are not acceptable.

42.1.14 The system shall be provided with Enterprise level application software for client management of door groups, user profiles, system reporting, door history etc. The system shall also be configured with an entry / exit reader to monitor real-time building occupancy to generate a report immediately in the event of an emergency for the purposes of identifying numbers in the building.

42.1.15 **Each door set containing an overdoor warning light linked to the X-Ray machine within the X-Ray Room shall be interfaced to disable door access once they have been enabled and read 'Hazard DO NOT ENTER" is on.**

42.1.16 **All perforations to walks or shielded boundaries within CT & X-Ray Rooms are to be shielded with Code 7 (3.15mm) Lead.**

42.2 Standards

42.2.1 The system provided is to be installed tested commissioned and certified to ensure the system and its respective components are in full compliance with, but not limited to the following standards: -

- I.S. EN 60839-11-1:2013 Alarm Systems – Electronic Access Control Systems for use in Security Applications
- The system installers and commissioners must have a current Access Control PSA licence. PSA 67:2021
- All equipment and installations shall comply with the current provisions of the following standards;

  -EMC Directive 2014/30/EU

  -Electromagnetic Compatibility Requirements

  -CENELEC

All electronic equipment and devices must have the CE mark of compliance.

The system installation shall be in accordance with current IS 10101 Wiring Regulations, Building Regulations as well as EN179 and EN1125 standards.

42.3 Equipment

42.3.1. Control Panels:

The control panels shall be microprocessor controlled and shall be complete with monitored battery backed power supply unit.

The system must provide the following functional operation;

- The system to installed over the ICT network
- The system shall monitor the status of each individual device and generate reports on access and alarms. Reporting history will include events and user activity for each individual door.
- The system shall permit the designation of minimum 16 user groups with unlimited configurations of door groups
- The system shall permit the operator to assign access or restrictions to individual or specific zones to individual users by daily or weekly schedule.
- The controller is to be complete with a network point.

Note all of the above minimum functions must be configured on the system PC and demonstrated to the Engineer before handover.

42.3.2. Card Readers:

Card readers shall be of the Proximity type with a read range of minimum 50mm. Card readers shall utilise multi-format RFID and shall be suitable for use with a range of proximity cards and fobs of other vendors

Card Readers shall be vandal resistant, IP65 and shall be suitable for internal and external installations.

Card readers shall support MIFARE, MIFARE DESFire EV1/EV2/EV3, and shall be compatible with Open Supervised Device Protocol (OSDP).

42.3.3. Electro Magnetic Door Locks:

Internal doors (not on emergency escape routes) shall be provided with Electro Locks of a high-quality face to face magnet type with a minimum holding force of 500kg. All locks shall be complete with a full transom housing to extend across the total door width. All locks shall be as manufacture by Abloy Assa or equivalent and shall be supplied complete with all necessary mounting brackets and accessories. The Contractor shall note that both doors in a double leaf arrangement must be retained and monitored.

The security specialist shall co-ordinate all fitting requirements with the Contractor.

42.3.3. Electro Door Locks:

External doors (for use on emergency escape routes) shall be provided with Electro Locks of a high-quality strike lock type with a minimum holding force of 500kg. All locks on external doors shall be fail secure from the outside and shall be fail safe from the inside with egress to be permitted via mechanical handle release without requirement for request to exit buttons etc., All locks shall as manufacture by Abloy Assa or equivalent and shall be supplied complete with all door concealment, loop kits and accessories.

The security specialist shall co-ordinate all fitting requirements with the Contractor.

42.3.4. Request to Exit / Door Release Buttons:

Request to exit button shall be of stainless-steel finish with an illuminated push button. The face plate shall state the words "DOOR RELEASE" which shall be engraved in green lettering.

42.3.3. Door Contacts:

Magnetic door contacts are to be provided to all access-controlled doors and shall be of recessed type and shall not be visible when the door is in a closed position. All magnetic contacts unless otherwise indicated shall be minimum Class ll: biased magnetic contact.

42.3.4. Emergency Break Glass Units:

Emergency Break Glass units shall be green in colour and shall be engraved with "emergency release". Activation of a break glass unit shall signal and illuminate an identification LED in order to ease identification of its use. The break glass unit shall be positioned on the secure side of the controlled door.

42.3.5. Access Cards:

The Contractor shall include for provision of 5 No. programmed access control cards, complete with lanyard neck straps and card ID holders. These shall be printed with Visitor Contractor clearly identifiable. These cards shall be used during the commissioning and handover stage with all cards to be presented to the client at handover.

The Contractor shall include for programming up to 10 HSE PUH user cards to the system as part of the system handover and training. Programming shall include profile configuration, access assignment on a door by door basis etc. The Contractor shall include for printing of staff user cards with agreed format logos etc. Staff cards shall be supplied with lanyard neck straps and card ID holders.

42.3.1 Schedule of Access Controlled Doors

This schedule is to be read in conjunction with IN2 Engineering layout drawings and schematics

Door Ref	**Configuration**
Type 1	
Generally Internal doors (non-fire escape doors)	Card reader external.

	Full transom type Electro Mag Lock, open able from inside via request to exit button. Door contacts Green Break Glass Unit
Type 2	
Generally External and high security doors	Card reader external. Electro Strike Lock, open able from inside via mechanical handle. Door contacts

42.4 Approved Vendors & Manufacturers

42.4.1 The system provided is to be installed, tested and commissioned by a registered member of the Irish Security Industry Association. All providers of security alarm installations to the project shall be licensed by the Private Security Authority (PSA) in accordance with the provisions of the Private Security Services Act, 2004.

Access control system providers shall be certified to PSA 67:2021 and PSA 74:2019

42.5 Installation

42.5.1 The controllers are to be wall mounted in the comm's room with PSU's to be located in the same room.

42.5.2 Card Readers, unless otherwise indicated, are to be mounted at 1,100mm above finished floor level.

42.7 Cabling

42.7.1 Complete wiring for the Access Control system shall be contained within ELV Security System trunking and conduit separate from all other.

42.7.2 The Contractor shall install all necessary power supplies conduits etc. to facilitate the system installation.

42.7.3 Tamper-proof circuit protection is to be provided to all devices and cabling.

42.7.4 All cabling for the access control installations shall be as system manufacturer's specification and shall be LSZH sheathed.

42.8 Testing & Commissioning

42.8.1 On completion of system installation full testing and commissioning is to be carried out in line with manufacturer's guidelines and as defined under IS EN 60839-11.

42.8.2 The system is to be configured to the Client's operational requirements and the satisfaction of the Engineer.

42.9 Documentation

42.9.1 In advance of the commencement of any works or orders being placed for any equipment the Engineer is to be provided with a full technical submittal document to consist as a minimum of the following;

- Technical information specification data sheets for each item or system component.
- Functional Description of operation for the proposed system.

42.9.2 Upon project completion the Contractor will provide complete Operation and Maintenance instructions with as installed drawings and an as installed Functional Description of operation.

42.9.3 At project completion all engineering access codes or application software relevant to the project shall be provided to the client as part of the O&M information.

42.10 Labelling

42.10.1 Adhesive labels are to be provided to each device on the access control system clearly indicating the device and associated controller. Principle components and power supplies shall be provided with engraved traffolite labels.

42.11 Samples

42.11.1 In advance of orders being placed or the installation of any items of equipment, samples of all components are to be displayed on site for review, comment or approval.

42.12 Training

42.12.1 In addition to attendances and brief system training at a client handover the training is to be given to personnel nominated by the client at a time to be agreed with the client. The system training to include 2 number 0.5 days is to include system operation, card configuration, door group configurations, user group configurations, system data interpretation and report generation.

42.13 Spares

42.13.1 In addition to access cards provided as part of handover , the Contractor shall provide an additional quantity of space cards (24No.) and a quantity of keyring fobs (12No.)

42.13.2 In addition, the Contractor shall provide a spare access barrier boom that can be fitted by local skilled operatives.

42.14 Maintenance

42.14.1 The Contractor shall include for full planned preventative maintenance of the access control system including the access barriers for the full duration of the defects period. A minimum of 2 service visits at not greater than six monthly intervals shall be included. All consumables and expected spares necessary, batteries etc. etc. shall be included.

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00	Suitable for Tender	22nd July 2026	Issued for Tender

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50.1 Outline Description

50.1.1 The Electrical Contractor shall be responsible for the supply, installation, commissioning, and demonstration of a complete Cat 6A UTP structured cabling system consisting of external and internal backbone cabling, copper & fibre optic field cabling, outlets, and passive equipment.

50.1.2 The Contractor shall engage a specialist Structured Cabling Systems Contractor and co-ordinate all elements of the installation to provide a complete system in accordance with the intent of this specification to the satisfaction of the Engineer.

50.1.3 The Specialist Contractor shall be able to demonstrate that they have proof of manufacturer approval having completed all manufacturers prescribed training that enables systems warranties to be provided.

50.1.4 The Contractor shall be responsible for all "passive equipment" to include fibre cables, copper cables, patch panels, fibre terminations, fibre connections etc. The Contractor shall be responsible for providing cableways and "meet-me" chambers to facilitate incoming fibre and copper connections to the point of entry withing the existing building and new Sub-station building linked back to the office building Main Comms hub.

50.1.5 All data cabling products must comply with the Construction Products Regulations and evidence shall be provided to include CE marks and Euroclass certification. All cables must bear the Euroclass standard and comply to EN50575:2014+A1:2016. Only **B2ca, s1a, d0, a1** cables will be accepted.

50.1.6 The Contractor shall include for liaison with the Clients representative to agree all ICT cabling installation protocols and shall provide a sample "benchmark installation" for review and acceptance, prior to commencement of any cabling installations.

50.1.7 The Structured Cabling System shall be delivered to suit wired Cat 6A 250Mhz and Wireless Applications up to 10 GbE 500 MHz.

50.2 Standards & Protocols

50.2.1 This specification refers to the supply and installation Cat 6A unshielded twisted pair (U/FTP) system. The system shall be compliant to ANSI/TIA/EIA 568C, ISO 11801 2nd Edition, and EN 50173. The system shall also be compliant with the electromagnetic compatibility requirements of EN 55015, EN 61000-6-3 and EN 61000-6-1.

Class EA: link/channel up to 250 MHz using Category 6A cable/connectors (Amendment 1 and 2 to ISO/IEC 11801, 2nd Ed.) and compatibility with draft 802.3bt for 100W.

50.2.2 The Cabling Installation shall conform to EN 50173-6:2018 Distributed Building Services and ISO 11801-6 for Distributed Buildings

50.2.3 The system shall support the following.

- Token Ring 4 and 16 Mbps
- Ethernet 10 Base T
- IBM 3270 SNA

- IBM s/36,38, + AS/400
- RS 232, 422, 423
- FDDI
- ISDN
- TPDDI
- 32 Mbps Token Ring
- 100 Base T 'Fast Ethernet'
- 155 Mbps
- 1000 Mbps

50.2.4 In addition to the above the system shall be fully compliant to IEEE 802.3 and TIA/EIA 854.

50.2.5 All products proposed must be provided with a 3rd party compliance certificate for panels, jacks, cable and patch leads showing fully compliance to TIA 568B and ISO 11801. The manufacturer will be requested to provide evidence that random audits on manufacturer are preformed from a 3rd part test house during the recent past.

50.2.6 The entire ICT & Structured cabling installations shall comply with the National HSE Structured Cabling Systems standard Version 5.2 May 2025.

50.2.7 The system installation shall be in accordance with NSAI I.S. 10101:2020+AC2:2025 Wiring Regulations.

50.3 Equipment

50.3.1 Backbone Subsystem Infrastructure

50.3.1.1 The Data Backbone for the works shall commence at the existing PUH CT Department Main Comm IT Core Room where fibre and copper links shall terminate in fibre switches and panels. The Contractor shall include for all terminations, patch panels and fibre optic tails to be presented in an LC Format. The Contractor shall also include for liaison with the HSE West IT Department to obtain their minimum and expected IT requirements.

50.3.2 Horizontal Subsystem

50.3.2.1 Wiring for all data outlets shall be in Category 6A U/UTP B2ca cables outer jacket green in colour. Where indicated for Audio Visual and other specifically identified applications the Cat 6A F/FTP B2ca cabling shall be used.

50.3.2.2 Wiring to each outlet shall be a separate cable from an intermediate distribution RJ45 patch panel frame shown on the drawings.

50.3.2.3 All outlets as shown on the drawings are dual-purpose data and telephone RJ45 outlets, which shall be configured at the IDF patch panel.

50.3.3 Cabling

50.3.3.1 All cabling shall be Cat 6a compliant U/UTP or F/FTP and **B2ca, s1a, d0, a1** compliant or equal and approved.

50.3.3.2 Cabling shall be selected for Increasing Bundled Cable Fire Performance - Euroclass Class **B2ca s1a, d0, a1**.

50.3.3.3 All fibre optic cables shall meet the following minimum general specifications:

- Minimum crush resistance of 200N/100mm
- Each fibre optic element shall be able to withstand a tensile load of at least 600N for the long term
- Each fibre optic element shall have a minimum bending radius of less than 40mm
- Thermoplastic flexible jacket.
- Internal fibre optic cables shall be of buffered construction with aramid-yarn for strain relief, approved by manufacturer for pulling through trunking or conduit for distances up to 20 metres and meet fire retardant standard BS 4066-1.
- External fibre optic cables shall be of buffered construction with aramid-yarn for strain relief, approved by manufacturer for pulling through trunking or conduit for distances up to 20 metres, meet fire retardant standard BS 4066-1, suitable for installation in external ducts prone to flooding and have a non-metallic moisture barrier.

50.3.4 Outlets

50.3.4.1 All outlets shall be a RJ45 punch down type conforming to IEC 60603-7. The RJ45 shall be Cat 6A compliant. Face plates for the RJ45 outlets shall be from the manufacture and range as all other adjacent general electrical services outlet plates. All outlets will be tested for POE ++ and offer retention force technology as standard. The outlets shall be as Leviton manufacturer or equivalent.

- Back boxes for RJ45 Outlets shall be minimum 35mm deep**.**

50.3.5 Patch Panels

50.3.5.1 The patch panels shall be 24 port U/UTP Cat 6A compliant. 1u cable management shall be provided every 48 ports. Data and voice shall be wired to separate panels and clearly labelled. The patch panels shall be as Leviton type or equivalent.

50.3.6 Fibre Optic cables shall terminate in 4U rack mounted Fibre Enclosures. The Fibre enclosures shall have a flush mounted bulkhead constructed of 16-gauge steel with a powder coated finish. Fibre Enclosures shall be provided to accommodate termination and splicing of fibre. Adapter bulkheads shall be provided to accept adapter plates and plug-n-play modules. Adapter plates shall be compliant to ANSI/TIA-568-C.3 and ANSI/TIA-604-X. Adapter plates shall use zirconia ceramic sleeves for optimum performance. Fibre Enclosures shall be as per Leviton Opt-X or equivalent.

50.3.7 Patch Cords

50.3.7.1 All Patch cords shall be Cat. 6A compliant

50.3.7.2 The Contractor shall include for the provision of the following Patch Cords.

- 20 No. 300mm RJ45 Cat 6A 4 Pair Patch Leads.
- 10 No. 150mm metre RJ45 Cat 6A 4 Pair Device Leads.
- 10 No. 1 metre RJ45 Cat 6A 4 Pair Device Leads.

Patch leads shall be colour coded.

50.3.10 Wireless Network Outlets (Wi-Fi)

50.3.10.1 The Contractor shall supply and install all cabling to enable an internal Wireless Network (Wi-Fi 6 (802.11ax)) as detailed on IN2 Engineering drawings. Each AP location is to be provided to two RJ45 outlets.

50.3.10.2 The Contractor shall include in their tender returns an amount for a detailed RF mapping of the X-Ray Room area to be completed by a specialist contractor once the building is weather tight to ensure that there is sufficient coverage in all areas of the building and, also sufficient wired access point connections at high level prior to ceilings being installed.

50.3.10.3 The RF mapping exercise carried out by the Contractor may require an increase in the quantities already determined on IN2 Engineering drawings and, these will need to be included and, installed to satisfy the minimum bandwidth requirements of the client. For the purposes of tendering the Contractor shall include all WIFI denoted points as per IN2 layouts and shall include for an additional 2 No. points to be deployed in any location where RF testing has determined that signal strength is insufficient.

50.3.10.4 The Contractor shall install twin Cat 6A outlets per wireless access point. The power for the access point shall be delivered via PoE on the Cat 6A cabling.

50.3.10.5 Wireless Access Points (AP's) shall be supplied and installed to the following standards and specification:

- 3 x 3 MU MIMO Radio,
- Dual band operation of access points; 2GHz & 5GHz
- IEEE 802.11ac Wave 2
- IEEE 802.11n
- Beamforming Technology

50.3.10.6 In addition to the items above, the contractor shall ensure their WLAN RF mapping design includes for the following factors:

- Client's minimum bandwidth requirements
- Co-channel Interference (CCI) in a high-density WLAN environment
- Channels shall be staggered between AP's on adjacent floors.
- The same channel shall be separated by at least two APs.
- Interference on wireless network from other sources such as microwave ovens, Bluetooth devices, cordless phones, wireless motion detectors, etc.

- AP devices supporting quality of service (QoS), transmit power control (TPC) and dynamic frequency selection (DFS).

50.4 Approved Manufacturers & Vendors

50.4.1 Only recognised specialist data cabling contractors that are manufacturer approved and certified installers shall be considered for the installation testing and commissioning of the installations.

50.4.2 The system manufacturer must provide a minimum **25-year warranty** to the client on completion and as such the installer must be manufacturer approved and shall have completed all required manufacturers training.

50.4.3 The Contractor shall be required to provide evidence that the installer is accredited and trained by the manufacturer. Training must be recognised by an appropriate recognised Industry Body. The Manufacturer should clarify date the installer has successfully completed training and has become an authorised installer, together with current Installer certificate.

50.4.4 The installer will be requested to provide certified accreditation from the system manufacturer demonstrating their membership of the manufacturers approved training programme. "Face to Face" training certificates must be provided; Online training will not be accepted.

50.4.5 Copper and Fibre training must be verified separately.

50.4.6 The manufacturer should confirm 5 similar sites warranted by same installer.

50.4.7 A professional installer should display proof of training and calibration of test equipment. The Installer should provide full details of test equipment together with up-to-date calibration certificates. A guide to company policy on testing on copper and fibre would be preferred.

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

50.4.9 The end-to-end cabling solution shall be as the same manufacturer.

50.5 Installation

50.5.1 The installation shall only be carried out by trained installers and must follow installation guidelines within EN 50174.

50.5.2 Separation of Data/Voice and Power cables

50.5.3 The following instructions should be followed when installing data, voice, and power.

- No separation between the horizontal data and power required if parallel run is less than 35m.
- For runs longer than 35m, separation distances shall apply except for the final 15m to the outlet.
- The separation distances are.

Type of installation	Without divider or non-metallic divider	Aluminium divider	Steel Divider
Unscreened power cable and unscreened data cable	200mm	100mm	50mm
Unscreened power cable and screened data cable	50mm	20mm	5mm
Screened power cable and unscreened data cable	30mm	10mm	2mm
Screened power cable and screened data cable	0mm	0mm	0mm

50.5.4 No cable run shall exceed 90 metres + 10 metres for patch leads. Cable ties shall not alter the geometry of the cable and should be placed every 300mm. There should be a maximum of 24 cables per bundle. After installation, the bend radii should be no more than 25mm. Cable routes should always be parallel with or perpendicular to walls. When cables pass through walls, the walls should be sleeved and pass through at 90 degrees.

50.5.5 Thermal basket infill consisting of a smooth based 5mm thick thermal formed infill that is tailored to the width of the containment system shall be provided to protect data cables.

50.5.6 Fibre optic cables shall be installed in separate containment to Cat 6A structured cabling.

50.5.7 When punching down, the cable shall not be untwisted more than 6mm at the outlet and at the patch panel.

50.5.8 For neater appearance and easier maintenance all cables terminated on the left side of panel shall be run up the left side of cabinet and the cables on right side run up right side of cabinet. Each panel shall be earthed to the common earth point by 1.5 sq. earth cable. Looping of earths or 'daisy chaining' is not allowed.

50.5.9 Labelling

50.5.9.1 All cablings shall be labelled with permanent labels at the faceplate end and the patch panel. The cables shall also be labelled at approximately 150mm from the termination. Cables shall also be labelled at any point they enter or leave concealment. The labels shall be proprietary modular fixed type and, in all cases, shall indicate that patch panel number, port, plus the destination equipment closet and hub number. The IT contractor should consult with Engineer in relation to finalising labelling scheme.

50.5.9.2 The Contractor shall also liaise with Client's IT Dept to agree labelling protocols and shall provide a "benchmark installation" for review and acceptance.

50.5.10 Port Plans

50.5.10.1 The specialist contractor shall include for maintaining an accurate and detailed record of the Works as they progress. The contractor shall include for supplying copies of 'As-Installed' Port Plans upon completion of each area.

50.5.10.2 Port plans shall be provided in advance of practical completion as assistance to other trades i.e., telephone system and wireless networks. The IT contractor shall provide for all liaison and assistance on these trades for the duration of their works.

50.6 Testing & Commissioning

50.6.1 The system shall be tested in compliance with IEC61935 to confirm Cat 6A performance. The meter used shall be a level 111 meter as per the Fluke DSP 4000. The PM01 lead shall be used to test the permanent link. 100 per cent of all links shall be tested. The following tests shall be recorded: -

- Wire Map
- NEXT
- PC NEXT
- Return Loss
- Attenuation
- Impedance
- Loop resistance
- PS ELFEXT
- ELFEXT
- ACR
- PS ACR
- Propagation Delay
- Delay Skew

50.6.2 Fibre optic light loss testing shall be carried out in accordance with BR Test Doc 10 and IEC 61280. The multimode fibres shall be tested @ 850 and 1300 nanometres and the single mode fibres at 1310 and 1500 nanometres.

50.6.3 Copper testing shall test 100% of the Cat 6A horizontal cabling over the permanent link to confirm cable plant performance characteristics as stated in the current editions of IS EN 50173 Class EA.

50.6.4 Following completion of commissioning the Contractor shall provide attendances on Client ICT equipment providers to ensure that the client Networks and associated equipment is fully operational at handover.

50.6.5 The Contractor shall note that responsibility for completion of building systems ICT networks for elements such as CCTV, BMS, Access Control, Emergency Lighting etc. are the responsibility of the Contractor. All required switches and components of this network are to be provided by the Contractor under this contract. These systems will not be permitted on the client ICT networks.

50.7 Warranties Testing & Certification

50.7.1 The system must offer a minimum 25-year warranty and a certificate of such shall be required to be submitted to the Engineer by the system manufacturer at practical completion.

50.7.2 Only an installer accredited and trained by the manufacturer must install the system. The installer will be requested to provide certified accreditation from the system manufacturer demonstrating their membership of the manufacturers approved training programme.

50.7.3 The warranty must be a channel warranty and must therefore include, cabling, outlets, patch panels, patch leads and backbone elements.

50.7.4 The warranty must be provided by the system manufacturer on their receipt of the installers test results. The warranty must be inclusive of product and labour. The warranty must cover all fibre and copper components. If the 25 warranty is not issued with the O&M upon completions of the project the liability will then be with the contractor for all parts and labour.

50.8 Training

50.8.1 In addition to attendances and brief system training at a client handover the contractor shall include for 2 No. additional training sessions to be given to personnel nominated by the client and at a time to be agreed with the client.

50.8.2 The system training is to include basic system configuration and patching etc. The additional sessions shall be devised to provide the operator with sufficient time to become familiar with the system before developing to provide a complete technical understanding. Additionally, the Contractor shall be required to provide 1 day's training / familiarisation of the completed ICT cabling network to the Clients directly appointed ICT specialists who will be providing "active equipment" such as servers and client network switches etc.

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51.1. Outline Description

51.1.1 The specialist Nurse Call Contractor shall be responsible for the supply, installation, commissioning, and demonstration of a complete Nurse Call System at Portiuncula University Hospital new X Ray Room suite and associated patient bay areas.

51.1.2 The Nurse Call System shall be an IP system and shall be provided at each treatment location, staff base and changing area.

51.1.3 The Nurse Call system shall utilise a simple CAT 6 RJ45 connector plug cabling system.

51.1.4 The System shall be wired back to a system data switch located in the main comms room in the IT core room and an extension of the existing Nurse Call system within the CT Area at Portiuncula Hospital.

51.1.5 The Contractor shall engage a Nurse Call specialist to co-ordinate, test and commission 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.

51.1.6 The system shall be capable of 30% expansion without the necessity to add further panels or control equipment. The system shall also be capable of interfacing with the fire detection and control systems.

51.2. Standards

51.2.1 The system provided shall be installed, tested, commissioned, and certified to ensure the system and its respective components are in full compliance with and satisfy the requirements of, but not limited to the following standards: -

51.2.2 In addition, the equipment and installations shall comply with the current provisions of the following standards:

- European Union (EU)
- EMC Directive 2014/30/EU
- Electromagnetic Compatibility Requirement
- CENELEC
- EN 50173-1
- HTM 08-03

51.2.3 All electronic equipment and devices must have the CE mark of compliance.

51.2.4 The system installation shall be in accordance with current Edition of the ECTI Wiring Regulations.

51.2.5 The system components, functional procedures, and data relevant for ensuring the security of the entire system must all conform to the relevant applicable regulations and standards:

- DIN-VDE 0834 – Call systems in hospitals, care homes and similar establishments, valid from 1 April 2000
- DIN-VDE 0834 / Part 1 – Device specifications, installation and operation, valid from 1 April 2000
- DIN-VDE 0834 / Part 2 – Environmental conditions and electromagnetic compatibility, valid from 1 April 2000

51.2.6 Provision of electricity in accordance with EN60950, EN61000-4-2 to -4-6 as well as EN61000-3-2 and EN55011 (Class B), Discharge current and isolation voltage in accordance with EN60601-1 (DIN750 part 1) as well as all standards and regulations referred to in these standards.

51.3. Equipment

51.3.1 The IP Nurse Call System shall comprise of the following equipment:

- Light indicator module above all doors into the X-Ray Room including from the Changing Room
- Connection modules on bedhead services medical trunking in Patient Recovery area outside X-Ray Room
- Remote Patient nurse call push button located at each patient location
- Pull cord located in Patient changing room
- System data switch in CT Area Main IT Core Room.

51.3.2 Automatic Software Upload:

If, during system operation, it becomes necessary to replace a system module, then this must be automatically detected by the permanently connected system server. The relevant firmware, software and configuration data are then automatically sent to the module and saved there: This happens without the rest of the system's functionality being compromised in any way.

51.3.3 Autarchic Computer systems

All system devices must, as necessity dictates, be equipped with autarchically functioning computer systems and software for the entire scope of functions. All speech connections must also be established autarchically. The required

storage media must use FlashProm technology, which allows a software upgrade to be made during operation.

51.3.4 Independent Structure:

All system devices are connected to so-called system switches. To allow the ports to be used in an optimal fashion, the functional links, which are independent of the physical assignment of the modules, are assigned via the system configuration.

51.3.5 Individual Functional Areas

Based on the non-hardware-based system structure, it must be possible to form individual functional areas at any time using the system configuration, without a) affecting or disrupting the continuous operation of the system and b) without needing to change the installation or the cabling. This ensures the utmost flexibility for the operator whilst still ensuring substantial cost savings.

51.3.6 Infinitely variable system construction

Even just a pair of communications terminals connected to one another by means of a system switch must be able to form a complete nurse-call communications system containing all features (call forwarding, speech connections, simultaneous system queries and announcements etc.). Every system must be able to be constructed using a bottom-up approach by connecting various system devices next to one another – it must also be possible to create virtually separated communications islands for e.g. bathrooms, treatment wards and intensive care wards.

51.3.7 Standard Additional Programs

The system devices must be able to be equipped with additional programs for manual and fully automatic adaptations to situations at any time, as well as for working in conjunction with other systems. Furthermore, care should be taken to ensure that all indicator displays display the individual room labels in system messages.

51.3.8 Enhanced Device Intelligence

Communications and patient terminals should be equipped for receiving up to 32 audio streams (e.g. radio programmes or in-house programmes). Furthermore, every system switch should contain an interface to an external TV device, which can be assigned to a specific room via the configuration.

It must be possible to unlock additional functions and to change configuration parameters differently on a room-by-room basis. To avoid unwanted disturbances during the operation of the system this should only be allowed from a single location. Parameters that affect entire wards may also only be programmed from a central location. The same applies to the individual room labels.

Faults or failures which may occur must be automatically recognised by this technological platform and indicated and automatically forwarded. The following hierarchy applies in this case:

At control panels and ward terminals they must be signalled separately and unambiguously as a fault or a failure, with the relevant event being recognisable without any risk of misunderstanding. On the displays of the communications terminals, in the first instance, only the functional restriction in the affected area is to be signalled, thereafter it should also be possible to read off the detailed source of the fault. These measures allow faults or failures to be minimised in terms of time that they occur for, thereby affecting operation as little as possible.

Furthermore, such events must also be forwarded from available system interfaces to a mobile end device or a pager to the responsible in-house technician.

51.3.9 Indicator Displays and Membrane Keypads

Communications terminals, staff terminals and ward terminals must be equipped with a graphic display for plain text indication of the call area (ward), call location and type of call. Plain texts and various indicating signals as operator hints should be used for optimizing the functional process.

Moreover 12-character corridor displays should be deployed, which also supply the same information. These large displays are also intended for other uses, which are described further below. However, for safety reasons, the information relating to nurse call issues must have priority in every instance.

All system devices must be fitted with membrane keypads for hygiene reasons or to permit simple cleaning. Patient terminals must be supplied in a splash resistant version.

51.3.10 Patient terminal plug connection

The plug and socket connections between the patient terminal and the accompanying connection sockets in the wall or in the media duct must be done in such a way, that the plug is automatically released regardless of which direction the cable is pulled in. Neither the plugs, nor the plug sockets nor any other components should sustain any form of damage in the process. The disconnection of the plug and socket connection must be automatically recognised by the system, and a relevant message to be sent.

51.3.11 Surfaces of plastic components and membrane keypads

The membrane keypads of the communications terminals and the patient terminals as well as the plastic case of the patient terminal must be fitted with anti-microbial surfaces. Antimicrobial surfaces reduce the risk of an outbreak of infections transmitted by contact with the surfaces of the unit. This preventive measure increased hygiene conditions and minimised the spread of infections.

51.3.12 Maximum Operational and Fail Safety

Hardware and software arrangements as part of the overall concept must offer maximum safety in operating processes and in critical alarm situations. Further details regarding these safety precautions can be found in the functional description which follows later.

System-related total failures are to be eliminated as follows: by using room-autarchic computer systems in all important devices, in the event of failures (e.g. wire breaks on the data cabling etc.), all other sections of the system will continue to function fully in their entirety, even if the areas in question only consist of two rooms.

51.3.13 Self-monitoring

Constant self-monitoring of all the components in the system as well as constant self-monitoring of all data and call circuits, ensure that failures or faults are automatically detected. At the same time, fault indications are generated automatically, and safety functions carried out.

51.3.14 The Fire Alarm:

This event is automatically generated by the fire alarm system and is interfaced to the communications system listed in this document by means of a unidirectional system interface and should be indicated on differing end devices dependent on the configuration. It must be possible to configure the following parameters:

- The display text for the event to be displayed.
- In which ward(s) it should be indicated,
- Whether the indication should occur only where there is staff presence marked or always
- Forwarding of the event to other system interfaces (e.g. DECT or alarm server)
- The duration for which it is to be indicated in the configured end devices.

It should be indicated optically on the terminal on the display (including information about the area in which the fire was detected) as well as acoustically with a quick call rhythm (alarm call conforming to VDE0834). The event cannot be acknowledged within the system that is the subject of this tender. It can only be cancelled via the fire detector system.

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51.3.15 IP Nurse Call Syste

- Satellite
- Announcements

51.3.16 The IP Nurse Call System shall comprise of the following equipment:

- Ward Terminal located at Nurse's Station / Reception
- Light indicator Module located above the X-Ray room doors.
- Connection Module mounted on bed services medical trunking
- Ward Communication Terminal located in the room.
- Remote Patient nurse call push button located in each room
- Pull Cord Button located in Changing Room.
- Staff pager system for staff to have on their person at all times
- System Data switch located in Comms Room.

51.4. Approved Vendors & Manufacturers

51.4.1 The system provided shall be installed, tested and commissioned by a specialist Nurse call vendor.

51.4.2 The nurse call system shall be as per VISO IP by Synergy Medical or equal and equivalent system installers may be considered.

51.4.3 The system must have a 3-year warranty for parts and labour, and the Manufacturer shall guarantee availability of parts, for a minimum of ten (10) years from date of shipment to site.

51.5. Testing & Commissioning

51.5.1 On completion of system installation, full testing and commissioning shall be carried out in line with manufacturer's guidelines and applicable HTM guidelines.

51.5.2 The system shall be configured to the client's operational requirements, and the satisfaction of the Engineer.

51.6. Documentation

51.6.1 Upon project completion, the contractor shall provide complete Operation and Maintenance instructions with as installed drawings and an as installed Functional Description of operation.

51.6.2 The hand over documentation shall include all equipment lists, and data sheets, system description and block diagrams for all equipment. All data necessary to evaluate design, function, quality, and configuration of proposed equipment and system(s).

51.7. Samples

51.7.1 In advance of orders being placed or the installation of any items of equipment, the contractor shall provide samples to be displayed on site for review, comment or approval.

51.8. Demonstration and Training

51.8.1 In addition to attendances and brief system training at a client handover seminar the contractor shall include for the provision of specialist training to be given to personnel nominated by the client at a time to be agreed with the client.

51.8.2 The contractor shall provide 3 No. 2 hours training sessions at a time to be agreed with the client. The training is to include basic system operations and procedures.

51.9. Maintenance

51.9.1 The contractor shall include 2 No. maintenance visits during the defects liability period. Copies of the signed maintenance reports shall be forwarded to the client representative.

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56.1 Outline Description

56.1.1 The Audio Visual (AV) and Video Conferencing (VC) systems including specialist equipment and cabling shall be supplied, installed, set up, tested and commissioned under this contract.

56.1.2 The contractor shall employ a specialist sub-contractor to supply, install, test & commission all AV & VC equipment within the new X-Ray Room development at Portiuncula University Hospital, CT & Imaging Department.

56.1.3 The Contractor shall supply and install all containment for the AV Facilities along with any associated power and data supplies to the specialist's requirements. Unless agreed otherwise all containment and cabling shall be installed flush in the building fabric.

56.1.4 All cabling shall be fully terminated and tested. Cables shall be connected to equipment via wall outlet plates with the appropriate connections. The works shall include the supply and fitting of all final connections from wall outlets to equipment.

56.1.5 The new speakers shall be recessed into the new suspended ceiling in the X-Ray exam room and linked to the control room as indicated.

56.1.6 The installation shall include all mounting brackets and fixings to mount equipment (speakers, microphones, etc.) at the correct height.

56.2 Standards and Protocols

56.2.1 The Audio Visual (AV) and Video Conferencing (VC) systems including specialist equipment and cabling shall be supplied, installed, set up, tested and commissioned under this contract. All AV & VC equipment supplied shall be installed, tested, commissioned and certified to ensure the system and its respective components are in full compliance with, but not limited to the following standards:-

- BS 6840 (IEC 268). Terminology for characteristics and measurement techniques of Sound System Equipment
- BS 6259: Code of Practice for the Design, Installation, Testing & Maintenance of Sound Systems.
- BS 60118 Part 4: Electroacoustics. Hearing Aids, Induction Loop systems for

Hearing Aid Purposes. System Performance Requirements.

- The complete system shall be considered as a Category S2 system, as defined within BS 6259:2015.

56.2.2 The electronic equipment and devices must have the CE mark of compliance and comply with Eco Design and Eco Labelling requirements.

56.3 Speaker System

56.3.1 All speaker outlets shall be of a high quality, highly finished and aesthetically pleasing in nature. The speakers shall be suitable for recessing and wall mounting, as detailed in IN2 Engineering Design Partnership drawings, and shall be supplied complete with proprietary mounting brackets. Speaker output as well as optimum position shall be selected by the Audio Systems specialist.

All speakers shall be suitable for the environment in which they are being installed and have the following minimum specifications.

56.3.2 **Surface mounted speakers -**

The internal speakers shall be passive column array type as per Audac or equivalent.

The speaker shall be of powder coated steel construction to RAL 9001 with aluminium construction.

56.3.3 **Recessed Ceiling - Speaker Type**

The internal ceiling recessed speakers shall be suitable for recessed mounting. The ceiling mount loudspeakers shall be a 2-way coaxial type, equipped with an 8'' aluminium cone low frequency driver and a 1''aluminium dome tweeter with neodymium magnet. The tweeter shall be mounted in the centre position of the woofer by means of an acoustically optimized arm. It shall have an RMS power handling of 80 Watt with a maximum power handling of 160 Watt and the frequency response (±3 dB) shall range from 46 Hz to 20 kHz. The sensitivity shall be 89 dB when measuring with an input signal of 1 Watt at a distance of 1 metre, while the maximum continuous sound pressure level shall be 108 dB. The nominal dispersion shall be a 135° conical coverage pattern at -6dB (average 100 Hz - 10 kHz).

The loudspeaker shall have an impedance of 8 Ohm and shall contain a passive built-in crossover network with crossover frequency of 3000 Hz. The speakers frame and basket

shall be constructed as one entity in strong ABS material with a black colour and textured matt surface finishing. A 4-screw quick-fixing mechanism shall be provided to mount the speaker into a ceiling.

The connectives shall be performed using Gold-Con Spring clamp connectors. The speaker shall have a white (RAL9003) grill with a very thin border of 1mm which extrudes the ceiling surface by only 3.2 mm. This grill shall be constructed of steel which can be painted to make it blend-in with any environment.

The speaker shall have a diameter of 270 mm, a depth of 118 mm and shall not exceed 2.25 kg. The speaker shall fit in a mounting hole with a cut-out diameter of 245 mm and a build-in depth of 115 mm

56.8.4 Features and Requirements

The projector shall include, but not be limited to, the following interfaces:

- Minimum 2 × HDMI inputs (HDCP compliant)
- HDBaseT input for long-distance signal transmission
- VGA/Computer input
- USB Type-A port (5V/2A)
- Audio input and output ports (3.5 mm)
- RJ45 (LAN) for network control
- RS-232 control port for integration with AV systems
- Monitor output port
- The projector shall include a built-in speaker with minimum 16W output.
- The projector shall support LAN-based remote management and control.
- It shall be compatible with standard AV control systems via RS-232 and network protocols.
- Firmware/service access shall be available via USB or network interface.
- Power Supply: 100–240V AC, 50/60 Hz
- Power Consumption:
- Normal Mode: ≤375 W
- Standby Mode: ≤0.5 Operating Temperature: 0°C to 40°C
- Noise Level:
- ≤37 dB (Normal)
- ≤27 dB (Eco Mode)

56.4 Approved Manufacturers and Vendors

56.4.1 The Contractor shall employ a specialist Audio System Specialist contractor for supply installation, commissioning and certification of the audio system.

56.5 Installation

56.5.1 The Contractor shall be responsible for the installation and testing of all power supplies and Audio system cabling infrastructure as indicated on IN2 Engineering Design Partnership Drawings or as advised by the Audio System Specialist.

56.5.2 Specified Cabling shall types as indicated on the layout and schematic drawings shall be strictly adhered to with no substitutions to be made without receiving written approval from the Engineer.

56.5.3 All wall mounted speaker outlets shall be terminated in adjacent audio outlet plates with jack connections to the speaker. Outlet plates shall match all adjacent electrical accessories within the space.

56.6 Testing & Commissioning

56.6.1 The system shall be tested and commissioned by the Audio system Specialist in line with equipment manufacturer's specifications to the satisfaction of the engineer.

56.7 Demonstration and Training

56.7.1 In addition to attendances and brief system training at a client handover seminar the contractor will allow two further training sessions each of 2hrs duration to be given to personnel nominated by the client at time to be agreed with the client.

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72.4 Underground Duct Cable Installations

72.1 Outline Description

72.1.1 The Contractor shall be responsible for the supply and installation of all Low Voltage distribution installations and cable networks installations to ensure a complete working installation.

72.1.2 All mains distribution cables shall be as indicated on the Main LV Schematic, which will begin at source from the PUH Undercroft Main LV Switchboard (OLB-01) located in the Main LV Switchroom. From the Main LV Switchboard sub mains cabling will be distributed downstream to the new X-Ray Room sub-distribution LV switchboard as indicated on IN2 Engineering drawings.

72.1.3 All cables used on this project including sub-mains LV general power and ELV fire, data and security systems cabling shall be Low Smoke Zero Halogen (LSZH) to BS 6724, BS 5467, IEC 60227 or IEC 60245 as appropriate to the cable type. No PVC sheathed cables shall be permitted.

72.1.4 The Contractor shall refer to specific specifications or to drawings for details on approved or specified cable types and sizes.

72.1.5 All Power and control cables must comply with the Construction Products Regulations and with I.S. EN 50575:2014+A1:2016 and I.S. 10101:2020+AC2:2025 requirements. All cables must bear the Euro class standard **(Minimum CPR Class Cca-s1a, d0, a1)**

72.1.6 All cables must be tested in accordance with I.S. EN 61034-2:2005+A2:2020 and the smoke generated shall result in transmittance values of not less than 60% as outlined in NSAI I.S. 10101:2020+AC2:2025 Wiring Regulations.

For all cable types proposed for use evidence shall be provided to include.

- CE marking
- Declarations of Performance (DoP)
- Confirmation of the Euroclass
- Confirmation of Smoke Emissions Generated

72.1.7 The following refers to cable installations not specifically mentioned in other sections of the specification but are indicated on IN2 Engineering Design Partnership drawings.

72.2 Sub – Mains Cable Installations

72.2.1 All cables used on this project including sub-mains LV general power and ELV fire, data and security systems cabling shall be Low Smoke Zero Halogen (LSZH) to BS 6724:2016, BS 5467:2016, EN IEC 60332-3-24, EN 62230 and IEC EN 60228. No PVC sheathed cables shall be permitted.

72.2.2 All sub-mains cables shall be of copper conductors, XLPE insulated, SWA and LSZH sheathing and shall be a minimum 1000V rating unless specified otherwise. 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 single galvanised steel wire armouring. The entire cable shall be covered with an extruded black LSZH sheath of the flame retardant to where the cable is installed within the building.

72.2.3 The maximum permissible volt-drop from source to supply for the entire electrical installation shall be 4% or as advised by NSAI I.S. 10101:2020+AC2:2025 Wiring Regulations Annex 52G

72.2.4 All cables shall be continuous in their length and terminations shall be complete with LSZH glands, shrouds, locknuts, and earth tags. Strictly no jointing of cables will be permitted without written permission of the Engineer.

72.2.5 Final connections of conductors to switches, busbars etc., shall be by means of crimped copper lugs, brass set screws, spring washers, washers, and nuts, or to the switchboard manufacturers cable clamps.

72.2.6 Sub-distribution cables shall be arranged in groups of cables (touching) on cable tray or ladder rack. The space to be provided between adjacent groups of cables shall be twice the overall diameter of the largest cable in either of the adjacent groups.

72.2.7 All sub-mains cables rising through the building shall be cleated to cable ladder. PVC cable ties will not be permitted other than for horizontal cable runs where the cables are laid into cable containment system. Cables shall not be inverted to cable containment.

72.2.8 All runs of sub mains cabling within the building shall be installed in strict accordance with the manufacturer's requirements and bends in the cable shall be a minimum radius of 8 times the overall diameter of the cable.

72.2.9 Low Voltage Cables shall be supported on dedicated cable containment tray and ladder systems separate from all other including Medium Voltage cables. A clear separation distance of minimum 300mm shall be maintained between LV and ELV data and signal cables where cable runs are parallel.

72.2.10 All sub-distribution cables shall be served by separate CPC's as detailed on the design drawings. The CPC's shall be fixed to the conductor served along the entire route of distribution. The armouring of sub-mains cables shall also be used in associated with the CPC's as an additional parallel earth path.

72.2.11 The colour coding of the phase and neutral conductors shall be in strict accordance with the NSAI Wiring Regulations I.S. 10101:2020+AC2:2025.

72.2.12 Each cable shall be labelled using the cable reference numbers. The means of identification shall be either an engraved plastic or brass label securely fixed to the cable with cable ties or a stamped brass or aluminium label securely fastened to the cable with galvanised iron or tinned copper bonding wire.

72.2.13 Cable identification labels shall be installed within 300mm of every termination and along the entire route at approximately every 25m or change in direction, etc.

72.2.14 Cores of all control cables will be identifiable either by means of the cable core numbering system or by means of proprietary identification ferrules.

72.2.15 All cables shall be selected from recognised manufacturers with proven test data to ensure conformity with all relating standards. Spurious cables shall not be permitted.

72.3 Fire Rated Cable Installations

72.3.1 All fire rated cabling shall be tested and manufactured in accordance with BS 7846:2015, BS 8491:2008, EN 50200 and BS6387 and bends in the cabling shall be a minimum radius of 8 times the overall diameter of the cable or as advised by the cable manufacturer.

72.3.2 All fire rated cables used on this project, typically for firefighting services such as evacuation and firefighting lifts, shall be installed in accordance with BS 8519:2020. Cables shall consist of stranded copper cores with XLPE insulation, LSZH inner sheath, steel wire armouring (XLPE/LSZH/SWA) with a PH120 rated fire-resistant outer sheath. All fire rated cabling shall be installed and fixed in strict accordance with manufacturer's guidelines.

72.3.3 Fire rated power cables shall also be installed on diverse containment routes from the primary and secondary power sources to comply with the resilience requirements outlined in BS 9999 and BS 8519:2020.

72.4 Underground Duct Cable Installations

72.4.1 All underground cabling shall be installed directly in ducts. Cables shall be installed in a duct sized at 125mm in diameter or twice the diameter of the cable, whichever is larger.

72.4.2 All underground cables shall be mechanically protected by enclosure in a concrete pipe or twin walled high density Class B polyethylene ducting and colour coded to IS 370:2016 and NSAI I.S. 10101:2020+AC2:2025 Wiring Regulations requirements.

72.4.3 All underground ducting shall comply with I.S. EN 50086-2 and 4 and shall have a 750N load rating for a deflection of 5%.

72.4.4 Where underground cabling enters the building below the water table, a "puddle flange" shall be built into the structure by the Main Contractor for each cable. All "puddle flange" installations shall be in cast iron with a drilled flange plate for the attachment of backing and sealing glands.

72.4.5 All external lighting ducting shall comply with I.S. EN 61386-24 and be single wall, manufactured from high density polyethylene and coloured red.

72.4.6 The cross sectional area of a Phase and Neutral conductors in underground cabling shall not be less than 6mm^2 serving lighting bollards and columns.

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73.1 Outline Description

73.1.1 The Contractor shall be responsible for the supply, installation, commissioning of Power Factor Correction Equipment and Harmonic / Active Filtering Equipment to be complete with the necessary components.

73.1.2 The Electrical Contractor shall provide Power Factor Correction equipment to achieve a Power Factor greater or equal to 0.97.

73.1.3 The appropriate Power Factor Correction / Harmonic Filter unit shall be selected following an initial power on time to the Main LV Switchboard of 6 months. Based on THD and PF readings obtained from multifunction metering on the Main LV Panel, the Contractor and their Specialist Contractor shall select the best suited rating for the unit to meet the power factor and harmonic levels of the development.

73.1.4 Power Factor Correction shall be achieved by means of automatically controlled stepped banks of capacitors, c/w integral active harmonic filtering. The capacitors shall be low loss units manufactured in accordance with EN 60831-1: 2014 for use on systems having a rated voltage up to and including 1000V.

73.2 Standards

73.2.1 The Power Factor Correction / Harmonic Filter installation shall comply with the requirements of the following standards:

- IS. EN IEC 61439-1:2021 - Low-voltage switchgear and control gear assemblies-Part 1: General Rules
- I.S. EN IEC 61439-2:2020 - Low-voltage switchgear and control gear assemblies-Part 2: Power switchgear and control gear assemblies.
- I.S. EN 60715:2017 - Dimensions of LV Switchgear and Controlgear
- I.S. EN 62477-1:2022 - Safety requirements for power electronic converter systems and equipment. General Rules.
- IEC 61000-6-2 – Immunity standard for Industrial Environments. Generic Standards.
- I.S. EN 50160:2022 – Voltage characteristics of electricity supplied by public electricity networks.

The complete power factor and harmonic filter installations shall be in strict compliance with NSAI National Rules for Electrical Installations I.S. 10101:2020+AC2:2025.

73.2.2 All components shall be compliant with European Union EMC (2014/30/EU) and LVD (2014/35/EU) Directives and shall carry the CE Mark of conformity.

73.3 Equipment

73.3.1 The Power Factor Correction Equipment enclosures shall be minimum IP43 fully extendable, Sheet Steel cubicle construction with powder coated finish RAL to be advised.

73.3.2 The Power Factor Correction Equipment shall be self-contained in a stand-alone switchboard separate from all other and shall not be integral within main or other switchgear.

73.3.3 The Power Factor Correction Equipment shall be floor standing and shall be designed for top and bottom cable entry / exit with front access for incoming cabling and outgoing circuits as indicated.

73.3.4 Panels shall be structured powder coated, finish RAL 7035.

73.3.5 The Power Factor Correction Equipment configuration shall be such that it fits within the allocated space shown in the Undercroft Main LV Switchroom. The height of the Power Factor Correction Enclosure, maximum height 2,200mm AFFL, shall take into account bending radii of any top entry cables.

73.3.6 The Power Factor Correction Enclosures shall be constructed such that it is completely vermin proof.

73.3.7 The Power Factor Correction Enclosure shall be suitable for operation on 400/230V 3phase 4 wire system with a short circuit prospective fault level of 50kA for 1 second.

73.3.8 Control wiring shall be 2 x 2.5 sq.mm XLPE/SWA/LSZH cable from the power factor regulator to the power factor CT's on the Main LV Switchboard.

73.3.9 The PFC shall be provided with a 3 or 4 as appropriate stage PFC indication/controller complete with protection fuses, power 'ON' indicator, and stage switching indicators.

73.3.10 On power failure the units shall reset such that the capacitors are initially disconnected from the supply on restoration.

73.3.11 The Monitoring CTs are to be provided and fixed to the bus bars of the main switchboards, and suitable double insulated cabling is to be supplied, installed and connected between the CT's and the PFC relay and between the relay and the kVAr control contactors.

73.3.12 All power factor correction equipment employed at the main switchboards as indicated on IN2 Engineering Design Partnership Drawings shall be of low loss modular system and shall comprise the following: -

- 1 No. Microprocessor controlled 4 step programmable regulator.
- 4 x 25 KVAr of de-tuned capacitors banks as indicated complete with all switchgear.
- Space provision within the power factor correction cubicle for the provision of additional future capacitors.
- The KVAr of future capacitors banks as indicated complete with all switchgear and controls

73.3.13 All power factor correction equipment shall be supplied complete with all necessary ancillary components necessary to complete the installation.

73.3.14 The power factor regulators shall be programmed by means of dip switches to provide a maximum capacity equal to the total of all of the capacitors fitted and switched in steps equal to the capacity of the smallest single capacitor specified.

73.3.15 The provision for future fitting of the additional PFC equipment as described above shall include all necessary bus bar connections and wiring required such that the future fitting out of this PFC equipment shall not require any modifications, additions to or restructuring of the L.V. switchpanel.

73.4 Harmonic / Active Filters

73.4.1 Harmonic / Active Filter shall be installed if required due to the maximum levels of Total Harmonic Distortion (THD) exceeding the permitted levels as outlined in I.S. 10101:2020+AC2:2025 and the Voltage Harmonic Limits for controlled and sensitive equipment by the industry standard IEC 61000-2-4 - Electromagnetic compatibility (EMC) Part 2-4: Environment - Compatibility levels for low-frequency conducted disturbances.

73.4.2 The Harmonic/Active shall be wall mounted in the Main LV Switchroom locally at Sub Distribution panel(s) where THD levels are above required limits.

73.4.3 Harmonic/Active Filter unit shall include for the required number of CT's to be provided within the associated switchgear assembly (typically 3 No. CT's). The Contractor shall ensure that during the tender period they consult with the Switchgear assembly manufacturer to ensure all is captured in the switchgear proposals.

73.4.4 The Harmonic/Active Filter unit shall provide for reduction in harmonic currents from the second up to the fiftieth harmonic (2,500 Hz) and include power factor correction for both inductive and capacitive power factor imbalances.

73.4.5 The Harmonic/Active Filter unit shall include a facility for phase current balancing and improvement of power consumption taken from the neutral conductor in 4 wire systems.

73.4.6 The Harmonic/Active Filter unit shall include ethernet capabilities to ensure Modbus protocol or similar connectivity (TCP/IP) to the Building Management System for visual display of operating status and alerts for any system faults.

73.4.7 The Harmonic/Active Filter unit shall a visual display on the enclosure cover to display real time outputs of voltage, frequency, THD % at each applicable level (5th, 7th ,13th, etc).

73.5 Approved Manufacturers and Vendors

73.5.1 The Contractor must select an L.V. Switchgear manufacturer with an established local supply chain for the assembly, testing and provision of the LV Switchgear installations. All LV switchgear associated with this project shall be provided by the same manufacturer and switchgear assembler, using identical components. The Manufacturer shall be as below or equal and approved.

73.5.2 The following or equal and approved manufacturers may be considered for the provision of all components.

- Schneider
- Circutor

73.5.3 All equipment and ancillary components must be selected from the same manufacturers range as stated above.

73.5.4 The Specialist must select an authorised Switchgear manufacturer for the assembly testing and provision of all Power Factor Correction equipment.

73.5.5 Contractor as part of their tender return shall allow for a specialist energy monitoring company to attend site after energisation of the entire electrical installations and occupation of building, to monitor the entire electrical installation for a period of at least 8 weeks or as deemed appropriate by the specialist energy monitoring company to ensure that the proposed PFC and/or Harmonic Filtering equipment to be installed is sized appropriately for the requirements of the buildings' electrical installations.

73.6 Installation

73.6.1 The power factor correction equipment is to be floor mounted within the electrical Main LV Switchroom depending on the rating and size of the equipment. Final locations to be agreed with Engineer.

73.6.2 The mains supply from the main switchboard to each PFC unit shall be a minimum of 35mm2 XLPE / SWA / LSZH single core cables or as advised by the PFC/Harmonic Filter specialist contractor based on the final unit sizing contained in galvanised steel trunking.

73.6.3 The mains supply from the Main LV switchboard to each Harmonic Filter unit (up to 75 Amp is rating) shall be a minimum of 25mm^2 XLPE/SWA/LSZH multicore armoured cable contained on galvanised steel ladder containment. Active Filters up to but not exceeding 100Amp in rating shall be wired in 50mm^2 XLPE/SWA/LSZH multicore armoured cable.

73.7 Samples & Technical Submittals

73.7.1 In advance of orders being placed for any equipment the contractor shall submit a full technical submittal including specific details of equipment dimensions, operational data, rated power, controls and wiring diagrams, materials specification.

73.8 Labelling

73.8.1 Each of the sections on the PFC / Harmonic Filter assemblies is to be provided with an engraved traffolite indication label with 12mm capital letters (minimum 4mm lettering) and fixed with rivets or screws.

73.8.2 The PFC / Harmonic Filter unit shall be provided with danger and warning notices.

73.8.3 The Specialist shall provide signage on the main LV distribution panel to warn users to isolate all PFC banks prior to entering the capacitor cubicle and of the total discharge time of the capacitors therein.

73.9 Testing & Commissioning

73.9.1 Testing and commissioning are to be carried out in accordance with current NSAI Wiring Regulations I.S. 10101:2020+AC2:2025 and I.S. EN 61439-1:2021.

73.9.2 The Electrical Contractor shall engage the switchgear manufacturer to attend site and carry out a final test and inspection on the switchgear assembly installation.

73.9.3 All Power Factor Correction equipment shall be re-calibrated on site under load conditions, and a calibration certificate shall be provided within the operation and maintenance documentation to this effect.

73.9.4 The Contractor shall include for 1 day's site attendance by the panel manufacturers to undertake adhoc modifications to installed distribution centres allowing for minor changes that may occur.

73.10 Documentation

73.10.1 Before placing final orders, full general arrangement and wiring drawings shall be submitted to the Engineer for the approval.

73.10.2 Before taking to site of any switchgear the Contractor shall provide to the Engineer a copy of the manufacturers test certificate for all distribution centres. 10 days. Notice must also be given inviting the Engineer to attend testing.

73.10.3 Upon completion of the project the Contractor shall provide the following documentation.

- I.S. EN 61439 Test Certification from manufacturers for the switchboards
- I.S. EN 62477-1:2012+A1:2017 Test Certification from manufacturers for the PFC Unit
- Safe Electric / RECI Test Certificates.
- Circuit charts.

73.11 Demonstration

73.11.1 The Specialist will provide a demonstration and training of the complete Power Factor Correction installations including operation and functional understanding of the metering equipment.

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75.1 Outline Description

75.1.1 The Contractor shall be responsible for the supply, installation, commissioning of distribution centres to be complete with the necessary MCB's, RCBO's, AFDD's and ancillary components as detailed on IN2 Engineering Design Partnership Drawings.

75.1.2 The Sub Distribution switchgear panels will be strategically located in dedicated cupboards, plantrooms and switchrooms as indicated on IN2 Engineering Design Partnership Drawings. The Low Voltage (LV) switchgear shall be separated from all Extra-Low Voltage (ELV) services.

75.1.3 All Sub Distribution switchgear panels shall have provisions for at least 25% future expansion in all components and compartments of the Switchgear assembly.

75.1.4 The Contractor shall allow for the testing of the existing Undercroft Main LV Switchboard Spare "Future CT" cubicle and motorised MCCB prior to energising for new LV supply to X-Ray Room Development new local SDB.

75.2 Standards

75.2.1 Distribution centres associated with this installation shall comply with the requirements of the following standards:

- IEC 60947-1:2020 - Low-voltage switchgear and control gear - Part 1: General Rules
- I.S. EN 60715-1:2017 - Dimensions of LV Switchgear and controlgear
- I.S. EN IEC 61439-1:2021 - Low-voltage switchgear and control gear assemblies- Part 1: General Rules
- IEC 61439-1:2021+A1:2023 - Low-voltage switchgear and control gear assemblies- Part 1: General Rules
- I.S. EN IEC 61439-2:2021 - Low-voltage switchgear and control gear assemblies- Part 2: Power switchgear and control gear assemblies.
- I.S. EN 61439-3:2024: Low-voltage switchgear and control gear assemblies- Part 3: Distribution boards intended to be operated by ordinary persons (DBO).
- MEIGaN Version 2
- Annex 1 to MEIGaN
- HTM 06-01 Electrical Services Distribution

The complete installations shall be in strict compliance with NSAI National Rules for Electrical Installations I.S. 10101:2020+AC2:2025.

All components shall be compliant with European Union EMC (2014/30/EU) and LVD (2014/35/EU) Directives and shall carry the CE Mark of conformity.

75.3 Equipment

75.3.1 The sub distribution centre enclosures shall be Sheet Steel construction as manufactured by Elsteel, or equivalent and will be suitable for wall or floor mounting and shall be constructed with the following:

- Distribution centres shall be suitable for continuous operation and be complete with insultation levels rated at 1000 Volts and the fault shall be capable of withstanding maximum fault conditions.
- The enclosure body shall be constructed of mild steel min 2mm, folded and seam welded. Minimum IP 44. Incoming Cable compartments, main isolation / circuit breaker termination compartments and Sub-Section Circuit Breaker compartments (Lighting / Power / General Services / Mechanical Power) are Form 3B separation to comply with I.S. EN 61439-1:2021; MCB and RCBO distribution sections shall be Form 2B separation, with all outgoing cables wired to cable terminals which shall be fixed onto din-rail.
- Panels shall be structured powder coated, finish RAL 7035.
- Distribution centres are to incorporate vertical cable management sections to allow for incoming and outgoing cable glanding, and this section shall also allow distribution and ease of crossover of cabling where required. The cableway shall form part of the switchgear assembly and glanding plates shall be sized to allow capacity for future cable terminations.
- Distribution Centres are to be suitable for top and bottom cable entry/exit.
- Distribution Centres are to be vermin proof.
- Lighting, General Services and Motive power sections are to be segregated including the separation of their respective MCB's and devices.
- RCBO's shall incorporate 30mA tripping unless otherwise indicated.
- Klippon type terminals are to be provided for all outgoing wireways
- 25% Spare capacity for future circuit ways shall be allowed in each of the lighting, general services, and motive power sections. Spare ways are to be fitted with proprietary blanking pieces.
- Access doors shall not require the use of proprietary tools for opening.

75.3.2 The distribution centre will be supplied complete with all necessary MCB's, RCBO's, etc and all ancillary components necessary to complete the installation.

75.3.3 All Sub Distribution Boards shall be suitably rated for fault currents and load capacity and each outgoing MCB shall have its own associated neutral terminal.

75.3.4 All circuits serving 13 A socket outlets shall have individual 30 mA rated RCBO's fitted within the respective distribution board serving that circuit, i.e., each circuit shall have a dedicated combined MCB/RCBO protective device.

75.3.5 All circuits serving 13A socket outlets in all areas of high risk as defined in I.S. 10101:2020+AC2:2025 shall be suitably protected by an Arc Fault Detective Device (AFDD). The AFDD shall be installed at the origin of the final circuit to be protected and comply with I.S. EN 62606. The AFDD shall be rated at 30mA and fitted within the respective distribution board serving that circuit i.e., each identified circuit shall have a dedicated combined MCB/RCBO/AFDD protective device.

75.3.6 All circuits serving WCs and ensuites shall be on dedicated 30mA RCBO's fitted within the respective distribution board serving that circuit.

75.3.7 Adequate space for cable terminations shall be provided noting cable sizes as indicated on the drawings.

75.3.8 Each of the distribution centres shall incorporate emergency lighting relays and a central test unit. The central test unit shall facilitate 30min and 3hour testing of the emergency lighting installations associated with the floor served. Sufficient emergency lighting relays shall be allowed to permit connection of current and future emergency lighting installations.

75.3.9 Distribution Centres shall incorporate Din Rail mounted Lighting Control Modules. The Lighting Control Modules shall be supplied by the Lighting Control Specialist to the switchgear specialists together with relevant wiring diagrams such that all components can be assembled in factory conditions before shipping to site. The Contractor shall during the tender period provide details of the proposed lighting control modules to the switchgear specialists so that complete account of all requirements is made.

75.3.10 Contactors shall be provided in the distribution centres for interfacing emergency relays with lighting control panels and with the emergency lighting system.

75.3.11 Each of the distributions centres and control panels shall be provided with electrical energy analysis meters to provide information on Amps per phase, kW load, Power Factor, THD and cumulative energy consumed kWhr. The meters shall be located within the distribution centres and shall be complete with facia mounted display. The meters shall be suitable for interfacing to the BMS system and shall be complete with a Modbus interface to achieve this.

75.3.12 The Contractor shall ensure that:

- Earth fault protection shall be provided
- All switchgear is provided with Electronic Surge Protection, selected in accordance with the requirements of the Lightning Protection Risk Assessment in accordance with I.S. EN 62305
- All sub-sections (Lighting / Power / General Services / Mechanical Power) will incorporate multi-function metering
- All metering is linked to the Building Management System for remote interrogation
- All Electronic Surge Protection is linked to the Building Management System for remote monitoring

- All Sub Distribution Boards are equipped with mimic circuitry, which shall schematically detail all busbar connections and outgoing service cabling
- Laminated Schematic drawings are provided, detailing all schematic details.

75.4 Moulded Case Circuit Breakers (MCCB's)

75.4.1 All MCCB's shall be installed on the Sub-Distribution Boards up to 1000A rated capacity and shall comply with the following standards:

- EN IEC 60947-1:2020
- EN IEC 60947-2:2024
- EN IEC 60947-3:2020
- EN IEC 60947-4-1:2023

75.4.2 MCCB's shall be provided with adjustable electronic releases to provide the following (LSI) protections:

- Overload protection with a continuously adjustable setting from 0.4 times the rate of current up to full rated value
- Adjustable selected short circuit protection; and
- Instantaneous short circuit

75.4.3 MCCB's shall be compliant with European Union Electromagnetic Compatibility (EMC) 2014/30/EU and Low Voltage Directive (LVD), 2014/35/EU, Directives and shall carry the CE Mark of conformity.

75.4.4 The trip unit within the MCCB shall be complete with overload protection in accordance with EN 60947-4-1 for motor protection, where applicable.

75.4.5 The rated impulse voltage of the MCCB shall be at least 8kV and suitable for installation at the origin of the installation.

75.4.6 MCCB's shall be complete with interchangeable trip units from 160A upwards to ensure an ease of installation upgrade and it should also be possible to select between thermomagnetic and electronic trip units.

75.4.7 In 4-pole MCCB's the neutral poles shall be protected and for a rated current equal or higher than 125A, protection of the neutral shall be adjustable at 100% or 50% while for lower rated current it shall always be 100%.

75.4.8 The MCCB's supplied for this project shall comply with the following characteristics:

- Rated Service voltage - 690V AC
- Rated Insulation Voltage – 800V AC
- Short Circuit Level Main Incoming MCCB - 50kA
- Short Circuit Level Outgoing MCCB - 36kA

75.5 Miniature Circuit Breakers (MCB's)

75.5.1 All miniature circuit breakers (MCB's) installed within distribution switchgear shall be manufactured and tested in compliance with I.S. EN 60898-1:2019. The MCB's shall be rated for uninterrupted duty at an operating voltage of 230/400V, within the enclosure they are affixed.

75.5.2 Selection and rating of MCB protective devices shall be in strict accordance with NSAI National Rules for Electrical Installations – I.S. 10101:2020+AC2:2025 (Part 55A.2.3).

75.5.3 Unless stated otherwise all MCB's shall carry a minimum rated short circuit capacity of 10kA. The MCB type and rating shall be as per stated on IN2 Engineering Design Partnership layouts or schedules.

75.5.4 The contacts of a multi pole i.e., 4 pole MCB shall operate simultaneously.

75.5.5 Any MCB's used for external lighting shall be rated with a minimum short circuit capacity of 15kA unless stated otherwise.

75.6 Residual Current Breakers with Overcurrent Protection (RCBO's)

75.6.1 All residual current breakers with overcurrent protection (RCBO's) installed within distribution switchgear shall be manufactured and tested in compliance with I.S. EN 61009-1, I.S. EN 61009-2-1 and I.S. EN 62423.

75.6.2 RCBO selection and installation shall be in full compliance with NSAI National Rules for Electrical Installations I.S. 10101:2020+AC2:2025.

75.6.3 All RCBO's shall operate within 0.4 seconds and unless otherwise stated shall have a tripping function of 30mA in 30ms. All RCBO's shall have a "B" type trip characteristic for final circuits with inrush currents between 3 to 5 I_n, "C" type trip characteristic for final circuits with inrush currents between 5 to 10 I_n and "D" type trip characteristic for final circuits with inrush currents between 10 to 20 I_n as defined in I.S. 10101:2020+AC2:2025.
Note: I_n is the rated current of the device.

75.7 Approved Manufacturers and Vendors

75.7.1 The following or equivalent manufacturers may be considered for the provision of all components:

- Siemens
- Schneider
- ABB

75.7.2 All equipment and ancillary components must be selected from the same manufacturers range.

75.7.3 The Specialist must select an authorised Switchgear manufacturer for the assembly testing and provision of all switchgear. All switchgear associated with this project is to be provided by the same manufacturer using identical components.

75.8 Surge Protection

75.8.1 All Sub Distribution Switchboards shall be complete with Surge Protection Devices (SPD's) selected in accordance with Lighting Protection System Risk Assessment which shall be carried out in accordance with I.S. EN 62305.

75.8.2 All Surge Protection Devices shall be fully coordinated with overcurrent protective devices and installed within any switchgear assembly as per I.S. 10101:2020+AC2:2025 and ESB Networks requirements and guidance.

75.8.3 All Surge Protective Devices shall be complete with auxiliary relays to indicate their status (Healthy / Failure) to the head end Building Management System (BMS).

75.8.4 Further details on Surge Protection Devices for the Main LV Switchgear can be viewed in Section E93 (Transient and Overvoltage Protection) of this specification document.

75.9 Installation

75.9.1 All equipment and ancillary components must be selected from the same manufacturers range.

75.9.2 The distribution centres are to be wall mounted within dedicated cupboards and service risers as per IN2 Engineering drawings. Where necessary and dependant on wall construction, distribution centres shall be supported on a "unistrut" support system to carry the full weight of the panel without compromising the integrity of adjacent construction.

75.9.3 The Contractor shall note the maximum available space, and allowances shall be made in the design and manufacture of the distribution centre to suit locations.

75.10 Labelling

75.10.1 Each of the sections on the Sub Distribution switchboard assemblies is to be provided with an engraved traffolite indication label with 12mm capital letters (minimum 4mm lettering) and fixed with rivets or screws.

75.10.2 The Sub Distribution Switchboard(s) shall have a main label affixed to the front of the switchgear assembly to I.S. EN 61439-1/2:2021 requirements to include the following details / information as a minimum:

- Assembly manufacturer name or trademark
- Type Designation or Identification Number
- Country of Origin
- IEC 61439-X (the specific part "X" shall be identified)
- Country of Origin

- Year of Manufacture
- Degree of Protection
- Short Circuit Protection Value
- Rated Voltage and Frequency

75.10.3 All Distribution Boards shall be fitted with sub-circuits charts in a waterproof; clear polythene envelope fixed to the back of each door.

75.10.4 Deep engraved plastic labels (black on white background) shall be provided for the following items (list is non exhaustive):

- Internal sections within the DB enclosures
- MCB's
- RCBO's
- Timeclocks
- Contactors

75.11 Testing & Commissioning

75.11.1 Testing and commissioning are to be carried out in accordance with current NSAI Wiring Regulations I.S. 10101:2020+AC2:2025 and I.S. EN 61439-1:2021.

75.11.2 The Electrical Contractor shall engage the switchgear manufacturer to attend site and carry out a final test and inspection on the switchgear assembly installation.

75.11.3 All metering shall be re-calibrated on site, and a calibration certificate shall be provided within the operation and maintenance documentation to this effect.

75.11.4 Circuit testing is to be undertaken by the Contractor with all panel testing and certification to be provided by the panel manufacturer.

75.11.5 The Contractor shall include for 1 day's site attendance by the panel manufacturers to undertake adhoc modifications to installed distribution centres allowing for minor changes that may occur.

75.13 Documentation

75.12.1 Before placing final orders, full general arrangement and wiring drawings shall be submitted to the Engineer for the approval.

75.12.2 Before taking to site of any switchgear the Contractor shall provide to the Engineer a copy of the manufacturers test certificate for all distribution centres. 10 days. Notice must also be given inviting the Engineer to attend testing.

75.12.3 Upon completion of the project the Contractor shall provide the following documentation:

- I.S. EN 61439 Test Certification from manufacturers for the switchboards
- Safe Electric Test Certificates for the switchboards.

- Circuit charts.

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80.1 Outline Description

80.1.1 The Contractor shall be responsible for the supply and installation of complete cable containment installations to ensure a complete working installation. Cable containment system components as detailed on IN2 Engineering Design Partnership Drawings are representative of primary minimum containment requirements. The contractor will determine additional cable containment to supplement the primary containment. The provision of additional containment as well as all ancillary components and supports shall be deemed included.

80.1.2 The Contractor shall be responsible for the Design, Selection, and installation of all cable containment support systems to include anchor systems and metal framing supports. The Contractor shall be responsible for determining the appropriate components, materials and methods of installation based on the fully loaded capacities +50% of proposed cable containment systems and the structure from which the systems are to be mounted.

80.1.3 These support system hangers shall be spaced at intervals of not greater than 1.2m and when fully loaded shall not deflect between supports. The Contractor shall consider all requirements when making selections and shall reduce spacing of supports as required but shall not increase spacings. Additional supports are to be provided at intersections and any changes in direction.

80.1.4 The Contractor shall provide details of all anchors and fixings for review by the Structural Engineers and shall allow for "pull-out" testing to verify selections based on site conditions.

80.1.5 The Contractor shall co-ordinate all containment routes with those of other services and shall liaise with the Specialists in their production of agreed co-ordinated installation drawings. The Contractor shall refer to Architects and Structural Engineers drawings to ensure all ceiling void depths are maintained and that all structural restrictions are known. The Contractor shall note adequate depth shall be maintained beneath cable containment systems for recessed lighting and other recessed electrical equipment. Failure to make provisions in regard to the above will result in the Contractor being responsible for alterations to installed cable containment at their own expense.

80.1.6 The Contractor shall include for supply and installation or rerouting of the cable tray system for conveyance of modular LV final sub-circuit wiring systems to sockets etc. The Contractor will also include for all LV cable tray required for conveyance of sub mains cabling.

80.1.7 The cable tray sizes indicated will be the minimum size acceptable. The Contractor will, prior to installation, satisfy himself as to their adequacy and will advise the Engineer if any of the tray sizes need to be increased. The contractor will include for all necessary supports and hangers.

80.1.8 In advance of commencement the Contractor shall erect a sample "benchmark" of the cable containment for the primary containment route. The Contractor shall include all elements including supports, brackets, end caps etc to present a detailed benchmark as an example of how the installed system will be presented. The benchmark shall be presented for design team review and upon acceptance of same shall become a reference for the remainder of the project.

80.2 Equipment

80.2.1 Cable Tray

80.2.1.1 Cable tray shall be in accordance with IEC 61084-1:2017 and EN 61537:2007.

80.2.1.2 Cable Tray shall be heavy-duty, hot-dipped, galvanized steel with perforated tray base suitable for fixing cables. Heavy duty gauge with returned flanges to EN 61537:2007 shall be utilised.

80.2.1.3 Constructed from mild steel and hot dipped galvanised to BS EN 10346:2015

80.2.1.4 For external installations cable tray shall be post galvanised BS EN ISO 1461:2009

80.2.1.5 Cable Tray sizes shall be as shown on the IN2 Engineering drawings.

80.2.1.6 Cable Tray shall have return flange at side tops for maximum strength.

80.2.1.7 Provide proprietary fittings (bends, tees, crossovers, reducers, and risers) to fit routing as shown on the Drawings. Tray radii shall maintain allowable cable bending radii.

80.2.2 Cable Trunking

80.2.2.1 Cable trunking shall be in accordance with IEC 61084-1:2017, EN 50085-1 and EN 10346:2015

80.2.2.2 Interior trunking shall galvanised sheet steel per EN 50085-2-1:2006+A1:2011, EN 50085-1:2005+A1:2013.

80.2.2.3 Trunking shall be manufactured from heavy gauge, hot-dipped galvanised sheet steel per EN 10346:2015.

80.2.2.4 All 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. The complete system shall be selected from manufacturers standard components. Site formed assemblies or modification to standard components will not be permitted. Provide cable retainers every 600mm. Bends and tees shall be gusseted.

80.2.2.5 Cable trunking shall be loaded to a maximum of 50% capacity.

80.2.3 Cable Basket

80.2.3.1 The entire steel wire cable tray system shall be hot dipped galvanised steel with 60 – 80 microns of zinc. All welds shall be manufactured to a tensile strength of 700kg per weld.

80.2.4 Conduit

80.2.4.1 Conduit and fittings shall be in accordance with IEC 61386-1:2008+A1:2017.

80.2.4.2 Conduit shall be Heavy gauge, seem welded, Class 4, hot-dipped galvanised steel, zinc-coated screw threads and zinc bichromate outer coating to comply with BS 4568.

- Fittings shall be threaded, zinc-coated malleable iron or steel.
- Expansion couplings for rigid steel conduit shall have earth jumper or internal bonding assembly.
- Rigid steel conduit, Metal conduit and fixings shall be corrosion-resistant and must not be in contact with dissimilar metals likely to set up electrolytic action.
- All fittings shall conform to BS 4568.

80.2.4.3 All equipment and ancillary components must be selected from the same manufacturers range.

80.2.4.4 The contractor shall provide technical data sheets for the cable containment. The contractor may also be requested to provide samples of all cable containment for approval by the engineer prior to placing the order.

80.2.5 Ladder Rack

80.2.5.1 Cable ladder shall be heavy duty galvanised type mild steel with rigid sides and return flanges and manufactured in accordance with EN 61537:2007.

80.2.5.2 Ladder rack shall be supported on proprietary support systems at maximum 1,000mm centres. Ladder rack shall have a load capacity of 600kg/linear metre when supported at 2,500mm centres.

80.2.5.3 Ladder Rack shall be hot-dipped, post galvanized steel in accordance with BS EN ISO 1461:2009. Standard proprietary fittings shall be used to provide slopes & bends etc.

80.2.5.4 All equipment and ancillary components must be selected from the same manufacturers range.

80.2.5.5 The contractor shall provide technical data sheets for the cable containment. The contractor may also be requested to provide samples of all cable containment for approval by the engineer prior to placing the order.

80.3 Installation

80.3.1 All cableways, wireways, trunking and conduits and all associated ancillaries 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. Any items failing to comply shall be rectified at the contractor's own expense.

80.3.2 The contractor shall determine from the cable loading with provision for 100% spare capacity the weight per linear meter of installed cable systems and all fixing and support systems shall be selected on this basis. The Main Contractor shall be advised of this weight in order that the grounds or structure is appropriate.

80.3.3 Support conduit in accordance with NSAI Regulations I.S. 10101:2020+AC2:2025. Ensure conduit is not under mechanical stress. Fix conduit boxes independently on conduit. Make allowance for any additional mechanical loading supported by conduit boxes.

80.3.4 Cable tray and trunking sizes are as indicated on the drawings are to allow for actual and spare circuits when connecting to distribution board. The contractor shall maintain 50% future spare capacity.

80.3.5 Cable containment systems must be carefully installed to maintain electrical continuity between sections. Riveted, screwed, or bolted jointed will be acceptable provided contact surfaces are good conductors. The joint connection must be the same shape and area so that the metallic section is maintained over the full length of the run. The use of bonding wires between two sections of tray, trunking etc., will not be accepted.

80.3.6 Manufacturers recommended installation instruction shall always be observed especially during the construction of tees, angles, crossovers, reducers, and radius bends. Easy sweep (45°) bends shall be incorporated at all changes of direction to ensure that the cable carrying capacity of the basket tray network or the bending radii of cables is not affected.

80.3.7 Cable Containment systems shall be cut clean and square with axis, prepare ends and remove burrs and sharp edges. Ensure inside of trunking / cable ways are free from anything liable to damage cables either during installation or after covers are fitted. Use only factory formed openings for accessories. Line unprotected apertures in trunking and tray with PVC or nylon edging strip.

80.3.8 The contractor shall refer to the manufacturer's cable tray and ladder rack recommendations prior to commencement of the installation.

80.3.9 Ladder racks, cable tray and trunking systems shall be exposed and accessible. Adequate space shall be provided to install and maintain cables. Separation distances of 150mm minimum shall be maintained between piping and all cable containment systems.

80.3.10 Installation shall be electrically continuous - earthed and bonded. Join sections with straight couplings with a copper bonding strap. All containment systems shall be mechanically and electrically continuous.

80.3.11 Provide grommets or brass bushes for extra low voltage cable exits cut in cable tray. Interiors of trunkings shall be free of sharp edges that may damage cables.

80.3.12 Trunking shall be supported to avoid sagging with manufacturer's brackets spaced at less than 1000 mm and with additional brackets at intersections, tees, and bends. Use radius or fillet bends at corners. Tee sections shall have no reduction in cross sectional area between main and tee.

80.3.13 Multi-compartment trunking shall be complete with metal dividing fillets with same gauge as trunking material.

80.3.14 Conduits shall have a sufficient number of supports to make rigid installation. Support conduits at 1200mm centres and 200mm on either side of bends, sets or terminations. Conduit bends shall be as stated in the regulations.

80.3.15 Conduit sizes shall be from standards 20mm 25mm, 32mm. with no less than 25mm dia. to be used for fire detection, alarm and ICT cabling.

80.3.16 Conduit recessed into solid wall construction shall provide minimum depth of cover of 12mm to allow for render finishes.

80.3.17 The contractor shall use keyhole spacer bar saddles for surface conduit and two-hole saddles for concealed conduit.

80.3.18 Sub-mains cables shall be 'cleated to cable ladders' by means of 'U' bolt cable cleats. Smaller cables shall be fixed to cable trays by means of Insuloid, black PVC. adjustable clips c/w set screws, nuts, and washers. The use of cable ties shall not be permitted.

80.3.19 Where utilised the steel wire basket system shall incorporate a fast-coupling system where each straight section of tray is joined to another section with a minimum of three No. couplers at each side and in the floor of the tray. All bends within the system shall be formed via the proprietary nut bolt and clamp assembly.

80.3.20 Where the steel wire cable basket system is used within the vertical rising elements, the electrical contractor shall utilise the appropriate vertical mounting accessories at 1 metre intervals along the entire length of the tray

80.3.21 All steel wire basket sections shall be cut on site via the proprietary side action bolt croppers to ensure that safe edges are left on the tray.

80.3.22 The contractor shall specifically note the requirements of the Specification Section 00.3 and shall take full cognizance of same before commencement of any cable containment systems.

80.3.23 The contractor shall reference all architect's sections and reflected ceiling drawings before commencement of installation of any cable containment such that adequate space is provided.

80.3.24 The contractor shall reference all architects and structural engineers' drawings and shall note all service void depths and obstructions.

80.3.25 The contractor shall co-ordinate all services routes with proposed recessed equipment, lighting, speakers, grilles etc and ensure provisions for same are maintained.

80.3.26 The contractor shall ensure that all cable ways passing through a fire barrier, compartment wall, through floors, ceilings and roofs incorporate suitable fire barriers of fire resisting material to prevent fire spread along cable ways. Fire barrier kits for electrical trunking and trays must comply with BS 476 Part 22 (1987), and EN 1363-1:2012. Fire barriers shall achieve integrity of not less than 180 minutes.

80.3.27 Major openings for the passage of cable trays and trunking shall be sealed utilising intumescent fire and smoke seal pillows or intumescent high-density rock fibre slab.

80.3.28 PVC trunking systems shall be fitted with an intumescent wrap which shall be capable of crushing the trunking in the event of a fire.

80.3.29 Labels shall be provided to all cable ways clearly indicate the location of fire barriers.

80.3.30 PVC end caps to be installed on Unistrut and threaded rod ends.

80.4 Samples & Technical Submittals

80.4.1 In advance of orders being placed for any equipment the contractor shall submit a full technical submittal including specific details of equipment dimensions, operational data, rated power, controls and wiring diagrams, materials specification.

80.4.2 The contractor shall include for the provision of 1 No. sample of each item as detailed. Samples to be erected and displayed for design team approval.

80.4.3 The contractor shall be responsible for determining quantities from IN2 Engineering Design Partnership drawings and specifications.

80.4.4 The contractor shall liaise with the various specialist suppliers to ensure that all necessary fixings kits, supports, connections, etc. are included.

80.4.5 The contractor shall refer to IN2 Engineering Electrical Specification, Section E00 General Specification, part 00.10 "Production of Information - Procurement Details".

80.5 Testing & Commissioning

80.5.1 Testing and commissioning shall be carried out in accordance with current NSAI IS 10101: 2020+AC2:2025 Regulations. Test to ensure electrical continuity of bonding and earthing connections. Maximum of 3.0 Ohms resistance to building earthing connection. Where discontinuities occur at adjustable splice plates and expansion splice plates, provide a 16sqmm copper jumper earth strap.

80.5.2 Upon completion of the work the entire installation shall be checked to inspect sections, fittings, and accessories. The contractor shall remove burrs, dirt and construction debris and repair damaged finish including chips, scratches, and abrasions. Repair galvanized finish damage with zinc-rich paint recommended by tray or trunking manufacturer.

80.5.3 Fire stopping shall be fitted at each location where trunking passes from one building fire zone to another. The electrical contractor shall refer to architect's drawings for details of fire barriers and zones. The Contractor as part of his responsibilities as BCAR "ancillary certifier" shall inspect and record all firestopping provisions and include photographs and scheduled locations are part of his BCAR inspection reports.

80.5.4 The contractor shall include for the supply and installation of the appropriate coloured labelling tags throughout the entire length of the containment installations. Tags shall clearly identify the service, i.e. LV , ELV , Fire, etc. Tags shall be appropriately sized and shall be clearly legible from ground level.

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81.1 Outline Description

81.1.1 The Contractor shall be responsible for the supply, installation, commissioning and demonstration of a complete Uninterruptible Power Supply (UPS) system consisting of power and control system and battery back-up.

81.1.2 The Contractor shall engage a specialist UPS installer for the installation and commissioning and 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.

81.1.3 The Contractor shall provide 230Volt, 50Hz, 5,000VA floor mounted UPS system with 60min autonomy at 100% loading for the new X-Ray Room Control Desk socket power outlets that are required to remain energised in the event of a mains failure.

81.1.4 The Contractor shall provide 400Volt, 50Hz, 10,000VA floor mounted UPS system with 60min autonomy at 100% loading for the new X-Ray Room Generator Machine that are required to remain energised in the event of a mains failure.

81.1.4 The completely integrated uninterruptible AC power system (UPS) shall provide regulated and transient-free AC power from the unregulated AC mains supply, i.e. under normal conditions including total mains failure and return of normal power.

81.1.5 The system shall automatically bypass the critical load directly to the AC mains supply in order to maintain power to the load in the event of a UPS malfunction or major short circuit on the load side.

81.1.6 The UPS system shall comprise of the following components, described below in this specification:

- PFC rectifier;
- Battery charger;
- Inverter;
- Battery;
- Dynamic Bypass
- Battery management system;
- Any and all other devices required for safe operation and maintenance, including circuit breakers, switches, etc.

81.1.8 The UPS system shall ensure continuity of electric power to the load within the specified tolerances, without interruption upon failure or deterioration of the normal AC source (utility power) for a maximum protection time determined by the capacity of the backup batteries installed.

81.2 Operating Principle

81.2.5 Transfer to bypass AC source:-

In the event of an overload exceeding system capabilities (short-circuits, heavy inrush currents, etc.) the load shall be automatically transferred, instantaneously and without interruption, to the bypass AC source, on the condition that bypass power is available and within tolerances. To that end, synchronisation of each inverter in phase and frequency with the bypass source shall be automatic. Transfer of the load back to the UPS-unit outputs shall be automatic or manual. During transfer, the load shall not suffer an outage or disturbance in the supply of power. To ensure transfer in complete safety, the system shall close simultaneously the static switches.

On request, the UPS system may automatically transfer the load with a micro-interruption if a major fault occurs on the UPS system and if synchronisation with the bypass source has not been established.

81.2.6 Maintenance on UPS units:-

For maintenance purposes, all electronic components shall be accessible from the front of the UPS.

In addition, a built-in manually operated mechanical bypass system shall be installed in each UPS unit

For personnel safety during servicing or testing, this system shall be designed to isolate the UPS units while continuing to supply power to the load from the bypass AC source. Transfer to the manual bypass mode and back shall be possible without interruption to the load.

The UPS shall also include a device making it possible to isolate the rectifiers and the chargers from the normal AC source.

81.2.7 Battery maintenance: -

For safe maintenance on the battery of each UPS unit, the system shall include a circuit breaker to isolate the battery from the corresponding rectifier/charger and inverter. When the battery is isolated from the system, the UPS shall

continue to supply the load without interruption or disturbance, except in the event of a normal AC source outage.

81.2.8 Cold start (normal AC source absent): -

The battery of each UPS unit shall be capable of ensuring UPS start-up even if normal AC power is not available and continuing operation within the specified back-up time.

81.3 Standards

81.3.1 The system provided shall be installed, tested and commissioned to ensure the system and its respective components are in full compliance with, but not limited to the following standards: -

The UPS equipment shall be designed in accordance with the standards as listed;

- IEC 62040-1 and I.S EN 62040-1: UPS-Safety
- IEC 62040-2: UPS-EMC
- I.S. EN IEC 62040-3:2021 UPS-Performance.
- EN IEC 62368-1: Safety of Audio, Video and ICT equipment, including electrical business equipment.
- IEC 61000-2-2: Compatibility levels for low-frequency conducted disturbances and signalling in public low voltage power supply systems.
- IEC 61000-3-4: Limits for harmonic current emissions in LV Systems
- IEC 61000-4 (All Parts): EMC- electrical fast transient /burst immunity.
- EN 55011 and EN 50561: Limits and methods of measurements of radio interference characteristics of industrial, scientific and medical (ISM) radio-frequency equipment – Level A conducted and radiated emissions.
- I.S. EN 61439-1: Low voltage switch gear and control gear assemblies.
- IEC 60529: Degrees of protection provided by enclosures (IP Code)
- ISO 3746: Sound Power Levels and Sound Energy Levels
- EN 60896-21:2004 & EN 60896-22:2004
- CE marking
- RoHS Directive (2011/65/EU)
- Low Voltage Directive (2014/35/EU)
- EMC Directive (2014/30/EU)

81.3.2 The system installation shall be in full accordance with NSAI National Wiring Regulations I.S. 10101:2020+AC2:2025

81.3.3 To ensure maximum reliability, all equipment to be supplied must comply with environmental-protection standards, with production taking place on premises certified to ISO 14001.

81.3.4 The manufacturer shall provide, on request, a complete qualification file demonstrating compliance with the above standards. What is more, the indicated levels of performance shall be confirmed by certification from independent laboratories (e.g. TÜV or Veritas).

81.4 Equipment

81.4.1 Enclosure:

The UPS shall be desk/rack mounted design.

Safety: The equipment shall comply with ingress protection of IP21, in line with IEC 60529. For safety of maintenance personnel, the cabinet shall be provided with a manually operated mechanical bypass designed to isolate the rectifier/charger, inverter and static switch while continuing to protect the load via mains.

The UPS system capacity should be capable of being easily increased with the addition of another compatible UPS rack mounted unit.

81.4.2 Battery:

The battery for each unit shall be sized to ensure continuity in the supply to the inverter for at least 60 mins up to end of life of battery, in the event of the normal AC source failure with each inverter operating at full load, 5kVA (230V) and 10kVA (400V) at a power factor of 0.8. The batteries shall be of the Valve Regulated Sealed Lead Acid VRLA type to I.S. EN 60896-21:2004 & I.S EN 60896-22:2004 with a minimum 10-year life.

The batteries shall be as manufactured by Exide or Yuasa, mounted on a steel rack. Sizing calculations shall assume an ambient temperature of between15-25 centigrade. The batteries shall be protected against deep discharge.

81.4.3 Protection:

The UPS shall include protection against mains over voltages (as per EN IEC 62040-1:2019+A11:2021 standard), excessive external or internal temperature rises and vibrations during transport.

Rectifier: The rectifier shall be equipped to receive an external command to automatically shut down under the following circumstances:

- Emergency off. In this case, the shutdown will be accompanied by opening of the battery circuit breaker.
- Battery room ventilation fault. The rectifier and the charger shall automatically shut down if the DC voltage exceeds the maximum value as specified by the battery manufacturer.
- Discharge time shall be limited to three times the backup time at full rated load to avoid excessive damage to the battery bank.

81.4.4 UPS Display:

The following information shall be monitored by alpha-numeric display or indicating lights on the display panel on the front of each UPS:

- Rectifier on
- Load on inverter
- Load on bypass
- General alarm.

A buzzer shall warn of faults, malfunctions or operation on battery power. The system shall have an alarm reset button.

The display panel on the front of the UPS shall indicate the following parameters:

- Remaining battery back up time.
- Internal fan fault or over temperature
- Bypass AC source outside tolerance or not available
- Battery malfunctions.

The display unit shall also indicate the following measurements;

- Inverter output, phase to phase voltages.
- Inverter output currents and frequency

- UPS input voltage, current and frequency
- Voltage across battery bank.
- Battery charge or discharge current.
- Rectifier input currents
- Load Crest factor
- Active and apparent power.
- Load Power factor.
- Load as % of UPS rated output.

81.4.5 Static Bypass:

The UPS shall be complete with facilities to instantly transfer of the load from the inverter to the bypass supply and back without disturbance to the load. Transfer shall take place automatically in the event of a major overload or an internal malfunction within UPS. Manual initiation of this transfer as well as transfer back to the inverter shall also be possible.

81.4.6 Inverter:

The X-Ray Machine UPS inverter shall be sized to supply a rated load of 10kVA at 0.8pf and shall comply with the specification as listed below:

- Rated Voltage: 420, 410, 400, 390, 380 volts
- Number of phases: 3 phase + neutral + earth.
- Steady state voltage regulation: Within ± 1% for a balanced load between 0 and 100% of the rated load
- Voltage transients: Output voltage transients shall not exceed ±1% of the rated voltage for 0 to 100%, or 100 to 0% for step loads. In all cases the voltage shall return to within the steady state tolerances in less than 20 milliseconds.
- Phase to phase harmonic distortion: The UPS shall be designed with a system limiting the THD of the phase to phase output voltage to 3% and the individual harmonic distortion to 1.5% irrespective of the type of load.
- Output frequency: 50Hz ± 0.5Hz, adjustable up to ±2Hz.
- Overload capacity: 110% of load for 1 hour, 125% of load for 10 mins. and 150% load for 1 min.
-

The Control Desk Socket outlet UPS inverter shall be sized to supply a rated load of 5kVA at 0.8pf and shall comply with the specification as listed below:

- Rated Voltage: 250, 242, 230, 215, 208,volts
- Number of phases: 1 phase + neutral + earth.
- Steady state voltage regulation: Within ± 1% for a balanced load between 0 and 100% of the rated load

- Voltage transients: Output voltage transients shall not exceed ±1% of the rated voltage for 0 to 100%, or 100 to 0% for step loads. In all cases the voltage shall return to within the steady state tolerances in less than 20 milliseconds.
- Phase to phase harmonic distortion: The UPS shall be designed with a system limiting the THD of the phase to phase output voltage to 3% and the individual harmonic distortion to 1.5% irrespective of the type of load.
- Output frequency: 50Hz ± 0.5Hz, adjustable up to ±2Hz.
- Overload capacity: 110% of load for 1 hour, 125% of load for 10 mins. and 150% load for 1 min.

81.5 Approved Vendors & Manufacturers

81.5.1 The following or equal and approved manufacturers shall be considered for the provision of the UPS;

- **Schneider APC Smart UPS Systems**
- **Socomec UPS Systems**

81.6 Installation

81.6.1 1 No. 5kVA and 1 No. 10kVA UPS shall be supplied and installed within the X-Ray Control room to provide a resilient backup to the socket outlets and X-Ray Generator as indicated on IN2 Engineering layouts.

81.6.3 The Electrical Contractor shall ensure that the UPS and location into which they are to be installed is compatible.

81.7 Interfaces & Connections

81.7.1 The UPS shall be designed to enable the extension of communications without system shutdown to:

- The BMS utilizing a RS485 serial link communication board.
- The UPS shall also be supplied with an SNMP communications board for connection to an Ethernet network.

81.8 Cabling

81.8.1 Complete wiring for the UPS system shall be provided including all AC and DC cabling as necessary.

81.8.2 The electrical contractor shall install all necessary power supplies conduits etc. to facilitate the system installation.

81.8.3 The Normal AC Source.

The normal AC source supplying each UPS rectifier unit will under normal operating conditions have the following characteristics:-

- Voltage: 230 volts, ± 15% & 400 volts, ± 15%
- Number of phases: 1/3 phases, N + earth.
- Frequency: 50Hz ± 10%

81.8.4 Bypass AC Source.
The bypass power supplying each UPS in the event of an inverter shutdown or an overload condition shall have the following characteristics.

- Voltage : 230 volts, ± 15% & 400 volts, ± 15%
- Number of phases: 1/3 phases, N + earth.
- Frequency: 50Hz ± 5%.

81.8.5 Entry for the power cables, including any auxiliary cables shall be possible from the back of the UPS module.

81.8.6 The entire UPS cabling installations shall be full compliance with NSAI I.S. 10101:2020+AC2:2025 Wiring Regulations.

81.9 Testing & Commissioning

81.9.1 The UPS manufacturer shall provide for full equipment test at the place of manufacture. Final inspection and adjustments shall be documented in a report drawn up by the suppliers.

81.9.2 The UPS system shall be site tested after completion of installation and cabling. Suitable load bank shall be utilised to establish system integrity and battery autonomy.

81.9.3 Commissioning of the UPS on the site shall be carried out by the manufacturer or an approved representative in accordance with manufacturers recommendations.

81.10 Documentation

81.10.1 In advance of the commencement of any works or orders being placed for any equipment the engineer is to be provided with a full technical submittal document to consist as a minimum of the following;

- Technical information specification data sheets for each item or system component.
- Functional Description of operation for the proposed system.

81.10.2 Upon project completion the contractor will provide complete Operation and Maintenance instructions with as installed drawings and an as installed Functional Description of operation.

81.11 Labelling

81.11.1 The contractor shall provide adhesive labels to each device on the system clearly indicating the device. Principle components, and power supplies shall be provided with engraved traffolite labels. All necessary warning labels shall be provided.

81.12 Training

81.12.1 In addition to attendances and brief system training at a client handover the contractor will allow 0.5 days training to be given to personnel nominated by the client at a time to be agreed with the client.

81.13 Maintenance

81.13.1 The Contractor shall be responsible for maintenance of the UPS installation during the first year of operation. The maintenance period shall commence at handover and shall include a minimum of two service visits by the manufacturer or authorised agent.

The maintenance shall include UPS testing by utilising a load bank to check various parameters including autonomy of the battery.

81.13.2 Emergency call out telephone number shall be displayed on UPS rack door.

81.13.3 The Date of last service and due date for the next service shall be recorded on a chart placed inside the UPS rack door.

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90.1 Outline Description

90.1.1 The earthing system shall be taken as a TN-C-S Type system as outlined in NSAI National Rules for Electrical Installations I.S. 10101:2020+AC2:2025.

90.1.2 The Contractor shall be responsible for the supply, installation, testing and commissioning of a complete earthing and bonding system in full accordance with NSAI National Rules for Electrical Installations I.S. 10101:2020+AC2:2025.

90.1.3 The Contractor shall make provisions for the disconnection of the Main Earthing Terminal from by means of earthing and or disconnecting the main equipotential bonding conductors.

90.1.4 An earthing busbar shall be provided as part of the LV Switchboard(s) installations and shall be a copper busbar sized at a minimum 100mm x 10mm. A removable isolating link shall also be provided at the main earthing bar to allow earth resistance measurements to be taken.

90.1.5 An Equipotential Bonding Busbar (EBB) shall be provided within the X-Ray Room suite as close as possible to Group 1 equipment to ensure that any potential differences between the following parts are equalised:

- Protective Conductors
- Extraneous Conductive Parts
- Screening against Electrical Interference Fields (where applicable)
- Connection to Floor Grids (where applicable)
- Metal Screens of Isolating Transformers

90.1.6 The main earth conductors to each earth electrode will be as indicated on IN2 Engineering 7800 series drawings and be LSZH stranded copper conductor cabling. The cabling will be PVC covered within the building and will be buried bare underground.

90.2 Standards

90.2.1 All entire Earthing and Bonding installations within the X-Ray Room development shall be carried out with the requirements for this specification and the following standards and regulations, where applicable:

- I.S. 10101:2020+AC2:2025 – NSAI National Rules for the Electrical Installations - 5th Edition (Part 710 Medical Locations)
- HTM06-01:2017 – Electrical Services Supply & Distribution
- HTM08-03:2013 – Bedhead Services

90.3 Equipment

90.3.1 The EBB (Equipotential Bonding Busbar) shall be constructed from epoxy coated mild steel and be suitable for flush or surface mounting. The enclosure cover shall require a tool to remove it and shall have the wording 'Earth Reference Bar' clearly and permanently visible on the front. The enclosure shall be suitable for cable entry from all four sides and the rear of the EBB enclosure.

90.3.2 Means of permanently labelling each internal earthing point shall be provided. The EBB shall have three separate internal copper earthing bars insulated from the metal enclosure, interconnected to the main incoming earthing terminal with solid copper links which can be removed for testing purposes. Screws and fixings for earthing purposes shall be manufactured from brass.

90.3.3 Each Earth Reference Bar shall incorporate the following:

- 1 off epoxy coated mild steel enclosure
- 1 off (3mm thick) Acrylic internal Label
- 1 off (5mm thick) Acrylic transparent front cover (surface or flush mounting)
- 3 off Sleeved removable coppers links
- 1 off main earth terminal supported on shatterproof hexagonal insulators
- 3 off separate earth bars supported on shatterproof hexagonal insulators

90.3.4 The EBB Enclosure shall be similar or equivalent to the following construction:

- Maximum Dimensions (mm) 320h x 520w x 100d (without front cover)
- IP Rating IP55
- Material Mild Steel Grade CR4
- Finish Epoxy Power Coat, RAL9010
- Front Cover Fixing 4 off M5 screws

90.3.5 The internal cover shall be manufactured from 3mm thick clear Acrylic. All areas except the bars and terminals shall be obscured by a solid white screen print when the internal cover is fitted. All bars and individual earth connection points shall be clearly marked on the cover with adequate space to allow individual earth cable labelling.

90.3.6 The front cover suitable for flush mounting shall be 540w x 340h x 5mm thick and manufactured from clear Acrylic and incorporate a 3mm bevel on all edges. A black border and the text "Equipotential Bonding Busbar" shall be clearly marked in black lettering and printed on the inside face.

90.3.7 The front cover suitable for surface mounting shall be 520w x 320h x 5mm thick and manufactured from clear Acrylic and incorporate a 3mm bevel on all edges. A black border and the text "Equipotential Bonding Busbar" shall be clearly marked in black lettering and printed on the inside face

90.3.8 The "Permanently Installed Medical Equipment and Supplementary Equipotential Bonding earth bars shall be made from 25mm wide x 4mm thick electrolytic copper threaded busbars.

90.3.9 The Lighting and 13Amp Socket outlets Equipotential bonding earth bars shall be made from 12 mm wide x 4mm thick electrolytic copper threaded busbars.

90.4 Installation

90.4.1 The EBB shall be installed above 1,000mm AFFL and below 1,800mm AFFL in an easily accessible and visible area.

90.4.2 All bonding connections to gas or water services shall be made as near as practicable to the point of entry to those services into the premises, and on the consumer's side of any insulating section or insert. For a gas service, the bonding connection shall be made on the consumer's side of the meter within 600 mm from the meter and before any branch connection from the main.

90.4.3 LSZH sleeving coloured green/yellow at all terminations shall suitably identify circuit protective conductors, who take the form of an uninsulated core of a multi-cored cable.

90.4.4 Earthing and bonding conductors and connections are to be provided to all elements as required by NSAI I.S 10101 Wiring Regulations and the following as a minimum:

- Provide a main earthing bus bar for single point connection of, cold water service.
- All metal parts of cable containment system shall be electrically continuous. Bonding jumpers shall be provided at all joints and intersections to maintain continuity.
- Motor frames and control enclosures shall be bonded.
- HVAC Installations Provide bonding conductor to each unit and to each air duct section. All extraneous metalwork, services pipework, ductwork etc. shall be securely earthed and bonded.
- Provide bonding conductor to water heater units, piping and connected equipment and components. Provide bonding across flexible joints.
- Bond interior cold-water piping at each toilet block.
- Risers of space heating and ventilation systems
- Suspended Ceiling Grids

90.5 Testing & Commissioning

90.5.1 The Electrical Contractor shall include for the testing, commissioning and certification of the complete earthing. Bonding and EBB installations in accordance with NSAI Wiring Regulations I.S.10101:2020+AC2:2025 in particular Part 710 Medical Locations.

90.5.2 The resistance of the protective conductors including the resistance of the connections between the terminals for the protective conductor of socket outlets and of fixed equipment or any extraneous conductive part and the EBB busbar shall not exceed 0.2Ohms.

90.5.3 Upon completion of the verification, a copy of the signed testing forms will be available for the user to show that the EBB and Earthing has been tested and commissioned as per I.S. 10101, HSE and HTM requirements.

90.6 Labelling

90.6.1 A permanent label inscribed "SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE" shall be permanently fixed to each main bonding conductor throughout the electrical installation by the Electrical Contractor.

90.6.2 The Electrical Contractor shall provide engraved traffolite warning labels to each of system Principal components.

Rev	Status	Date	Comment
00	Suitable for Tender	22nd July 2026	Issued for Tender

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93.1 Outline Description

93.1.1 The Contractor shall be responsible for the supply and installation transient over voltage protection with a peak withstand current of 50kA on Sub LV Metering and Distribution panels.

93.1.2 Transient overvoltage protection shall involve the protection of all incoming and outgoing electrical services cables entering or leaving the building to protect equipment connected to the distribution system against damage from transient over voltages entering the building from outside.

93.1.3 Where an IS EN 62305 risk evaluation determines that a structural LPS (Lightning Protection System) is not required but there is an indirect risk of any electrical services feeding the structure via overhead lines, they shall require lightning current SPD's (Surge Protection Devices). For mains supply Type 1 SPD's, the surge current rating per mode of protection shall be 12.5kA at 10/350µs waveform and for signal / telecoms SPD's, the surge current rating per mode of protection shall be 2.5kA at 10/350µs waveform.

93.1.4 Where an IS EN 62305 risk evaluation determines that a structural LPS (Lightning Protection System) is not required but there is an indirect risk of any electrical services feeding the structure via underground connections, they shall require lightning overvoltage or mains Type 2 SPD's and signal / data Category C SPD's (both shall be tested with an 8/20µs waveform in accordance with IS EN 61643.

93.1.5 Protection shall be provided to all cables including -

- Incoming / outgoing 400V / 230V power supplies.
- X-Ray Equipment
- Incoming / outgoing fire alarm cabling.
- Signal transmission cabling to roof level
- Incoming / outgoing telephone and data cabling.
- Incoming / outgoing BMS cabling and other controls signal cabling.

93.2 Standards

93.2.1 All surge protection devices shall be tested and installed in accordance with the requirements of.

- IS EN 62305 Parts 1 – 4: Lightning Protection Standard
- IS EN 61643-11:2012+A11:2018: "Low Voltage surge protection devices. Requirements and test methods."
- IEEE C62.41.1:2002 "Recommended practice on surge voltages in low voltage AC power circuits.
- NSAI National Rules for electrical Installations 5th Edition - I.S. 10101:2020+AC2:2025

- NSAI National Rules for electrical Installations 5th Edition - I.S. 10101:2020+AC2:2025 - Part 710 Medical Locations

93.3 Equipment

93.3.1 The protectors used shall be of Dehn, Furse ESP range or Wallis equivalent. The Contractor will have been deemed to have consulted either of the above and have included for in his tender for all the necessary equipment and works to undertake the full transient protection of all the electrical systems as discussed herein.

93.3.2 Protectors shall be rated for a High Exposure Level (as defined by IS EN 62305-1: 2011 + AC:2016).

93.3.3 The protector shall not interfere with or restrict the LV system's normal operation. It shall not corrupt the normal mains power supply, break or shutdown the power supply during operation or have an excessive earth leakage current.

93.3.4 The protector on LV cables shall limit the transient voltage to below equipment susceptibility levels. Unless otherwise stated, the peak transient let-through voltage shall not exceed 600 Volts, for protectors with a nominal working voltage of 230 Volts.

93.3.5 On data cable installations the protector shall not interfere with or suppress the system's normal signal voltage or restrict the system's bandwidth or signal frequency system's normal operation. Surge protection devices connected to telecommunications and signalling networks shall be installed and manufactured in accordance with IS EN 61643-21:2001+A2:2013.

93.3.6 The surge protection device shall have a rate impulse - withstand voltage of 4kV as per tests and categories outlined in IS EN 60364-4 and NSAI IS 10101:2020+AC2:2025.