

DIFE Multi Tertiary Building Extension, Co. Louth

Volume A.2.3 Electrical Specification

Part 1 of 4: Project Particulars Electrical Specification

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1 INTRODUCTION

1.1 SITE LOCATION

The project is an extension to the existing Institute of Further Education (DIFE) located in the Twenties, Drogheda, Co. Louth.



1.2 DESCRIPTION OF THE SITE

A new extension, approximately 1700m², is proposed to the Drogheda Institute of Further Education (DIFE) to support the delivery of innovative training programmes and the enhancement of skills in a modern, adaptable learning environment.

This project involves the construction of a two story, multipurpose tertiary education building located to the northeast of the existing DIFE campus. The facility will include multipurpose spaces, specialised teaching and practical rooms, social and collaborative areas and ancillary support facilities. Additionally, new changing rooms will be constructed adjacent to the previously developed all-weather sports pitches, enhancing the overall student experience.

The development also encompasses all associated site works, including updates to existing utility supplies, an updated ESB substation, the provision of car and bicycle parking to support accessibility and sustainability.

Within the existing body of the school, the existing plant room will be revamped to upgrade the existing heating system to incorporate new, more efficient air source heat pumps and associated mechanical infrastructure.

1.3 ELECTRICAL DRAWING SCHEDULE

See Electrical Document Issue Sheet for details of all Electrical drawings associated with Site Wide and specific Electrical Works.

1.4 GENERAL

This specification calls for the supply, delivery, installation, testing, commissioning and setting to work all necessary materials and equipment to carry out the complete electrical services installation associated with the construction of the extension to DIFE.

The electrical services installation shall comply with the Electro-Technical Council of Ireland National Rules for Electrical Installations, NSAI I.S. 10101: 2020: and with the requirements of the Local Authority and Statutory Bodies. The electrical reserved specialist shall be a registered RECI electrical reserved specialist. The Emergency Lighting and Fire Alarm Installations shall comply with IS3217: 2023 and IS3218: 2024 respectively. The complete installation shall be handed over to the client in a condition suitable for immediate use.

The schedules and drawings accompanying this specification whilst indicating the extent of the works do not purport to be bills of quantities and do not include such items as fixings, accessories etc., which shall be supplied together with all other items, whether specifically mentioned in the text or not, necessary to complete the installation in every respect.

Any difference between, or omission from, the said drawings and specification shall not absolve the contractor from liability to provide a complete installation according to the true meaning and intent of all taken together. The contractor shall supply and erect everything implied therein requisite to the satisfactory completion and convenient working of the installation.

Each service, when complete, shall be tested and commissioned in full accordance with the relevant sections of the specification.

This specification shall be read in conjunction with the Conditions of Contract and Contract Preliminaries.

Contractors should note that this is a FIXED PRICE TENDER. This specification shall be read in conjunction with the accompanying drawings and schedules.

2 COMPLIANCE & STANDARDS

The electrical services installation shall comply with the Electro-Technical Council of Ireland National Rules for Electrical Installations, NSAI I.S. 10101: 2020: and with the requirements of the Local Authority and Statutory Bodies. Emergency Lighting and Fire Alarm Installations shall comply with IS3217: 2023 and IS3218: 2024 respectively. The complete installations shall be handed over to the Client in a condition suitable for immediate use. Note: The contractor shall refer to the most recent version of all standards mentioned in this specification.

The electrical contractor shall be registered with RECI.

The electrical contractor shall be responsible for ensuring that the electrical installation is in compliance with the regulations and shall make allowance for and carry out all ancillary works required in order to achieve full compliance.

2.1 NOTE ON SPECIFICATION PARTS

This part of the specification (Part 1) contains information specific to this project and shall be read in conjunction with the drawings and other Parts of the specification i.e. Parts 2-4 Inc. For details on the required specific equipment technical specification refer to Part 4: Equipment Schedules and also Part 1 Particular Electrical Specification and the electrical drawings. Where an item of equipment is not specified within Part 1, Part 4 nor specified/indicated on the electrical drawings, the materials specification described for those equipment elements in Part 3: Standard Clauses, shall apply. The equipment schedules also reference Part 3 clauses for certain materials and in general, Part 3 clauses shall apply for any item not specified elsewhere. Part 3 workmanship clauses shall apply throughout unless stated or specified otherwise in Part 1 or on the electrical drawings.

In the event that an apparent contradiction exists between any of the specification parts or between any of the specification parts and the drawings, this shall be addressed in writing to the Employer's Representative during the tender period for clarification. If an apparent contradiction is not identified during the tender process, then it shall be at the discretion of the Employer's Representative to identify which document or clause takes precedence. Claims raised post-tender in relation to apparent contradictions shall not be entertained and the onus shall remain with the contractor to highlight any such issues during the tendering period. This in no way over rides the order of precedence of information as defined within the Contract.

3 BUILDING CONTROL AMENDMENTS REGULATIONS 2014 (BCAR)

3.1 GENERAL

The Building Control (Amendment) Regulations 2014 [BC(A)R] have taken effect from 1st March 2014 and shall apply to this project. These regulations outline the statutory and regulatory requirements and obligations relating to starting, certifying, completing and registering a building project.

For works coming within the scope of S.I. 9 of 2014, certificates of compliance on completion must be lodged with the Building Control Authority and placed on the public register before the buildings may be opened, occupied or used. The certificate must be signed by the Assigned Certifier and the main contractor and certifies that the building or works have been carried out in accordance with the Building Regulations. The electrical contractor and each of his appointed sub-specialists shall also be required to provide ancillary certification as outlined below for each Phase of this project.

3.2 INSPECTION PLAN AND NOTICE FOR SITE INSPECTIONS

Inspections will be carried out during the course of the works to review works in progress. Milestone inspections shall occur at first fix, second fix, third fix and commissioning stages of each phase of the project at which point the contractor shall notify the consulting engineer when the services will be ready for inspection. A milestone inspection shall apply to the entirety of the relevant building being presented for inspection at the same time i.e. a series of partial inspections shall not be permitted for each particular stage.

The electrical contractor must give the consulting engineer a minimum of 5 full working-day's notice for inspections at each milestone/stage of the proposed electrical works. Prior to notifying the consulting engineer that a particular stage will be ready for inspection, the contractor shall inspect the works themselves, carry out their own internal snagging, close out all issues snagged and be satisfied that all elements appropriate to that stage have been completed and carried out in accordance with the specification and drawings and in accordance with the building regulations. Confirmation to this effect shall be provided in writing at the time of notification. Should the engineer subsequently attend site to find that a stage is not ready for inspection, the consulting engineer shall charge the contractor an hourly rate of €500 for the repeat visit and for every repeat visit thereafter. The contractor shall agree to payment of same before another date is agreed.

If due notice is not provided for an inspection and/or the contractor proceeds to close up services without the required notification to the engineer, the engineer shall be at liberty to request the contractor to reveal services for inspection at the contractors own expense.

Issues raised by the engineer shall be addressed by the contractor and clear photographic evidence shall be provided to prove that each issue has been addressed. Semple McKillop Ltd. will not issue Ancillary Certification to the Assigned Certifier until the contractor has closed out all issues and has provided the necessary documentation for each phase of the works.

All costs associated with meeting BCAR requirements shall be included at tender stage.

3.3 CONSTRUCTION PRODUCT REGULATIONS (EU305/2011)

From 1 July 2013, all Construction Products covered by a Harmonised European Standard (hEN) or a European Technical Approval (ETA) are required to carry the CE mark. The CE mark indicates that a product has met the essential requirements of all the appropriate Directives and Regulations. The CPR requires Declaration of Performance documents (DoPs) to be available for all CE marked products.

The contractor must provide Declaration of Performance documents and CE certificates for all items at the time of product submittals.

3.4 DESIGN CRITERIA:

The criteria listed below apply to all Sections included in the Contract unless specified otherwise:

Department of Education & Skills Technical Guidance Documents

TGD003:	Mechanical & Electrical Building Services Engineering Guidelines for Post Primary School Buildings
TGD005:	Information and Communication Technology (ICT) Infrastructure Guidelines for Post Primary School Buildings
TGD020:	General Design Guidelines for Schools - Primary & Post-Primary
TGD021-5:	Acoustic Performance in Schools (November 2015)
TGD023:	Post Primary School Design Guidelines
TGD026:	Planning Guidelines for Primary & Post Primary School Specialist Accommodation for Pupils with Special Needs (including Addendum 1, Sept 2013)
TGD031:	Amendments to the M&E Building Services Guidelines (2004) TGD003 & ICT Infrastructure Guidelines TGD005 for Post Primary Schools
TGD032:	Guidelines for the Design & Installation of Woodwork Dust Extraction Systems in Post Primary Schools
TGD	Guidance Document for the Provision of Wireless Network Installations in Post Primary Schools (May 2016)

3.5 STATUTORY REQUIREMENTS & REGULATIONS

- Building Control Regulations 1997-2013
- Building Control (Amendment) Regulations 2014 [BC(A)R].
- Electricity Regulation Act 1999
- NSAI I.S. 10101: 2020 National Rules for Electrical Installations & Amendment A1:2011

- Electromagnetic Compatibility (EMC) Directive (89/336/EEC)
- Safety, Health & Welfare at Work (General Application) 2007
- Department of Environment, Community & Local Government Fire Safety Codes of Practice
- Waste Management (Amendment) Act 2001
- Building Regulations (NZEB Amendment) Directive 2010/31/EU

N.B. British (BS) and European Standards (EN) are referenced throughout all Sections of the electrical specification. However, the equivalent Irish Standards (IS) shall be applied where available in each case. Where no Irish Standard is applicable, order of preference is for appropriate European Standards and Directives and then British Standards.

With reference to the following common (non-exhaustive) list of Code of Practices and Regulations the following shall apply:

- IS3217: 2023 shall apply where BS5266 is referenced.
- IS3218: 2024 shall apply where BS5839 is referenced.
- NSAI I.S. 10101: 2020: shall apply where BS7671 is referenced.

3.6 DOCUMENTATION REQUIRED THREE WEEKS PRIOR TO SUBSTANTIAL COMPLETION

For each phase of the project, the following mandatory is required as part of this contract from the electrical contractor prior to Semple McKillop Ltd. releasing their Ancillary certification to the assigned certifier. Separate certification shall be required for each phase of the works.

- All Ancillary Certificates and Testing & Commissioning Certificates as listed in the Schedule of Ancillary & Commissioning Certificates included as part of the tender package. Note: Ancillary Certificates shall be in the template format developed and agreed to satisfy the requirements of BC(A)R, S.I. No.9 of 2014.
- Other certificates and information not mentioned in the Schedule of Ancillary & Commissioning Certificates but referenced elsewhere in the specification or contract drawings.
- Accurate As-Installed drawings that include individual device numbers across all electrical installations, fire alarm commissioning sound levels recorded, lighting and emergency lighting LUX levels recorded, all circuit numbers plus all emergency luminaires labelled, data outlets labelled, external cable routes etc.
- Completed O&M manuals which includes a section detailing any product, material and installation changes that has occurred from tender design via the product submittals process. These are required 3 weeks before substantial completion or phase handover.
- Declarations of Performance/Conformance in relation to each product supplied by the contractor. (Please note it is the contractor's responsibility to ensure that all products supplied are in accordance with the Building Regulations.)

The electrical contractor shall be responsible for preparation of phased hand over documentation of the above in respect of each phase.

3.6.1 Contractor Design Elements

The electrical contractor shall refer to the Schedule of Ancillary & Commissioning for elements of the works that shall require design certificates from specialists and sub-specialists where a design element is undertaken by such parties. In such cases, the contractor and electrical sub-contractor shall ensure that relevant specialists/sub-specialists have professional indemnity insurance in place prior to their appointment and the contractor shall make all due allowances at tender stage for costs associated with same. Policy details will be required to be included on the relevant Ancillary Certificates as listed in the schedule above.

Examples of design elements shall be the provision of lighting calculations or the provision of fabrication/shop drawings for lifts, switchboards etc.

4 M&E COORDINATOR ROLES & RESPONSIBILITIES

4.1 GENERAL

The main contractor shall employ a full time M&E coordinator for the duration of the contract works and their duties shall be as outlined below;

The M&E coordinator shall be responsible for guiding the overall M&E strategy and implementation of related activities within the project and with assistance of the M&E sub-contractors provide timely and relevant information to project stakeholders. This will entail close communication with all involved in M&E design and coordination.

The M&E coordinator shall act as an interface between the M&E subcontractors and his/her own company contracting team, particularly but not being limited to matters for builder's work in connection with services. This role is distinct from a commissioning coordinator, however the M&E coordinator's role in commissioning is a final sign off before system demonstration to the M&E consultants. M&E coordinator under this contract shall adopt also the role of the commissioning coordinator.

Critical tasks for the M&E coordinator include setting up the M&E system and ensuring they are implemented effectively by relevant parties. This is undertaken through the joint development of a shared M&E system that is based on existing formal and informal mechanisms and systems within the contract team. This needs to be supported by ensuring that all parties have appropriate capacities for and undertake their own M&E activities, and to link these into an overall assessment of project progress and required actions. The M&E coordinator shall be responsible for ensuring that adequate time is allocated for all M&E issues, in particular coordination items throughout the project, commissioning and demonstration, and ensuring that the construction programme allows for the building to be suitably ready to enable M&E installations to be fully witnessed and inspected, for example inspection of services prior to closing of ceilings, dust free environment prior to any system soak tests, intumescent strips installed on all fire doors prior to the fire alarm testing to give an example.

The M&E coordinator must ensure that sufficient time is allocated to consultants and clerk of work to allow inspection and any remedial works to be undertaken. This includes ensuring the M&E requirements described are developed and implemented in a timely fashion and in accordance with the design intent and BCAR requirements. The M&E coordinator shall also be responsible for making sure there are sufficient and appropriate personnel with the right level of resources and other support needed to implement good quality M&E installations and finishes.

The M&E coordinator shall be based full time on site throughout the contract period. Particular emphasis shall be placed on the production, coordination and preparation of contractor coordinated construction issues drawings, development of fire systems C&E strategies based on the services and fire consultants design intent.

The M&E coordinator shall coordinate the commissioning, testing, demonstrations of all systems to the design team and client. A detailed commissioning programme shall be agreed with the contractor and their sub-contractors/specialists which upon agreement shall be incorporated into the main contractors overall programme.

4.2 M&E COORDINATOR RESPONSIBILITIES

The M&E coordinator's responsibilities shall include but not limited to the following:

- Coordination with M&E contractors and building trades
- To fulfil the role of on site coordinator for the services installation
- Responsible for supervising the M&E installations, reviewing and resolving daily coordination issues, reviewing of shop drawings and preparation of services drawings & to lead, manage and control relevant sub-contractors.
- Review and provide bi-weekly progress reports to the design team on the quality and progress of the M&E installations.
- To make design/installation decisions without external references where applicable.
- Be required to make design/installation decisions when they cannot be taken at site level and be able to contact the relevant person or company that would resolve the situation in the timer period.
- Contract administration of M&E subcontractors.
- Establish and effective M&E system based on the technical specifications.
- Liaise with M&E subcontractors on their work and the builder's work erequirements and thereafter produce builders works drawings for comment by the design team prior to carrying out the works.
- Liaise with manufacturers of equipment and or plant of provided, nominated or issued as part of the project installation requirements or have a direct impact on the installation methods or location restrictions.
- To coordinate on site relocation of services and/or terminal positions if any unforeseen clashes occur, within the constraints of the technical specification and the statutory requirements on locations of M&E services.
- Review monitoring reports, analyse them for impact evaluation and to identify the causes of potential bottlenecks in project implementation.
- Undertake regular visits to the field to support implementation of M&E and to identify where adaptations might be needed.
- Resolving conflict between subcontractors in matters of setting out and services positions.
- Liaison with contracting team on matters relating to and impacting on M&E services.
- Manage commissioning process
- Review and coordinate the reserved specialist O&M, as built and Health & safety information before transmitting to design team for final review.
- Confirm subcontractors defects lists are completed and signed off prior to inviting the DT to inspect
- Liaise with contracting team on an programming issues.
- Ensure that all services are adequately protected by the main contractor during the full duration of the works contract. For example ensuring that containment & pipe work and all other services when installed are adequately protected from dust, dirt, debris and weather environment. Any services related installations found to be defected or damaged due to inadequate protection shall be replaced under this contract at no additional charge to the contract. It is imperative that the services coordinator fully makes their main contracting team aware of the importance of protection of services at all times.

4.3 CLIENT & DESIGN TEAM LIAISON

- Promote a teamwork approach with the client, client's representative, main contractor, M&E sub-contractors and their specialist sub-contractors.
- Liaise with the designers to resolve design queries and with the sub-contractors to ensure compatibility between systems.
- To create a comprehensive technical query schedule for both M&E works, incorporating information issued by the various sub-contractors.
- Negotiate approval for M&E changes to the project.
- Help M&E contractors to identify any project discretions with cost implications and implement an early warning system to inform and record any such implications to the client and design team.
- Distribute any changes or instructions provided by the employers representative.
- Provide to the design team any costs for design developments in a timely manner to enable decisions and or instructions.
- Prior to any formal technical submissions of services, check and review the M&E subcontractors submittals to ensure they meet the M& specification documentation including within the equipment schedules and drawings and when satisfied they are in compliance with the contract documents issue to the design team for review and comment in a timely manner.
- Assist the M&E sub contractors in providing a detailed cost profile in conjunction with the main contractors programme for an overall spend profile and projected interim claims.
- Filter and manage requests for information (RFI's) and technical query process, ensuring contractors information requests are generated to allow a minimum of 10 working days for design team/client response.

4.4 COORDINATED DRAWINGS

Prior to commencement of any installation works on site, the M&E coordinator shall hold internal M&E coordination meetings with relevant parties to fully agree routes and risers and coordination between all parties and only then prepare a full set of mechanical and electrical coordination drawings indicating the inter-relationship of all services and their relation to the structure and building fabric.

Once the M&E coordinator is satisfied that the coordination process is full detailed and complete, including a number of detailed sections, shall these coordination drawings then be issued to the design team for review and comment. It is the M&E coordinators responsibility to ensure that the coordination process is fully complete prior to any works commencing on site. Please refer the General Responsibilities Clauses for details of Coordination drawings requirements.

4.5 BUILDERS WORK DRAWINGS

The main M&E coordinator shall be responsible for the production of builders works drawings. They shall agree open sizes with the M&E contractors. Upon agreement they shall mark up a builders works drawing and circulate to the design team for comment prior to forming any opens.

4.6 WORKING DRAWINGS AND DOCUMENTS

- Upon completion of the M&E coordination drawings, the M&E coordinator shall prepare fully detailed M&E services working/installation drawings for each of the individual services with the primary purpose of defining that information needed by the tradesmen on site to install the works. Please refer to General Responsibilities Clauses for details of Installation drawings requirements.
- Review of drawings and specification and assist in the management of on site changes.
- Review sub contractors documentation including method statements, test plans, quality assurance documents and risk assessments.
- Audit compliance with sub-contractors systems
- Shall be required to be self sufficient to create your own site library for i.e. documentation files, construction drawings, design schedules, minute files. Etc.
- To access the quality of the M&E design drawings, construction drawings and M&E technical schedules and comment on them accordingly.
- Check discrepancies between project drawings and technical specification.
- Ensure any drawings are issues in a timely manner to the design team for their comments and alterations thereafter.
- The M&E coordinator shall keep on site available for reference by the engineer or other members of the design team, a full set of their own M&E services working/installation drawings on which they shall record deviations as the work proceeds.

4.7 TESTING AND COMMISSIONING

- Fulfil the role of commissioning coordinator engineer.
- Arrange to make available to the design team and client in all progress testing and commissioning throughout the duration of the project.
- Witness and record tests and inspections as required.
- Review the M&E programme and monitor installation, in progress testing and commissioning dates.
- To discuss the commission works for both M&E works with the various commissioning engineers and witness same to ensure their method statement is being adhered to.
- Provide support and arrange for factory inspections.
- Arrange for testing and commissioning of M&E systems including the handover of all replacements parts, warranties, operating manuals and maintenance tools and equipment.
- Lead contracting team on all systems interface matters, for example between door furniture supplier, access controls specialist, fire specialist and ICT systems. Etc.

- Prove all cause and effect strategies are operational before witnessing and demonstrations commence to the Design team and client.
- Ensure all systems are fully operational as per the design intent prior to demonstrations to design team.
- Ensure and record all instruments used is covered by a valid calibration certificate.

4.8 HEALTH & SAFETY

- Monitor site safety, particularly with respect to electrical installations.
- Review and monitor the collation and hand over of final documentation including the O&M manuals.
- To review the 'as built' drawings, O&M documentation and commission documentation and ensure all sections are fully completed and an accurate reflection of that installed on site, prior to handover to the design team for final review and sign off.
- Monitor any toolbox talks on operating on/near live systems as and when they become live/operational and record documented proof of such talks.

4.9 TRAINING & HANDOVER

- Review and monitor the implementation of a training programme for system end users
- Shall be required to organise client hand over procedure, which shall include a demonstration of all services.
- Arrange all training sessions in a timely manner to ensure all clients representatives, sub-contractors, design team and themselves can be in attendance.

4.10 TECHNICAL MEETINGS

- To chair technical meetings both on and off site.
- Ensure that the coordination meetings are attended by all M&E sub contractors and recorded
- Distribute all meeting minutes to the design team for their action/attention in a satisfactory time period from each meeting to ensure each item can be attended to.

4.11 IN PROGRESS INSTALLATION & MONITORING

- Prepare M&E risk assessments and method statements, works schedules and snagging schedules.
- Make comments on the items of M&E works included within the construction master program.
- Assist in the deployment and storage of M&E materials, plant and equipment delivered by the M&E sub-contractors

4.12 INSTALLATION QUALITY CONTROL

- Comply with the M&E specifications and drawings, statutory regulations, code of practices and good working practices.
- Supervise and inspect all M&E works carried out by M&E contractors.
- Supervise completion of in progress snagging and testing.
- Ensure all defects have been rectified prior to commissioning/demonstration of systems to the Design team and client.

4.13 FINAL TESTING, COMMISSIONING & DEMONSTRATIONS

- Perform the duties of a commissioning coordinator for all their tasks below.
- The coordinator shall be responsible for ensuring that a commissioning plan is in place for the entire project, showing clearly how the project will be commissioned and handed over.
- The commissioning programme shall include details of all mechanical, electrical and lift systems and how the completion of building works within each phase will be impacted by this process.
- The coordinator shall ensure that all calibration documentation, test record sheets and commissioning figures are fully completed and included within the O&M's and for coordinating the end user demonstrations for all mechanical, electrical and lift services.
- The coordinator shall also be responsible for ensuring that full load tests on installed equipment do not interfere with any client held areas of the building and liaising with the design team and client to ensure a complete solution is provided.

4.14 BUILDING CONTROL AMENDMENTS REGULATIONS (2014) BCAR

- At the end of the project the M&E Co-ordinator shall be responsible for compiling the M&E Reserved Specialists sub-contractors and their sub-sub specialists obligations in completing CIF Ancillary Certificates for the project, reviewing that the certificates are fully completed and only then shall forward to the Design Team for review and comment in a timely fashion. Please refer to Project Particulars of the M&E Specifications for details of the requirements.

4.15 M&E COORDINATOR QUALIFICATIONS & COMPETENCES

- A copy of the CV of the proposed Co-ordinator should be included by the main contractor at Tender Return for review and comment by the design team.
- Proven track record in the successful design, implementation and evaluation of comprehensive M&E systems.
- Current knowledge of various M&E methods and tools, including outcome mapping.
- Familiarity with the collection and analyses of M&E data.
- Experience in M&E project management.
- Sound judgement and an ability to professionally deal with sensitive issues.
- Ability to multitask and change to priorities, systems, processes and statutory requirements.

5 PRODUCT & SYSTEMS PROPOSALS

5.1 GENERAL

Tenders shall be based on the named products and suppliers throughout. Should the contractor wish to propose alternative suppliers and products it shall remain their responsibility to ensure that all products & materials proposed are in accordance with the electrical specification and drawings. Comments issued by Semple & McKillop on contractor proposals do not in any way absolve the electrical reserved specialist from this responsibility. The risk of non-compliance and the supply of unsuitable products or systems shall remain fully with the electrical reserved specialist until the system or product has been installed, tested, commissioned and successfully demonstrated to the engineer and project architects and only in the absence of any defects, shortcomings or non-compliances will only then be deemed acceptable by Semple & McKillop Ltd.

The tenderer must base his tender on the based named specification herein.

The engineer may consider any products put forward by the tenderer and his decision on whether they meet the specification shall be final.

If the electrical reserved specialist contractor wishes the engineer to consider a product, they must obtain approval in principle from the engineer for that product. Approval in principle will only be given when the electrical reserved specialist has submitted a fully itemised comparison schedule for each proposed product set out clearly against the tender specification together with all necessary supporting relevant technical information to prove evidently that the product being proposed by the electrical reserved specialist meets the required specification and the submission must be made early in the contract period to allow the engineer sufficient time to fully review the submitted data (minimum of ten working days). The electrical reserved specialist shall be responsible for carrying out full comparison evaluations and it shall be their responsibility to ensure that all proposed products comply with the specification prior to submittal. The submission of products that do not meet the specification shall be rejected and the consulting engineer shall be at liberty to charge the electrical reserved specialist an hourly rate for time spent reviewing non-compliant submissions. For this project this will be hourly rate of €300 payable in advance of any review.

In particular to lighting submittals in order for a technical submittal to be considered, calculations for all areas of the installation including details of the assumed maintenance factors, interior surface reflectance's, lamp type details, glare ratings, and lumen outputs must be included in the full comparison schedule. Calculations provided (as part of a technical submittal or otherwise) shall be carried out and certified by a Chartered Engineer employed or appointed by the contractor and evidence of Professional Indemnity insurance shall be provided with the submittal otherwise such calculations shall not be accepted. Ancillary Certificates (SD, SC and SI) shall be required from the contractor's elected lighting design specialist for BC(A)r at time of submittal.

The consultant's basis for review of 'equal approved' or 'equivalent' products shall be in respect of material, safety, reliability, fitness for purpose, technical performance / support, warranties / guarantees, compatibility with adjacent construction or spatial/dimensional requirements, availability of compatible accessories, spare parts, dimensional size and, where relevant, appearance aesthetics, glare. Any submitted foreign language documents must be accompanied by certified translations into English.

5.2 CE MARKING OF CONSTRUCTION PRODUCTS

The contractor shall be aware of the Construction Products Regulation (CPR), which entered into force on 1 July 2013 and requires mandatory CE MARKING of construction products covered by Harmonised European Standards (HENs), when products are placed on the EU market. The purpose of the CPR and CE Marking of construction products is to facilitate the free circulation of construction products across the EU market. In doing so, the CPR has established a common technical language for declaring, specifying and setting requirements for construction products.

All CE MARKED construction products must have a Declaration of Performance (DoP), drawn up by the manufacturer. The DoP provides information on the performance of the construction product in relation to technical essential characteristics e.g. compressive strength, durability etc.

It is important that the electrical specialist uses only CE MARKED construction products within this installation and obtains a DoP for each product to ensure the product is fit for the use for which it is intended and for the conditions in which it is to be used. Furthermore, it is the electrical reserved specialist's responsibility to ensure all works should be carried out using "proper materials...which are fit for the use for which they are intended and for the conditions in which they are to be used" in order to demonstrate compliance with the requirements under Building Regulations.

The specialist must provide Declaration of Performance documents and CE certificates for all items at the time of product submittals. This is also mandatory for B(C)ar compliance sign off.

6 CONTRACT DRAWINGS AND GENERAL DETAILS

6.1 CONTRACT DRAWINGS

The contract drawings issued with this specification are as listed in the Electrical Document Issue Sheet.

Details of plant and equipment, luminaires, general services, etc. are indicated on the contract drawings and described within this specification. The exact locations of all equipment shall be agreed on site with the consulting engineers prior to installation where any doubt or potential conflict with other installations is perceived. Plant and equipment which is installed and which conflicts with existing work or installations will be removed and reinstalled without expense to the client by the electrical reserved specialist.

Containment routes indicated on the drawings are indicative and the contractor shall include for all necessary containment routes not indicated in the drawings thereby providing the completed electrical containment installation throughout.

7 GENERAL CLAUSES FOR SUB-CONTRACT WORKS

7.1 CONTRACT PRELIMINARIES:

The electrical contractor shall refer to the main contract preliminaries for information including programme dates. These can be obtained from:

Joe Beggs MSCSI MRICS - Chartered Quantity Surveyor

T: 00353429331192

M: (086) 3779254

A: Block 1, Quayside Business Park, Mill Street, Dundalk, Co. Louth

W: www.mcgahonsurveyors.com

7.2 PROGRAMME

The contractor shall refer to the main contract preliminaries for details regarding programme. The contractor shall make all necessary prior arrangements with suppliers and specialists and shall coordinate the activities of the public utilities in good time so that the contract dates for possession and handover may be met.

7.3 REGULATIONS

The works to which this specification relates too must comply with the current issue of the following regulations:

- This specification
- Health and Safety at Work Act
- The Asbestos regulations
- Local Authorities By-Laws and regulations
- Water Supply Authority's requirements
- Electricity Supply Authority's requirements
- Gas Supply Authority's requirements
- Fire Officers' Committee Rules
- Any other Special Licensing Authority's requirements
- Appropriate British Standards and Codes of Practice
- Constriction (Design and Management) Regulations
- Regulations for Electrical Installations
- Gas Safety Regulations

7.4 ASBESTOS

Products containing Asbestos shall not be used.

7.5 WARNING NOTE

In the case of any existing materials to be dismantled/alterd to enable the works to carried out, the contractor shall advise the contract administration in this case DoES Architects of the discovery of any materials suspected of containing asbestos prior to commencement of any stripping out work.

When removing asbestos materials use only a licensed specialist removal firm to carry out the work.

7.6 CONTRACTS MANAGER/ SITE SUPERVISION

The electrical reserved specialist shall retain on site throughout the duration of the sub-contract works a non-working foreman/contracts manager to act as the electrical representative and to receive such instructions as are necessary for the execution of their obligations and to attend scheduled and non-scheduled site meetings when requested in accordance with the contract. The nominated person shall be capable of project/contract administration. Site operatives or working foremen shall not be acceptable in this capacity.

7.7 SITE SET UP/ SECURITY MEASURES

The electrical reserved specialist shall provide as necessary temporary stores, offices other temporary buildings and security measures for their own exclusive use. Location of temporary structures shall be agreed with main contractor. The office shall be complete with telephone connection, a computer with Auto-Cad and email facilities together with broadband connection for receiving documentation/communication from the design team electronically.

All drawings shall be issued to the contractor by email or on disk in Auto-Cad 2015 format.

7.8 TELEPHONES

The electrical reserved specialist shall provide the necessary telephone facilities for their own exclusive use. Contractors are not permitted to use any of the client's equipment or phone lines.

7.9 WATER, LIGHTING, ELECTRIC POWER AND FUEL

The main contractor shall supply water, lighting, electric power and fuel in accordance with the contract preliminaries. Provide all other water, lighting, electric power and fuel necessary for the installation and completion of the sub-contract works, together with the means of supply, generation, storage, distribution and use, as required.

7.10 SCOPE OF CONTRACT

The scope of electrical contract is detailed under the National Standards Buildings Elements:

- 61 Electrical Supply
- 62 Power Supply
- 63 Lighting
- 64 Communications
- 66 Transport
- 67 Fire Systems
- 68 Security Protection
- 69 Earthing

The works shall be carried out with the best quality plant, equipment, materials and workmanship in the manner specified and shall be installed, connected up and left in complete operational order to the engineer's satisfaction in accordance with the true meaning of the specification and contract drawings taken together.

Any equipment, appliance or material not shown on the drawings, but mentioned in the specification or vice versa, or any minor details or accessories not shown or specified, but necessary for the proper installation and operation of the contract works, shall be delivered, supplied and installed by the electrical reserved specialist without additional expense to the client.

7.11 SITE VISIT PRIOR TO TENDER SUBMISSION

Tenderers shall arrange to visit the site to ascertain for themselves the full extent and nature of the works and to familiarise themselves with the general site conditions, to its accessibility, ESB requirements, and the supply of and conditions affecting labour and of executing the contract generally.

Tenderers shall note that no claim in respect of lack of knowledge of prevailing site conditions, builders work or existing services can be considered.

The tender drawings are based on the best information available at the time of preparation and by visiting the site the contractor shall satisfy himself of the exact extent and nature of works involved.

7.12 LOCATION OF EQUIPMENT

The location of equipment shown on the drawings is diagrammatic and the final location, mounting heights, etc., of each item shall be agreed with the Engineer before the commencement of any particular works on site. Any equipment or installations mounted without engineers approval which subsequently requires to be removed or re-positioned shall occur at No additional cost to the contract. The decision of the engineer is final on this matter.

7.13 BUILDER'S WORK ASSOCIATED WITH ELECTRICAL INSTALLATION

The main contractor under the terms of the main contract will carry out builder's work in connection with the electrical services installation such as forming opes in walls and floors, cutting or drilling of holes, chases in walls, floors or ceilings, joinery works for the installation of cables or conduits, ducting to external and to make good and fire stop around all opes. The electrical reserved specialist shall be responsible for the fire stopping internally within all electrical installations that pass through a fire wall/floor for the correct together with marking out of all attendances and all other cutting to be performed. The electrical reserved specialist shall carry out all drilling and plugging for conduit and cable fixing.

The electrical reserved specialist will be required to provide and erect his own secondary support system suspended from the steelwork or other structure of the building. All secondary supports shall be installed in an approved manner.

All secondary support systems shall be fit for their purpose particularly in respect of brackets. The M&E Engineer shall approve the support system arrangement and in this regard the electrical reserved specialist shall submit details of fixings etc. for approval before installation work commences.

It shall be the responsibility of the electrical reserved specialist to co-ordinate this works with the main contractor and to install the electrical equipment in the locations as reflected on the architect's reflective ceiling plans.

7.14 FIRESTOPPING

Refer to **Part 3: Standard Clauses** of the specification for details on fire-stopping of services. In addition to the details contained within the standard clauses, the electrical reserved specialist shall allow within their tender for Fire stopping mock ups of electrical installations passing through fire walls made up on site for fire engineers & architect comment and review prior to installation commencement. Furthermore, fire stopping detail drawings and fire stopping register shall be submitted for review at the commencement of the project. It is a requirement for this project that every electrical fire stopping location is photographed together with it being traffoylte labelled and cross referenced on as installed drawings and fire stopping register which shall form part of the O&M safety file.

7.15 WORKING DRAWINGS

The reserved specialist contractor shall be responsible for producing a full set of coordinated mechanical and electrical working drawings. These drawings shall be produced in AutoCAD and issued to the Design Team for comment prior to commencement of work on site.

7.16 EQUIPMENT

The electrical works shall be carried out with the best quality plant, equipment, materials and workmanship in the manner specified and shall be installed, connected up and left in complete operational order to the Engineer's satisfaction in accordance with the true meaning of the specification and contract drawings taken together.

Any equipment, appliance or material not shown on the drawings, but mentioned in the specification or vice versa, or any minor details or accessories not shown or specified, but necessary for the proper installation and operation of the contract works, shall be delivered, supplied and installed by the contractor, without additional expense to the contract. Detailed drawings showing sections of the building and building details are available from the office of the project architects.

7.17 SERVICE ROUTE RESTRICTIONS

It should be noted that ceiling heights and available service voids will be limited in some areas within the existing school and the GP area. The routing of containment within these areas shall be very carefully coordinated with other services including mechanical equipment, pipework and ducting.

Within the GP area, the main electrical infrastructure will be mounted to the half-height wall between the extension and the link corridor.

Prior to submitting tender, the contractor shall visit the site and assess the ceiling voids and existing routes which will need to be made accessible and make all due allowances to facilitate full workable access to each area.

The contractor shall refer to the Architect's specification for details of ceiling specification. Routing of containment systems shall be very carefully coordinated as the proposed ceiling voids will be densely serviced with both mechanical and electrical infrastructure. In general, containment systems shall be supported at one-metre intervals. Unistrut brackets and threaded rod anchored to the floor slab structure and roof structures shall be employed. In the case of roof-spaces, Unistrut brackets shall be fabricated to ensure the containment is supported a minimum of 300mm above the top of the ceiling structure or thermal insulation, whichever is at the higher level. All containment shall be mechanically and electrically continuous and shall be mounted face-up at all material times.

In the corridors, due to restrictions of space, the services will need to be stacked in some locations. The contractor is responsible for allowing for all transition pieces to make the installation successful.

7.18 CLEANLINESS OF SITE

This site shall at all times be kept free from obstruction and rubbish and all surplus materials and temporary works shall be removed from site as soon as these are no longer required. On completion of each section of the works the section shall be left in a clean and tidy state to the satisfaction of the M&E Engineer. The word "site" shall be the area as defined in the Main Contract Preliminaries.

7.19 INSPECTION BEFORE CONCEALMENT

Whenever work requiring inspection or testing is subsequently to be concealed, due notice shall be given to the Engineer so that inspection may be made or tests witnessed before concealment.

Failure to give due notice (minimum 2 working weeks) may necessitate the electrical reserved specialist's uncovering the work and reinstating it at his own expense.

7.20 PRODUCT SAMPLES:

The reserved specialist shall include in their contract for providing samples of any electrical product relating to this project where requested by a member of the design team. They shall include for providing a completed mock-up classroom, fitted out with light fittings, power, data points, dado trunking, security, access, fire alarms and all other electrical services outlets as indicated on the drawings for approval. Sample boards of equipment such as intruder, CCTV, access shall be provided for approval. Samples of each type of light fitting called for in the specification document shall be provided if requested FOC.

7.21 INSPECTION AND TESTING OF WORKS

Where required, the electrical reserved specialist shall arrange for the consulting engineer and in some instances lead architect and/or end user to visit the various manufacturer's plant to inspect, witness test and/or approve equipment proposed for this project. Such items will include main LV switchboard, specialist lighting, security & fire equipment, panic attack installations, access control. In such instances the electrical reserved specialist and their sub specialist shall be responsible for all costs associated with arranging and facilitating this requirement. A minimum of three weeks' notice shall be given to the consulting engineer ahead of any planned inspection visits.

7.22 PRACTICAL COMPLETION

Before the sub-contract works are included in certificate of practical completion, the sub-contract works must be fully complete. The term completion shall include setting to work, testing and proper commissioning of plant including a minimum 10 day soak tests for the various electrical installations. Soak tests shall be incorporated into the main contractors overall programme of works and it shall be the responsibility of the electrical reserved specialist to ensure that they have input into the main contractors programme with electrical installations, soak tests and commissioning.

7.23 OBLIGATIONS AFTER PRACTICAL COMPLETION

Between the issue of a certificate of practical completion and the certificate of making good defects relating to the whole or part of the sub-contract works, the electrical reserved specialist shall provide the following:

- A prompt call back service, available at all reasonable times, to attend to any faults and client operational queries.

- Carry out a final test at the end of the defects liability period to demonstrate to the Supervising officer that the sub-contract works are operating efficiently and that all components are functioning correctly.
- Carry out all work using competent, trained personnel, and except where made necessary by abuse, misuse or negligence by other than the Sub-Contractor, make no charge to the Employer.
- Notwithstanding the foregoing paragraph, charge to the Employer the net cost of replacement for life-expired disposable parts.

7.24 DESIGN CRITERIA:

The criteria listed below apply to all Sections included in the Contract unless specified otherwise:

Statutory Requirements & Regulations

- Building Control Regulations 1997-2013
- Building Control (Amendment) Regulations 2014 [BC(A)R].
- Electricity Regulation Act 1999
- NSAI I.S. 10101: 2020 National Rules for Electrical Installations
- Electromagnetic Compatibility (EMC) Directive (89/336/EEC)
- Safety, Health & Welfare at Work (General Application) 2007
- Department of Environment, Community & Local Government Fire Safety Codes of Practice
- Waste Management (Amendment) Act 2001
- EC European Compatibility Regulations 2007

N.B. British (BS) and European Standards (EN) are referenced throughout all Sections of the electrical specification. However, the equivalent Irish Standards (IS) shall be applied where available in each case. Where no Irish Standard is applicable, order of preference is for appropriate European Standards and Directives and then British Standards.

With reference to the following common (non-exhaustive) list of Code of Practices and Regulations the following shall apply:

- IS3217: 2013 A1:2017 shall apply where BS5266 is referenced.
- IS3218: 2013 shall apply where BS5839 is referenced.
- NSAI I.S. 10101: 2020: shall apply where BS7671 is referenced.

8 60 SITE SERVICES

8.1 GENERAL

The cables shall follow the same path as indicated on the contract drawings for the ducts connecting the same areas and the contractor shall ensure that the cable manufactures guidelines on installation and especially bend radii are applied in full. All other underground electrical services cables shall be within ducts. All ducts for containment of electrical services cables shall be high-impact uPVC and red in colour except in the case of communications where grey shall be used. Easy-sweep bends and draw-in chambers shall be utilized on all duct runs to enable ease of drawing in of cables. Suitable pre-formed duct bends that meet the requirements of the cable manufacturer for bending radii shall be used at ends of duct routes where cables rise out of the ground. Ducts for respective services shall be buried to depths below finished ground level in accordance with NSAI I.S. 10101: 2020: and in accordance with the specific requirements of the various utility providers. Yellow warning tape with a black legend shall be provided for duct identification along the duration of all routes. It shall be ensured that ducting routes shall reside outside the zones identified for future extensions to the buildings. In the case of utilities, the ducting specification, marker tape, burial depths etc. shall meet the requirements of the respective utility bodies.

An open duct policy, whereby all ducts provided are under the ownership of the school authorities and are available for use by any service provider, shall apply. To achieve this, manholes shall not be fitted with branded manhole lids supplied by the utility companies to the contractor. Only unbranded manhole lids shall be used. This is to ensure that the school authorities own and control the ducting network to their school and will have the freedom to change service providers as they wish up to the boundary of their property. The Contractor shall be responsible for the order charges and line rental for all lines until the school authorities take over the building.

8.2 GPRS DRAWINGS

The contractor shall refer to the drawings issued as part of the tender information which indicates the approximate routes of existing underground services. The contractor shall still be responsible for carrying out a full scanning of the site and be satisfied as to the exact locations of underground services throughout the site.

9 60 SITE POWER SUPPLIES

Electrical power supplies and communications are required for various items of plant and equipment throughout the site e.g. power and/or communications to sewage treatment stations, rainwater harvesting (RWH), water meters, entrance sign lights and other items as indicated on the electrical drawings.

All underground power services shall be wired in XLPE/SWA cables in ducting. All communications cables shall be of external grade and suitable for installation in ducting. Power supplies shall originate from the site lighting boards indicated on the electrical drawings.

10 60 EXTERIOR SITE LIGHTING

10.1 PERFORMANCE OBJECTIVES

An exterior site lighting installation shall be provided as indicated on the electrical drawings and as specified.

10.2 DESIGN PARAMETERS

The exterior lighting shall be in accordance with the following:

- BS EN 13201 – 2:2015 Lighting requirements for outdoor car parks. (P3). The following levels shall be achieved in the proposed carpark:

Maintained average illuminance (E_{av})	Maintained Maximum illuminance (E_{max})	Maintained minimum illuminance (E_{min})	Minimum Uniformity (U_o)
6.5 lux	47.3 lux	1.3 lux	0.2

- BS EN 13201 – 2:2015 Lighting requirements for outdoor pedestrian areas, (P4). The following levels shall be achieved in the proposed pedestrian spaces:

Maintained average illuminance (E_{av})	Maintained Maximum illuminance (E_{max})	Maintained minimum illuminance (E_{min})	Minimum Uniformity (U_o)
7 lux	12 lux	1.2 lux	0.22

- BS EN 13201 – 2:2015 Lighting requirements for Public Road Lighting. The following levels shall be achieved in the proposed Public Road:

Maintained average Luminance (L_{av})	Maintained Maximum Luminance (L_{max})	Maintained minimum Luminance (L_{min})	Minimum Uniformity (U_o)
1.5	2.16	1.11	0.4

10.3 SYSTEM DESCRIPTION

10.3.1 General

This system shall comprise a combination of external amenity luminaires around the perimeter of the buildings and luminaires on root-mounted hinged columns associated with the proposed carpark and avenues. Other areas of lighting include ground mounted bollard lighting and public road lighting which is covered in the next section and as indicated on the contract drawings.

All lighting columns shall be wired in XLPE/SWA cables to the cross-sectional areas indicated below:

- Site lighting columns 3C 10mm² XLPE/SWA in ducting
- Bollard lighting 3C 6mm² XLPE/SWA in ducting
- Wall lighting 3C 6mm² XLPE/SWA in ducting
- Façade mounted luminaires 2.5mm² LSZH singles in galvanised conduit

Luminaires shall be wired as circuited on the electrical drawings and originate from the respective site lighting boards referenced on the drawings and circuiting.

LED (Light Emitting Diode) type light fittings shall be utilised where specified.

All exterior lighting columns shall be hinged to facilitate ease of maintenance and in accordance with DoES requirements.

Every lighting unit and underground cable, on completion and before being energised shall be inspected and tested to verify that the requirements of NSAI I.S. 10101: 2020 have been met. The inspection and the test results shall be submitted to the Engineer a minimum of 3-week in advance of hand-over.

'As Installed' drawings shall be forwarded to the Engineer showing column positions, cable routes, depths, sizes and positions, and service positions.

A fused cut-out and looped cable connection shall be provided in the base of each lighting column as specified below.

10.3.2 Siting of Columns

Columns must not obstruct footpaths or vehicular accesses. They shall be sited in accordance with BS EN 5489-1:2003 + A2:2008 and BS EN 13201-2:2003 and generally be planted beyond the edge of the footpath farthest from to roadway or in the absence of a footpath, a minimum of 0.3 metres from the kerb or pathway edge to the face of the column. No obstruction or planting shall hinder access to the column base compartment or the light distribution from the lantern.

10.4 SITE LIGHTING COLUMNS:

Lighting columns within the site boundary shall be octagonal galvanised steel tapered hinged column with gear door. (Tubular steel to be used where indicated in luminaire schedule.) Hot-dipped galvanised to BS EN 1461. Root-mounted and set in foundation to Structural Engineer's requirements.

10.4.1 Column Design

All columns shall be designed in accordance with BS EN 40 and be suitable to achieve the height to photometric centre of the lantern as required by the lighting design. The abbreviation "TLS" as noted on the drawings, the luminaire schedule and elsewhere in this document shall mean "height above ground level to light source" and the height of the column shall be customised and manufactured accordingly. The column should be hot-dipped galvanised in accordance with BS EN 1461. All runoffs, flashes and lumps of galvanising material should be removed before painting. Columns should be powder coated in accordance with BS EN 13438 (2013) to match the RAL colour of each respective luminaire/lantern head. The contractor shall include for a non-standard RAL colour in each case. Full visual inspection must be given to ensure finish quality complies with BS EN 13438 (2013). Appropriate adhesion testing must be completed to ensure compliance with BS EN 13438 (2013).

Columns shall have a design life of a minimum of 25-years in accordance with IS EN 40-3-3 and shall be certified by the manufacturer. Declarations of Conformity / Performance shall be provided.

Columns shall be as per below to achieve the required TLS height as specified in the luminaire schedule:

In each case, refer to lighting schedule for technical details of applicable luminaire references.

Columns and brackets shall be designed to be capable of accepting lanterns with the weights and windage of the lanterns specified on this project.

All columns shall have a root for planting to a depth shown by the middle range listed in Clause 5 of Part 2 of BS 5649 applicable to the column height.

Column roots shall be treated with dense bitumen which shall extend to 250mm above ground level.

All columns shall have a cable entry slot minimum 75mm x 150mm with the top of the slot approximately 350mm below ground level.

Columns manufactured in galvanised tubular steel shall have shaft and base sections manufactured from continuous lengths of new steel tube and shall not contain any welded or stepped sections.

The base section of columns shall have a minimum wall thickness of 3.2mm and have base compartment openings of a minimum:

- 500 x 100mm

The shaft sections shall have minimum diameters of 76mm and 114mm for 5/6 and 8/10 metre columns respectively or as necessary to ensure full compatibility with the proposed lanterns. The contractor shall be responsible for ensuring full compatibility of all components.

The same pattern of door lock shall be used throughout all columns. Keys shall be supplied for 10% of all columns supplied. The door fixing bolt shall have a tapered end to facilitate self centring when closing.

An internal full length base board, equivalent to the door size, substantially non-hygroscopic, shall be fitted in each compartment for mounting control gear. Three coats of intumescent varnish shall be applied to the baseboard in order to prevent fire propagation. The rate of coverage shall be 2.5 square metres per litre in order to provide class 0 protection. The clearance between baseboard and inside face of door when secured to be not less than 100mm Base board fixing studs or bolts shall not protrude beyond the front face of the base board. The base board shall be firmly bolted in position. On delivery, the column door shall come assembled on the column.

All columns shall be fitted with M8 x 30mm brass earth studs, threaded the whole length, with two plain washers and two nuts within the base compartment and that are easily accessible. Column doors shall be provided with an internal lug to enable earthing of the column door with an M8 brass earth stud.

There shall be no sharp edges within columns or bracket arms to damage electrical cables during installation or service. An anti-chafe ring shall be fitted where cable routes change direction from horizontal to vertical within the bracket.

The column and bracket assemblies shall conform with the deflection requirements of Class 2 as defined in IS EN 40-3-3.

10.4.1.1 Cut Outs and Isolators

A cut-out and isolator shall be provided in each column. All cut-outs shall incorporate a double pole isolation switch complying with BS5419 and BS7654 having a rating of 25 amps and of adequate short circuit withstand for the position in the circuit in which it is installed. The isolation switch shall be capable of being positively and visibly locked off by means of a padlock or locking bar and it shall not be possible to remove the outgoing fuse(s) unless the isolation switch is in the off position.

The cut-outs shall be of the all insulated type with drip proof enclosure affording a minimum degree of protection to IP22 and have a high mechanical and dielectric strength. The terminals shall be capable of accepting stranded copper conductors from SWA cables.

The incoming phase terminals shall be shrouded when all connections have been made, the shroud shall be capable of removal for inspection or disconnection of cable ends, but shall not be capable of accidental detachment or be of a push fit type. Movement of cables shall be prevented by the use of bushes or inserts. Fuse carriers shall utilise fuses to IEC269-1 and BS88 Part 1 – AC19 Tag Type (LST).

The units shall be provided with separate terminals for phase and neutral conductors manufactured from solid brass and electro-tinned and be entirely suitable for connecting the requisite cables.

Where connection is made into any cut-out for supplying a sub-circuit the cut-out shall incorporate a second fuse link to protect the sub-circuit.

Electricity Service Connections cut-outs shall be double pole and manufactured by Charles Endirect from the Helix 'HLX200' range or equal and approved. Each cutout shall be supplied with a glanding plate capable of accepting minimum 2 No. 16.0mm² SWA cables glanded-in using proprietary BW glands (with earthing ring onto stud on cutout) facilitating a "loop-in loop-out" configuration and shall incorporate an outgoing fused circuit. Include for extension boxes, terminals and gland-plates for each cut-out as necessary.

The cut-outs shall be securely fitted to the baseboard with non-corrodible screw fixings in the case of each column.

10.4.1.2 Cables

Underground cables shall be laid in ducts and consist of stranded copper conductors, XLPE insulated, LSF extruded bedding, a concentric layer of steel wire armour, overall LSF sheathing suitable for operation in an earthed system and of rated voltage 600/1000 volts at 50HZ, all in accordance with BS 6346 for metric cable, have BASEC approval under the product certification scheme and produced by a manufacturer who has been awarded a Certificate of Assessed Quality Management, to BS 5750, by BASEC.

All cores shall be of equal cross-sectional area indicated on the drawings and be of such a size that the requirements of NSAI I.S. 10101: 2020: are met and allow for a disconnection time not exceeding 5 seconds.

Internal wiring between the terminal block in the lantern and the components in the base of the column shall be heat-resistant flex insulated and sheathed cable of 300/500 volt grade, have a copper conductor size of not less than 2.5 sq mm.

All underground cables shall be identified as to their origin and destination by permanent markers located over the sheath at the cable ends i.e. Traffolyte label affixed securely to either end of the cable.

Ducts for exterior lighting cables shall be laid with 800 mm minimum cover.

10.4.1.3 Cable Laying

Joints in underground cables shall not be permitted and continuous lengths of cable shall be laid and looped in and out of the terminations i.e. proprietary cut-outs in the base of each column.

Cables shall not be laid in a frozen state or when the ambient temperature is below 0°C.

The internal radius of a cable bend shall be such as not to cause damage to the cable and shall not exceed the manufacturer's maximum bending radius.

10.4.1.4 Erection of Columns and Brackets

The columns shall be erected in the locations shown on the drawings. Columns shall be provided with a structural support base/foundation in accordance with the structural engineer's details. The column shall be correctly aligned (plumbed) in the vertical position with the door opening facing away from oncoming traffic.

Bracket arms shall be fixed to the columns at the site of installation. The method of securing the bracket arms must be positive such that the arm cannot rotate. The arm and lantern shall be at right angles to the roadway to be illuminated.

10.4.1.5 Internal Wiring and Distribution Cables

Columns shall be supplied on various sub-circuits from the various site lighting distribution boards by means of the SWA underground cable and looped from column to column. All looped connections shall be made in the bottom terminals of the fused isolator cut-out. The armouring of the underground cables shall be secured onto the gland plate of the cut-out or have a non-ferrous sleeve fitted below the armouring and earthing clamps fitted to make a positive grip on the armour wires. The earthing clamps and gland plate shall be bonded to the main column earthing terminal with 10 sq mm single core LSZH cable. SWA glands shall be external grade type providing a seal on the outer sheath of the cable to IP66.

10.4.1.6 Earthing

The whole of the installation shall be earthed in accordance with the requirements of NSAI I.S. 10101: 2020: and with the recommendations contained in BS 7430, Earthing. Earthing shall be carried out in LSF insulated copper cable green/yellow in colour. All metallic parts of the ancillary equipment, column, lantern and gear shall be bonded together to form a continuous earth path to the earth stud of the column.

10.4.1.7 Painting

After erection, any areas of damage to the paint protection system shall be made good by abrading the edges of the damaged areas and re-coating the damaged areas in accordance with the column manufacturer's instructions and no painting shall be carried out during extremes of temperature or when the surface is damp or wet.

10.4.1.8 Electrical Testing of Equipment and Commissioning

Prior to being energised, all equipment wiring and cabling of every completed installation shall be tested in accordance with NSAI I.S. 10101: 2020:

Testing shall be carried out in compliance with the Electricity at Work Regulations 1989 and such that no danger to persons or property or damage to equipment can occur even if the tested circuit is defective.

The columns and underground cables should be tested in the following sequence.

1. Visual Inspection – to verify that the electrical equipment has been correctly installed in accordance with the design with correctly rated protection devices and bonding and that no visible damage exists.
2. Continuity – every protective conductor, including bonding, shall be tested to verify that it is electrically sound.
3. Insulation Resistance – the insulation resistance should be measured between all the conductors and the conductors to earth with a test voltage of 500 volts. The insulation resistance should not be less than 0.5 mega-ohms.
4. Polarity – a polarity test should be made and a check to verify that protective devices are connected correctly and fuses in the phase conductor only.
5. Earth Fault Loop Impedance – measurements should be taken at the point of supply and, where underground cables have been installed, at the most distant point of each circuit. The values should accord with those shown in NSAI I.S. 10101: 2020: to ensure the circuit protective device will function within five seconds.
6. Earth Electrode Resistance – tested in accordance with BS 7430 and NSAI I.S. 10101: 2020:.
7. Operation of Residual Current Device – verify by a test simulating an appropriate fault condition independent of any test facility incorporated in the device. The device shall be tested at 50% and 100% of its rated trip current.
8. Voltage Drop – measured at the most remote point from the supply under full load conditions.

All results shall be recorded and submitted to the Engineer prior to an adoption inspection. The results, for each unit, shall be recorded on the test record sheets and inserted into the Operation and Maintenance manuals.

10.4.1.9 Lighting Levels Commissioning

LUX levels shall be commissioned by the contractor during hours of darkness and attendance by the specialist lighting supplier(s) shall be required on 2 No. separate occasions i.e. at commissioning stage and during the defects liability period. A calibrated LUX meter shall be utilised.

10.4.1.10 Control Requirements

Photocell, time clock and HOA (Hand-off-auto) control arrangements shall be utilised as illustrated on the LV distribution schematic and general & emergency lighting drawings. HOA switches and the site lighting time switches shall be wired back to and located in the locations indicated on the drawings where they are easily and readily accessible. Switches shall be suitably engraved and such engraving shall be agreed PRIOR to order. HOA switches shall be presented on grid-switch modular arrangements as opposed to individual switches with dedicated back-boxes. Immediately beside each group of HOA switches, a framed and laminated chart shall be fixed to the wall clearly indicating the areas controlled by each individual switch.

Prior to commissioning, the contractor shall request from the consulting engineer details of the time clock settings for each zone.

The exterior high-level façade lighting shall be interfaced with the intruder alarm to turn these particular lights 'ON' in the event of an alarm condition arising.

All time-clocks shall be digital and shall be wall-mounted as opposed to integral to a switchboard or distribution board.

10.5 PUBLIC ROAD LIGHTING

The reserved specialist shall be responsible for the installation of a number of new public lighting columns along the newly constructed public road as indicated on the contract drawings. The reserved specialist shall be responsible for liaising with ESB Networks in relation to connections and supply and also liaising with the local authorities in relation to the lighting scheme and the equipment used.

The reserved specialist shall, at an early stage, submit a GMPRN application to ESB Networks to request supply to connect the public lighting and also the individual crossings as set out on the contract drawings.

The Reserved specialist shall refer to the Civils package for exact wiring details for the proposed equipment. All public road lighting shall be installed in accordance with the following:

- BS EN 13201 – 2: 2015
- Midland Counties Public Lighting Specification (WCC)
- WCC Public Lighting Policy Document

10.6 PUBLIC LIGHTING COLUMNS

Tapered tubular or tapered hexagonal / octagonal / hexadecagon (16-sided) galvanised lighting columns shall be selected for use on new schemes and all columns shall be galvanized on both the inside and outside to BS EN ISO 1461: 1999. Exterior lighting columns shall be designed to the BS-EN 40 family of standards as set out in Table 5.

The lighting column manufacturer shall be registered with and certified by either NSAI, British Standards Institute of Quality Assurance Services, or Lloyds Register Quality Assurance Register for the design, manufacture, supply and verification of road lighting columns and brackets under their quality assessment schedule to ISO 9001. It is important to note that ISO 9001 does not imply Certification to EN 40 series

NOTE: Plain tubular stepped columns, widely used to date, are not acceptable to the Local Authority

Columns proposed to be installed shall have a finish with a proprietary paint to an agreed BS or RAL colour which takes account of the surrounding environment and shall be installed as agreed by the Local Authority at construction stage.

Each Pole shall be hot dip galvanised inside and outside to a minimum average coating thickness of 140 microns irrespective of the pole thickness at each point. The minimum average coating thickness is defined as the average of 7 to 10 individual local area measurements taken across the length of the pole with a minimum of 2 measurements taken at the butt of the pole, 1 from the middle section of the pole and 2 measurements taken at the top of the pole. 2 measurements shall be taken from the inside of the pole, one at the butt and one at the top. Testing of the coating shall generally be to BS EN ISO 1461.

All columns/poles must be provided galvanised steel cap shall be permanently secured to the top of the steel pole either through a designated cap insert, the bracket or by pole top fitting. The provision of a stand-alone cap is to be provided for OH network mounted poles and should be made of steel cap shall be galvanised in accordance with 2.06.01. The coating finish shall be in accordance with specification 05030. The cap shall prevent water ingress. The bolt, nut and washer used to secure the top cap shall be of either grade 304 austenitic stainless steel or galvanised in accordance with section 2.06.01.

10.6.1 Electric Supply to Public Lights

The installation of schemes in residential areas shall comply with the Code of Practice for Public Lighting ET211: 2003, the National for Electrical Installations (NSAI I.S. 10101: 2020: current at time of issue and shall include the provision of a Customer Service Pillar(s) in line with the requirements of ESB Networks National Code of Practice for Customer Interface (current edition). The electrical services design for the scheme shall be undertaken to comply with the relevant sections of NSAI I.S. 10101: 2020 National Rules, viz. ET: 101 and ET: 211. The requirements set out in section 714 of ET: 101 as well as all the requirements set out in ET: 211 shall be complied with. The detailed cable design shall be undertaken to match the calculated electrical load which would typically allow between 4 and 8 fittings to be supplied per phase.

The provision of earth loop / fault level calculations and circuit disconnection (fuse rupture times) shall also be completed at the design stage. Exterior lighting schemes requiring cable lengths more than 200 metres require careful design by the contractor to meet the earth loop impedance requirements of ET: 101. Disconnection / fuse rupture times shall follow those set out in ET: 101 (National Rules for Electrical Installations) rather than those specified in BS 7671 for Public Lighting and Street Furniture.

In all cases install power supply cable from the following shall be installed:

- SWA Cable to BS 6346 (0.6 / 1kV);
- SWA Cable to BS5467 / I.S. 273 (0.6 / 1kV);

Where ESB high voltage cables (10 kV / 20 kV) cables run in parallel with Exterior Lighting cables in ducts, a minimum segregation of 300 mm shall be maintained. Where ESB high voltage cables and Exterior Lighting Cables cross, they shall do so at right angles. The requirement of crossing at right angles also applies to gas mains.

Fuses and circuit breakers shall have a minimum rupture capacity of 16 kA.

Generally, the main customer service pillar customer fuse rating shall not be greater than 25 Amps.

C-Type circuit breakers shall be used.

The use of circuit breakers (MCB's) in exterior lighting columns is not permitted by the Local Authority. Fused isolators / disconnectors, such as Lucy C040SLF fused isolators / fused cut outs, shall be used in Exterior Lighting Columns.

Exterior Lighting cables shall not be jointed in inaccessible locations particularly where water ingress is likely. Inspection chambers / draw pits shall be installed at both sides of under carriageway crossings, at every 50m length of duct and at every change of direction.

The availability of electricity supplies shall be confirmed by the Distribution System Operator ESB Networks prior to design of the exterior lighting scheme.

Main road exterior lighting schemes shall have power supply infrastructure installed with a minimum of 25% spare capacity (Maximum Installed Capacity at Customer Service Pillar).

Cables to be sized for 25% additional load (and at least 25% additional length) to allow for future extension. The spare capacity requirements shall be advised by the Local Authority at the design review phase.

The Local Authority does not accept exterior lighting schemes that are centrally controlled from a contactor in the interest of energy conservation, scheme reliability and public safety. As mentioned previously, each luminaire shall have a photocell or sub-miniature photocell.

The installation of schemes in Residential Areas shall comply with the Code of Practice for Public Lighting ET211: 2003. All exterior lighting schemes shall include the provision and installation of a Customer Service Pillar (Micro Pillar).

Designers of Electrical schemes must take cognizance of the many external factors of installing equipment in an outdoor environment including members of the public.

All equipment must be provided with a local means of isolation. The established practice of using a fuse carrier as the isolation and switching device is allowed for in TN systems provided only authorized maintenance personnel carry out the works.

The contractor should divide circuits such that:

- It avoids hazards and minimizes inconvenience in the event of fault or overcurrent It facilitates safe inspection, testing and maintenance
- It takes account of danger that may arise from the failure of the circuit
- It reduces the possibility of unwanted tripping of RCDs due to excessive protective conductor currents produced by equipment in normal operation.
- It mitigates the effects of electromagnetic interferences
- It prevents the unintentional energisation of a circuit that is intended to be isolated.
- It allows for daytime testing by way of a bye pass switch

10.6.2 Pillars

Feeder pillars shall comply with IP 34 of IS EN 60529. They shall include a full size back board of varnished (intumescent) marine plywood at least 15 mm thick or other approved non-hygroscopic material. Alternatively, a purpose designed equipment mounting system may be used. The entry for cables shall be via the root.

The distribution MCBs or fuse boards shall have sufficient spare capacity to accommodate at least one extra circuit. (One three phase spare way on a three-phase distribution unit and one single phase spare way on a single phase distribution unit). All components secured to the back board shall be neatly arranged and securely attached ensuring that there shall be at least 25% spare space on the back board.

The pillar doors shall be fitted with tamperproof locks, all locks being identical in pattern and two sets of keys shall be provided to the Local Authority & ESB. All hinges and locks shall be of stainless steel to BS 6105 or BS 970.

Distribution boards where used shall be provided with an external earth, phase barred and colour coded. They shall be fitted with the same number of live and neutral bus bar terminals as there are outgoing circuits plus at least one spare way.

Circuit details and labelling shall be provided in each feeder pillar with a circuit drawing provided as part of the safety file or take in charge procedure. Feeder pillars shall be mounted as per manufacturers specification on a 150 mm thick foundation of mix ST2 concrete. After completion of the cabling the feeder pillar base shall be filled to 25 mm below the door with rounded coarse aggregate conforming to BS 882 graded aggregate 14mm to 5 mm.

A durable warning sign indicating "Danger 400 Volts" or "Danger 230 Volts" as appropriate, in 5 cm high letters, shall be fixed to the front of the pillar where applicable. Each pillar shall have a permanent label fixed externally which identifies it as a public lighting pillar. All pillars to be taken in charge by the Authority will be marked with a Deadsure asset number to be indicated by the Local Authority.

For all maintenance works, a Lock out and tagging system of power isolation must be used in all power supply points. The tag must provide contact details of the Electrician who put in the tag in place and the date.

10.6.3 Isolation and Earthing

All earthing and bonding shall comply with the requirements of the National Rules for Electrical Installations and with any additional requirements. Circuit protective and equipotential conductors shall be installed and shall be green/yellow PVC or XLPE insulated or sleeved. Where bolted connections are required, these conductors shall be terminated in accordance with manufacturers' instructions in correctly sized purpose made lugs. Such connections shall be made with non-ferrous nuts, bolts and washers.

The circuit protective conductor shall be of equal cross-sectional area to the associated circuit conductor except where it is contained within a composite cable when its cross-sectional area may be reduced as permitted in the National Rules for Electrical Installations.

A circuit protective conductor shall connect the earth terminal on each lantern to the main earth terminal associated with the service cut-out unit.

A separate circuit protective conductor of not less than 2.5 mm² cross-sectional area shall connect all metal enclosures of all electrical components to the main earth terminal.

All extraneous conductive parts, as described in the National Rules for Electrical Installations shall, where required in these Rules, be bonded to the main earth terminal in accordance with these Rules.

Earth values must be in accordance with the requirements of Table 41.1

Equipment installed on the street requires a means of local isolation

Earth electrodes shall be as per NSAI I.S. 10101: 2020 Sect. 542.2.3. All power supply pillars must have an independent earth utilising one of the following:

- a) Solid Copper Lattice Mat 600mm X600mm X3mm - Solid copper lattice mats are often used for potential grading and are a preferred option on installations where touch and step potential could cause problems. The Local Authority recommend this earth for installation in Urban environments with the provision of an adjacent chamber where the bond to the lattice can be inspected.
- b) 25mm Earth strap – The length of selection is dependent on the resistivity of the ground and should be installed in a trench which is situated at 180 degrees from the DSO earth.
- c) Earth bar A driven earth bar must only be undertaken with a full knowledge of the Utilities in the area including a full risk assessment. Earth electrodes shall be of the Cu. plate type with an area of $1/2 \text{ m}^2$ and set vertically at a minimum depth of 600mm. from the ground surface to the top of the plate to ensure that the soil near is sufficiently damp as per IEE Guidance Note 8. Earthing & Bonding

11 61 ESB SUPPLY

The contractor shall be responsible for liaison with the ESB for all site alterations that may be required.

A new ESB substation and adjoining customer switchroom to be construction to the North of the site to serve the whole building, including the upgrade to the existing heating system. The substation will serve two main switchboards, one in the extension and one in the existing building.

The contractor in conjunction with ESB shall co-ordinate all matters relating to the ESB substation.

ESB Utility meter shall be located in the adjacent customer switchroom in accordance with ESB code of practice. The supply authorities feed shall terminate in a factory-built LV switchboard and metering arrangement located in the customer switch room at ground level. This will achieve a single point of electrical connection and isolation.

Utilities services drawings indicates the ESB routes and metering arrangements which has been agreed with local engineering ESB officer.

Space for ESB metering arrangement shall be provided in the main switchroom adjacent to the main switchboard with the space and layout approved by the ESB Networks prior to installation. The meter arrangement shall be installed to ESB 'National Code of Practise for Customer Interface 4th edition'.

12 60 ELECTRICAL VEHICLE (EV) CHARGING

The Electrical Reserved Specialist shall provide an Electric Vehicle Charging point for use by electric plug in vehicles at one location in the car park as indicated on the contract drawings. The contractor shall also install ducting to 20% of the car parking spaces in the development. These Electric Vehicle Chargers, known from here on as EVC's, should be model EVBox BusinessLine and have a minimum set of technical requirements as set out below:

- Designed to IEC 61851-1 (2010) & IEC 61851-22 (2002)
- Mode 3 Z.E. Ready 3.7kW to 22kW
- B3322-E1801 2 x 22kW 3Phase EVBox BusinessLine G4
- Single or Dual Type 2 IEC62196 sockets (compatible with all electrical vehicle types)
- Minimum IP54 rated and IK09 Vandal Resistant
- Integrated RCBO + DC leakage current protection
- OCPP compliance allowing cross vendor compatibility
- Available in Wall or Pole mounted BusinessLine options
- BackOffice Cloud based, web accessed back office capable of processing payments, analysing data and offer remote upgrades for firmware as and when required
- Connectivity should be Via UMTS/4G technology with no LAN Connection for increased local security
- Smart Charging capable to allow for Card Administration, Load Management and Power Usage monitoring.
- Payment processing capable via QR Code with added service bolt on
- Minimum 3-year parts warranty, upgradeable to 5 years.
- MID-certified kWh meter

The units should be available in the following formats:

- As a single or double connector
- Optional fixed Type 1 or Type 2 charging cable
- Automatic tracking and settlement of charging costs with inclusive MID-certified kWh meter
- Easy and efficient management of multiple charging stations with the Hub / Satellite configuration
- Energy-efficient distribution of the available power with Smart Charging solutions
- Adjustable charging rates
- Remote maintenance and software/firmware updates
- Available in 3 standard colours or any RAL colour of preference
- Vandal proof, non flammable and discolouration proof
- Robust and modular build with UV resistant material.

12.1 ELECTRIC VEHICLE MINI PILLAR

The electrical reserved specialist shall include for the supply and installation of feeder pillars as indicated on the site drawing. The feeder pillars as a minimum shall be as Lucy Heritage Range HY-CAST 407 cast iron service pillar or equal & approved. They shall be adequately sized to house a distribution board for serving all potential future car charging points, separate UMTS/3G control units contained within a dist board enclosure, PoE IP security switches and comms patch panels for future add-ons.

12.1.1 Pillar Specification

- Finished in black RAL colour finish c/w zinc phosphate resin treatment.
- Pillar cap and sides in close grain grey iron to BS 1452 Grade 180.
- IP3L3 degree of protection to IEC 947-1 standard c/w 2No. yale lock.
- Doors and back panel to be fabricated from 4mm special chrome enriched steel.
- C/w 15mm marine ply backboard.
- C/w concealed ventilation.
- Root mounted pillar.
- C/w power circuits.
- C/w tubular heater and thermostat.
- Pillar shall be highline (1454mm H x 1553mm W).
- House PoE equipment and switches
- House relay units
- Contain local distribution board

12.1 SPECIALIST SUPPLIER

A specialist supplier and installer, of the above equipment and system, contact details are as follows:

Rexel Energy Solutions

Damien.philips@rexel.ie

0873747359

Or equal & approved.

13 61 SWITCHGEAR INSTALLATION

13.1 GENERAL

The contractor shall supply and install all switchgear necessary for the complete and proper operation and protection of the completed electrical engineering system. The switchgear and distribution boards shall be as indicated on the contract drawings.

All MCCB's, MCB's and distribution boards shall be of the sizes hereinafter described, or as may be shown on the relevant drawings associated with this specification or as may be detailed in the schedules associated with this specification.

13.1.1 EEC LOW VOLTAGE DIRECTIVE & CE MARKING

All switchgear and sub-distribution board assemblies supplied shall be CE marked, issued with a Certificate of Conformity and a technical file created and maintained for each assembly as required by the EEC Low Voltage Directive. All information shall be handed over as part of BC(A)R certification.

Each assembly shall contain the assembly/panel manufacturer's company plate affixed to the front of each panel and containing the CE number unique to that assembly. This information shall correspond to that listed on the commissioning certification.

13.1.2 PROPOSED LV SWITCHBOARDS – QUANTITIES & LOCATIONS

The following switchboards shall be provided under this contract:

- **MSB-1:** to be located in customer switchroom adjoining sub-station.
- **MSB-2:** to be located in extension building switchroom.

13.2 DESCRIPTION OF WORKS

Factory built assembly switchgear shall be provided for the main LV switchboards for this project. The baseline switchgear shall be based on cubic framework with Schneider electric NSX electrical components. Local distribution boards shall be loose sheet steel metal construction type. A single factory assembly specialist shall supply main switchgear and sub distribution boards.

13.3 MAIN LV SWITCHBOARD

The proposed main switchboard arrangement required to facilitate the project is detailed on specific LV switchgear drawings. The electrical reserved specialist shall appoint a specialist panel manufacturer to carry out the layout design, construction, installation and commissioning of the same.

The board shall be freestanding sheet steel cubicle pattern switchboard suitable for bottom cable entry incoming and bottom & top exit outgoing.

The switchboard shall comprise all components indicated on the drawings and be a factory built assembly - Multi-cubicle type to Form 4B Type 2, front access, as defined by BS EN 60439-1 and shall comply with EN 50051, EN 50001/2, BS EN 60 - 439-1:1994, and IEC 60439-1. The switch panel shall be designed to suit the cable entry from above and shall be RAL 7035 in colour. **Written confirmation shall be provided to confirm that the proposed switchboard conforms to the above standards.**

The switchboard shall be fitted with bus bars mounted in a segregated chamber to the rear of cable ways and chambers containing the switch and control devices. The location of the bus bars shall be such that top cable entry/exit is viable. ACBs shall be withdrawable. MCCBs requirements detailed below. The design of the switchboard shall facilitate re-configuring on-site of outgoing circuits employing MCCBs and fused combination switches by unplugging and re-arranging the outgoing units. It shall be possible at a later date to add outgoing MCCBs and fused combination switches on their plug-in sub-assemblies to the switchboard.

13.3.1 Framework

The panels shall be cubic framework and constructed from 2.5mm thick Zintec or similar sheet steel, which shall be treated with an epoxy self-etching filler primer undercoat and two finish coats of stove enamelled synthetic paint to an approved RAL colour. The panel shall have total front access and be provided with removable lifting eyes if necessary.

Doors shall be fitted with hinges utilising screws as their top and bottom pivot points and requiring a tool to remove the door and flush mounted key operated locks. The switchboard enclosure shall be suitable for mounting in an enclosed switch room and have an IP rating of at least IP3x as defined by BSEN 60529 Individual sections of the panel shall be interlocked so that doors cannot be opened until the supply has been isolated.

The main incomer and all outgoing supply cables shall be top entry and exit. The main isolator shall be industry standard mounted to the lower left corner of the board.

The modular system shall be based on a size of 192 mm. This modular size secures the maximum versatility and therefore allows all the individual requirements from the client or consulting engineer to be built in the switchboard. The framework shall offer;

- Maximum versatility
- Short delivery time of assembled switchboard
- Easy to rearrange and make changes
- Easy to extend for future additions and/or alterations
- Type tested according to EN 61439-1, verified by KEMA, ASTA, SABS, Det Norske Veritas, UL and Germanischer Lloyd
- Excellent documentation - Design software, technical assembly Instruction, projecting manual, temperature-rise calculation software etc. All information shall be provided as part of switchboard submission for approval by the electrical reserved specialist's sub-specialist.
- Capability of having bus-bar systems rating up to 7000 amps
- Short-circuit test I_{cw} up to 120 kA and I_{pk} up to 264 kA

13.3.2 Main Earthing Cubicle

A main earthing cubicle shall be provided as an integral part of the main switchboard.

This cubicle shall be complete with a suitably sized copper bus bar or terminal bar to accommodate the connection of the main earthing conductor and the main equipotential bonding conductors as installed by the electrical reserved specialist. All cable connections to this bar shall be lugged and bolted. All cables shall be identified at the connection point with an industry standard cable ferrule.

13.3.3 Bus bars

All bus bars and bus bar connections shall be of the sizes shown on the drawings, be of hard drawn, square edged, high conductivity solid bare, copper complying with BS 1432. All bus bar and associated connections shall be firmly secured and supported on self-extinguishing polyester, ceramic or fibre type mountings. Bar rating shall be certified as being capable of withstanding a short-circuit current of 50kA rms, 105kA peak, for a minimum of 1 second. Bus bars shall be rated at 1000A minimum. Refer to schematic for exact rating.

Interconnection of bus bars between sections of the assembly shall be achieved using captive nuts in one bus bar, the bus bar from the next section overlapping and being connected using bolts and Bellville type washers as required to form a maintenance-free joint. The main bus bars shall not be connected by fish-plates.

13.3.4 Internal Cabling

Phase ways in three phase sections shall be coloured in accordance with the harmonised cable colours and not red/yellow/blue. Any cabling shall be single core LSF (6491X) pattern, solid or stranded conductor as appropriate.

13.3.5 Rubber Mats

The electrical reserved specialist shall supply and install a suitable rubber mat complying with BS 91 - 1976 adjacent the main switchboard. The mat shall be 1 metre wide and shall run the complete length of the main switchboard.

13.3.6 Commissioning of Plant

The electrical reserved specialist shall allow in his tender for the main switchboard to be commissioned by the panel manufacturer on site before the project is handed over and for the instruction of the staff in its operation. Factory visits shall be arranged for the engineer and end client to visit the panel manufactures plant and witness testing prior to the board leaving the factory. All costs associated with such visits shall be borne by the electrical reserved specialist and his switchboard specialist.

13.3.7 'As Installed' switchboard Drawing

The electrical reserved specialist shall allow for the provision of an 'A1' framed drawing of the switchboard to be installed within the switch room. The drawing shall be fitted with a framed Perspex cover.

13.3.8 Conformance with IEC 61439-1&2

In order to verify compliance with IEC61439-1, the switchboard shall undergo a full range of tests in the most critical configurations. Design verification shall include the following construction and performance verification:

Construction:

- No. 1 – Strength of materials & parts
- No. 2 – degree of protection of enclosures
- No. 3 – clearances and creepage distances
- No. 4 – protection against electric shock and integrity of protective circuits
- No. 5 – incorporation of switching devices and components
- No. 6 – internal electrical circuits and connections
- No. 7 – terminals for external conductors

Performance:

- No. 1 – dielectric properties
- No. 2 – verification of temperature rise
- No. 3 – short circuit withstand strength
- No. 4 – electromagnetic compatibility
- No. 5 – mechanical operation

Confirmation of the above shall be included on the commissioning certification by the panel manufacturer for each switchboard and sub-distribution board assembly and shall be included in the operation and maintenance manual.

13.4 MAIN PROTECTIVE DEVICE (ACB ON MSB-1 & MSB-2)

Schneider adjustable ACB (main breaker) shall be provided with shunt trip auxiliary contacts which shall be linked to a fire fighter's electrical isolation switch located directly inside the main entrance. The shunt trip shall only operate the main breaker upon operation of the fireman's isolating switch. A loss of utility supply or internal electrical distribution system supply shall not signal the shunt to operate the main breaker. Main ACB shall be sized as per schematic.

13.5 MCCB's

13.5.1 General

The MCCB's shall match be Schneider NSX MCCB's as per the following technical specification. All MCCB's shall be motorised type to enable load stepping of the standby generator.

All MCCB's shall be manufactured to BS EN ISO9001 and comply with BS 4572. Compliance with international standards, IEC 61439-2, UL, CSA, JIS & CCC. All MCCB's shall be complete with Thermal and Magnetic overload settings as indicated in the technical specification below.

All switching toggles shall be in the up/down operation. All MCCB's shall be Traffolyte labelled. Spare spaces shall be fitted with blank labels for future engraving.

13.5.2 MCCB's Technical Specification

To meet the following specification:

- Shall comply to IEC 60947-2
- Rated current as per schematic
- Rating and model number indicated clearly on the front of the housing and with clear "ON" and "OFF" indication
- With thermal magnetic trip unit (TMD)
- Breaking capacity (Icu) 50kA
- Ics = 100% Icu as per IS/IEC 60947-2
- Suitable for isolation
- Class II front face
- Adjustable thermal setting $0.7 - 1 \times I_n$
- Adjustable short-circuit from $5 - 10 \times I_r$
- c/w rotary handle
- As Schneider Electric 'Compact NSX'

All MCCB's shall be relevant British Standards BS 3871 Part 2. All switching shall be in the up/down operation. A number of MCCB's are indicated as having short circuit (magnetic only) protection only as thermal overload protection shall form part of an upstream installation. MCCB's shall be capable of withstanding a short circuit current of 20kA minimum for 5 seconds.

All MCCB's shall be Traffolyte labelled. Spare spaces shall be fitted with blank labels for future engraving.

Manufacture shall be uniform throughout to provide for accurate discrimination in the event of a fault.

13.5.3 Devices installation

Each device shall be installed onto a dedicated mounting plate.

Each mounting plate shall have an independent fixing system affording them to be transformed and moved anywhere in the switchboard and to ensure the switchboard can be expanded.

Front plates shall be installed in front of all control and protection equipment with IEC 144 - IP54 classification, in order to avoid direct access without a tool to the devices and consequently to the active parts.

13.5.4 Discrimination Calculations

Manufacture shall be uniform throughout to provide for accurate discrimination in the event of a fault. The switchboard specialist shall provide a full suite of discrimination calculations and individual settings of each device as part of their switchboard submittal.

13.6 FIREMAN'S SWITCH AND SHUNT TRIP

A fireman's switch shall be provided at the main entrance to the school and shall be linked to a shunt trip on the main breaker on MSB-2. A fireman's switch shall be provided at the door to the customer switch room and shall be linked to a shunt trip on the main breaker on MSB-1.

The fireman's switches shall be of non-flammable aluminium construction sealed to IP65, painted red and to comply with IEC 60947-3 and BS7671. The unit shall be complete with an auxiliary normally open contact.

The contractor shall note that the shunt trips shall only operate the main breaker upon operation of the fireman's isolating switch. A loss of utility supply or internal electrical distribution system supply shall not signal the shunt to operate the main breaker.

On and off positions to be clearly indicated on the front side with "I" and "O." Operating handle designed to allow a fireman-hook or axe to switch off and a "two-hands grip" required to reset. The interlocking mechanism prevents accidental manoeuvres. Manufactured by ABB (or equivalent).

They shall be mounted at high level and shall enable de-energisation of the electrical supply within the building by the fire authority in the event of an emergency. A Traffolyte label shall be mounted directly below the unit engraved "FIRE FIGHTERS ISOLTING SWITCH" using white letters on red Traffolyte background. The nameplate shall be 150mm by 100mm in size and the writing shall be clearly legible from a distance appropriate to the local conditions.

13.7 CONTACTORS

These shall be surface or panel mounted metal clad units poled, phased and rated as indicated on the drawings. Each unit shall have an AC magnet system and control circuit fuse suitable for operation on 230V 50 Hz supply. Contactor contacts shall be gold plated AC23 and the unit shall operate for a minimum of 1 million operations.

13.8 POWER FACTOR CORRECTION

The electrical reserved specialist shall allow for the provision of power factor correction equipment to form an integral part of the main switch panel. The power factor correction equipment shall automatically come on in stages as indicated on the contract drawings. The PFC compartment shall be provided with a suitably sized fan to provide adequate air movement to prevent the PFC equipment overheating.

13.9 TRANSIENT VOLTAGE SURGE SUPPRESSORS

Transient voltage surge suppression devices shall be provided as indicated on the distribution schematic diagram. The devices shall be suitable for a TNC-S system of earthing.

The devices shall be capable of suppressing lightning, voltage spikes and surges. The device shall be low measured limiting voltage performance on switching generated ring wave transients, incorporating metal oxide varistor suppressor design and low impedance surge paths. Type C MCB's shall be fitted in series with each device. Each device shall have an indicator to denote if the device has operated.

Surge protection shall also be provided within each distribution board to automatically protect against voltage spikes.

Main Surge protection devices in the main Switchboard shall be linked to the BMS to notify the client of an occurrence of a surge.

13.10 PRIVATE ENERGY MULTI-METERING MODBUS

As part of an overall site energy monitoring strategy by the client, smart meters shall be installed under this contract. The proposed meters shall be installed local to each breaker within the main switchboard. The proposed meters shall offer uncomplicated operation and high accuracy measurement of three-phase voltage, current, frequency, Watts, VAr, VA, energy, power factor, and total harmonic distortion measurement of both phase and system, current and voltage.

Each meter shall be complete with a communication bus and operate on Modbus protocol with data transmitted across the schools network for integration with the BEMS installation. The data extracted from the meters shall be transmitted onto the BEMS front end by the controls specialist.

The contractor shall be responsible for obtaining and configuring the required static IP address from the client's service provider in order for the remote monitoring via the BEMS to be fully enabled prior to practical completion. All costs associated with arranging this shall be included at tender stage.

The baseline Modbus meter shall be manufactured by Socomec Diris A20 or equal & approved.

13.11 SUB-SPECIALIST MINIMUM REQUIREMENT CRITERIA

The electrical reserved specialist's proposed switchgear sub-specialist shall meet the below minimum requirements in order for them to be considered for installation on this project. All information shall be provided as part of the switchboard approval process;

- 24hour Emergency call number
- Insurance cover for public liability, product liability and goods in transport
- Technical team at hand to answer any queries
- Switchboard system build accreditation
- Dedicated vehicle suitable for delivering Switch boards
- Employees enrolled with construction skills register (CSR)
- All switchboard delivered in sections and therefore joined and retested shall only be carried out by qualified engineers
- Evidence that adequate glanding and termination facility has been given for the electrical reserved specialist cables
- Evidence that employees are put through a framework training regime (such as cubic) that includes compliance with the manual system build construction course.
- Trackable build procedure for accountability purposes
- Flash test and load test facilities
- Documented rigorous testing procedure
- Documented test certificates issued with every switchboard

13.12 TESTING REQUIREMENTS

The LV switchboards shall go through a rigorous pre-test check list and a thorough testing procedure to ensure that the product reaches the expected standards and safety expected.

Test certificates shall be completed for all switchgear involved in this project and shall be signed off by both the switchboard technician that built the switchboard and the test engineer before final signoff by the director of the company.

All test certification, copies of test sheets records and results associated with this project shall be submitted both in hard copy to form part of the O&M manual and electronic copy.

13.12.1 Testing Equipment

The sub-specialist shall be in possession of the following schedule of equipment in order to carry out the required tests.

- **Primary Current Injection System**
 - Manufacturer T&R test equipment
 - Model – PCU1E & LU3000LP
 - This unit can inject a primary current of up to 3000A when testing over current protection devices

- **Secondary Injection Tester – Full Function Test Kit**
 - Manufacturer – Schneider Electric
 - Model – 33595
 - This unit can secondary test the trip units on Schneider ACB's and MCCB's

- **Flash Tester**
 - Manufacturer – Megger
 - Model – FT4
 - The unit shall produce up to a 4kV test voltage which will expose any breakdown in insulation or short circuits present

- **Digital Microhmmeter**
 - Manufacturer – Megger
 - Model – DLR010
 - The unit shall be a low resistance ohm meter for testing switch contact resistance and bus-bar joints etc.

- **Power Logger**
 - Manufacturer – Fluke
 - Model – 1735
 - The unit shall be used to monitor and log voltage, current, power, power factor and energy over a given time and is a useful tool when analysing energy consumption and verification of metering arrangements.

- **Thermal Imaging Camera**
 - Manufacturer – FLIR
 - Model – E40
 - The unit shall be used to highlight any hot spots or imbalances that may cause premature problems. A perfect preventative maintenance tool to minimize downtime.

- **Ultrasonic Detector**
 - Manufacturer – Ultraprobe
 - Model – Ultraprobe 2000

- The unit shall be used to detect ultrasounds that are produced by arcing and tracking which cannot be seen by the naked eye or by a thermal imaging camera. Arcing, tracking and corona all produce ionization which disturbs the surrounding air molecules. An Ultraprobe detects high frequency sounds produced by these emissions and translates them (via heterodyning) down into the audible ranges. The specific sound quality of each type of emission is heard in headphones while the intensity of the signal is observed on a display panel. Normally, electrical equipment should be silent, although some equipment such as transformers may produce a constant cycle hum, or some steady mechanical noises. These should not be confused with the erratic, sizzling frying, uneven and popping sound of an electrical discharge.

13.13 WARRANTY & SCHEDULED MAINTENANCE

13.13.1 12 Month Warranty

For this particular project, the electrical reserved specialist and his switchgear sub-specialist shall provide a 12 month full warranty and planned maintenance on the new LV switchgear. Testing and maintenance of the products/MCCB's etc. shall be in accordance with manufacturers requirements. All maintenance shall be performed at weekends outside of normal working hours. All costs for including replacement of parts, travel, expenses etc. shall be included at time of tender. A shall be noted that the 12 month warranty period is from the date of PC of the project and not when the switchboard in commissioned on site.

13.13.2 Thermal Imaging

Six months after PC and again prior to the end of defects period and before retentions shall be released, the electrical reserved specialist shall arrange for his switchgear sub-specialist to carry out thermal imaging of the main LV switchboard & kitchen switchgear and all its various components, connections etc. in-situ under 'live' conditions. A full report shall be issued thereafter to the client and consulting engineer. All costs associated with this shall be included at tender stage.

13.13.3 Ultra Sonic Detection

Six months after PC and again prior to the end of defects period and before retentions shall be released, the electrical reserved specialist shall arrange for his switchgear sub-specialist to carry out Ultra sonic detection testing of the main LV switchboard and kitchen switchgear and all its various components, connections etc. in-situ under 'live' conditions. A full report shall be issued thereafter to the client and consulting engineer. All costs associated with this shall be included at tender stage.

13.13.4 Power Logging Tests

Six months after PC and again prior to the end of defects period and before retentions shall be released, the electrical reserved specialist shall arrange for his switchgear sub-specialist to install a power logger within the main LV switchboard and kitchen switchgear and record and monitor all supplies for a minimum of 7days under 'live' conditions. The unit shall monitor and log voltage, current, power, power factor and energy over the given time which shall assist the client analysing energy consumption and verification of metering arrangements. A full report shall be issued thereafter to the client and consulting engineer. All costs associated with this shall be included at tender stage.

13.14 DISTRIBUTION BOARDS

All final-distribution boards shall be selected from the same range, rated for an incoming current of up to 160 A. Regardless of the installation method flush or surface mounted they shall meet the following criteria;

- International standard IEC 60439-3 / European standard EN 60439-3
- The degree of protection, as per IEC 60529, shall be at least: IP30 for enclosures without a door; IP40 for enclosures with a door.
- Enclosures shall provide Class II total insulation (as per IEC/EN 60439-3, section 7.4.3.2) between outer space and all live components inside.
- The impact strength as per IEC 62262 shall be IK08. Large enclosures (24 modules wide) shall be fitted with metal reinforcements to increase the rigidity of equipped enclosures for shipping, handling, installation, etc.
- Access to devices shall be protected by a door with a two-point closing mechanism guaranteed by the manufacturer to withstand a pulling force of 8 kilograms. The door shall be equipped with a closing system locked by a key
- Out-goers will be identified by labels affixed on front of the switchboard, at least 5 cm high, aligned with each device and be of traffolyte type. Access to the inside of the enclosure for maintenance purposes shall be possible row by row, without uncovering any next row.
- Common devices such as measurement and indication devices, pushbuttons, emergency off switches and socket-outlets shall be installed together in the same part of the enclosure and easily accessible to users. For enclosures equipped with a door, access to the above devices shall be possible without opening the door.
- Cable entry to flush-mount enclosures shall be possible for flexible conduits or insulated cables, from all four sides and from the rear of the enclosure. Cable entry to surface-mount enclosures shall be possible from all four sides, for flexible conduits are cable trunking, or from the rear of the enclosure to facilitate subsequent renovations. For cable running in the enclosure, clearance between the rails and the back shall be at least 20 mm for flush-mount enclosures and 35 mm for surface-mount enclosures.

- Enclosures shall be equipped with a removable chassis enabling cabling operations on a workbench, even if the back of the enclosure is already set on the wall. On the chassis, it shall be possible to adjust the height of each rail over at least 2 cm. It shall also be possible to adjust the depth of rails to enable installation of non-modular devices, e.g. moulded-case incoming devices, intermediate terminals, contactors, isolating transformers, etc.
- Chassis installation in the enclosure must be stable and functional even before it is permanently secured by screws.
- Earth and earth/neutral terminal blocks in enclosures shall comply with standard IEC 947-7-1. It shall be possible to install the earth and earth/neutral terminal blocks and distribution devices either at the top or bottom of enclosures, near the incoming cables, in the rear or on rails, e.g. near the RCCBs.
- Terminal blocks shall be designed to secure cables in compliance with standards IEC 60947-1, section 8.2.4, IEC 60998-1 and IEC 60998-2-1. For cable cross-sections up to 6 mm² (rigid or flexible without ferrules), cable connection shall not require tightening by the installer. Terminal-block extensions, e.g. for installation modifications, must be easy to add and dependable.
- The connection between earth and neutral terminal blocks must be rigid and removable only using a tool.
- The colour of the distribution boards shall be metal-like grey for fronts providing access to devices.
- It shall be possible for users to personalise doors without risk of touching live parts (non-transparent, transparent, images, wallpaper, etc.). When a number of enclosures are installed side by side, with or without socket-outlets, the overall system must remain aesthetically and functionally consistent.
- Shall include a fully shrouded and insulated main bus bar assembly, the shrouding over line conductors must be non-removable.
- They shall also include an integral off load switch disconnecter for the electrical disconnection of spare poles and the line terminals of outgoing ways, this would have an inbuilt interlock to prevent inadvertent operation of the switch disconnecter unless an outgoing device is fitted.
- Where boots or similar devices are supplied to cover live parts of spare poles the board will be deemed not to comply with this requirement.
- The integral switch disconnecter is to have a padlocking facility for the off position only
- Incoming connections and outgoing neutral bars shall be supplied complete with insulating cover requiring the use of a tool to facilitate its removal.
- Shall be suitable for different types of incoming device including terminal blocks, switch disconnecter, Moulded case circuit breakers and Residual Current circuit breakers, such that the maximum flexibility is maintained.
- Shall facilitate the protection, disconnection and isolation of all incoming and outgoing live conductors including the neutral, such that routine tests can be performed with the minimum of effort.
- Contain all miniature circuit breakers that have the facility for padlocking in the on and off position and be of the trip free design
- Contain incoming devices that have the facility for padlocking in the on or off position, circuit breakers must be of the trip free design.
- Main bus bars shall have a current carrying capacity of up to 250A.

- Outgoing bus bar stabs shall have a current carrying capacity of 100A.
- Voltage up to 415vAC
- shall be possible to convert any outgoing pole to a neutral terminal, such that it may be disconnected, isolated and protected, along with the associated phase conductors, with the use of a 2 or 4 pole MCB's or miniature circuit breaker with add on residual current protection
- Shall be type tested with the following minimum withstand capacities Unconditional 16kA for 0.2s, Conditional: 25kA
- Phase ways in three phase boards shall be coloured in accordance with the harmonised cable colours and not red/yellow/blue.
- Fitted with deep dividing and insulated fillets between phase banks and the neutral bar.
- Enclosed in an amply proportional heavy gauge enclosure made from 1.2mm sheet steel with covering door of 0.9mm sheet steel secured to the case with hinges and cylinder type lock.
- Fitted with "Traffolyte" labels, one engraved in black to indicate the purpose of the board and another engraved in red "DANGER 400 VOLTS" when accommodating more than one phase, screwed to the outside of the door. Provide with a circuit chart.
- When accommodating more than one phase be fitted with the appropriate phase identification colour disk.
- Provided with double pole 125 amp integral isolating switch where of the SPN consumer unit type or with 3-poles and neutral lug 125 amp integral isolating switch where of the TPN type. (250 amp distribution board shall be used where indicated.)
- Incoming device shall have terminal capacity for proposed cable conductor cross sectional area specified.

In addition to the requirement for accepting standard 1,2, 3 and 4 pole miniature circuit breakers as outgoing units, be capable of accepting the following out-goers;

(A) to BS EN61009.1 Combined Miniature circuit breaker / residual current device of single phase type (1P RCBO's) having the following characteristics:

- B or C curve overload characteristics
- A type classification
- 10mA, 30mA or 100mA sensitivities
- Permanent non-adjustable and non-removable earth fault protection.
- A width of no more than one outgoing pole where the neutral is unswitched.
- Provide residual current protection in the event of a broken neutral through a functional earth connection
- Be able to accept auxiliary contacts, under voltage release or shunt trip.
- Visible tripped indication separate from the toggle operation
- 6kV withstand voltage
- 50 degree calibration on thermal overloads

(B) Combined Miniature circuit breaker / residual current device of three phase type providing protection, disconnection and isolation of all live conductors including the neutral.

- B,C and D curve overload characteristics
- 10000 amp breaking capacity to BS EN 60898
- Class 3 let through energy classification
- 15kA breaking capacity to BS EN 60947-2
- 6kV withstand voltage
- Be able to accept auxiliary contacts, under voltage release or shunt trip.
- Visible tripped indication separate from the toggle operation
- 6kV withstand voltage
- 50 degree calibration on thermal overloads

(C) MCB's combined with a full range of electrical auxiliary devices:

- B,C and D curve overload characteristics
- 10000 amp breaking capacity to BS EN 60898
- 15kA breaking capacity to BS EN 60947-2
- 6kV withstand voltage
- shunt trips.
- Under voltage releases.
- auxiliary switches.
- alarm switches.
- Overvoltage release
- Visible tripped indication separate from the toggle operation
- 6kV withstand voltage
- 50 degree calibration on thermal overloads

(D) Any combination of a, b and c above.

13.15 DISTRIBUTION BOARDS ESSENTIAL & NON-ESSENTIAL STRATEGY

The electrical reserved specialist shall refer to LV schematic drawing for details of how the essential and non-essential loads shall be separated with the use of essential and non-essential distribution boards to ensure that energy usage is minimised during out-of-hours.

The electrical reserved specialist shall ensure that a full suite of discrimination calculations is provided to ensure discrimination is achieved to the final point of failure from source. Essential power supplies have been identified on the contract drawings by (CIRCUIT IN GREEN).

As per DoES guidelines TGD-033/2018, the contractor shall provide a sustainable and efficient method of isolating the non-essential electrical supplies upon the building becoming unoccupied.

The objective of this approach is that all unnecessary electrical load is isolated when the school is shut. The design to achieve this should be developed as an integral part of the electrical system design and not as a single product or manufacturer supplied proprietary solution. As such the following should be considered.

All sub-distribution boards shall be divided into an essential and non-essential side. This shall be achieved by dividing the electrical bus bar into two separate sections, the upstream supply from the main distribution boards supply cable shall connect to the essential section of the board through a series of protective devices and isolation points. A dedicated connection shall then be taken from the essential bus bar and run through a BMS controlled contactor again incorporating a series of protective devices and isolation points. Once passed through this BMS controlled contactor the supply cable shall connect to a non-essential bus bar. It will be from this point that all non-essential services shall be supplied. The BMS System shall signal all of the aforementioned contactors, energising them once the building is occupied, thus allowing conductivity to the non-essential side of all the sub-distribution boards.

Within all sub-distribution boards a suitable quantity of essential services connection points shall be incorporated, to facilitate any future requirement to change the nature of a specific supply from non-essential to essential, including sufficient length on all cables entering the distribution boards to allow for transfer from one side to another. All essential services shall be labelled and coloured appropriately at the field end (essential services to be installed in a contrasting colour to all other services) to eliminate any ambiguity. Essential services shall be indicated on all As-installed drawings.

All essential services shall be demonstrated to both the design team and school management at project handover and all schedules of essential and non-essential services shall be detailed within the operation and maintenance documentation.

The local arrangement includes a “HOA” switch that allows the relay to be manually bypassed. This is an emergency feature so that if the system fails and incorrectly cuts power to an area of the school (for example a relay sticking) then the school can manually bypass the relay. This is a vital feature to ensure the school has the confidence to know that they can easily bypass the system if it does cause a fault.

The essential sockets are identified on the drawings with essential services notation also provided, i.e. (CIRCUIT IN GREEN). The essential services outlets are to be of red colour finish so that the school users know that a red socket will always stay live and can be used accordingly.

A link shall be provided from the intruder alarm system to the BMS so that once the building’s intruder alarm system is armed, after 15 minutes the BMS system shall remove all holding signals and allow all contactors to return to their normally open state, resulting in the disconnection of all non-essential services. The shutdown relays are to be linked to the BMS to retain close control in the school. The BMS will allow for a 15 minute delay after the intruder alarm is set before the vampire load strategy is activated.

The alarm for the GP Room zone should be separately connected so that if the main part of the school has the alarm set at say 5pm but the GP Room continues in use or at the weekend then the vampire strategy will activate in the part where the alarm is set. Function shall be available to have the system automatically respond in specific pre-determined time schedules.

High quality suitably rated heavy duty contactors shall be installed in order to reduce the risk of failure; all contactors shall be a normally closed type. Manual bypasses (Hand/Off/Auto) switches shall be installed in parallel to all dividing contactors so as to provide a manual override function in the event of BMS, intruder alarm or contactor failure. Services deemed essential and non-essential may vary throughout different areas of each school. These must both be scheduled and agreed with the client and the engineer on site.

The electrical reserved specialist shall ensure that school lighting, emergency lighting, communications, security and fire alarm systems shall always be supplied from an essential supply and shall never be disconnected.

It is important that the electrical reserved specialist liaises with the school's IT department to ensure the school's data equipment is appropriate for use with the above system. If schools use LED projectors, then potential for deterioration to lamp performance by the vampire load cut off may be reduced as LED projectors don't deteriorate if the power is cut to them unexpectedly.

13.16 PROTECTIVE DEVICES

Protective devices shall be of the modular type (DIN profile). To maintain the best cost/performance ratio between continuity of supply and safety, all devices shall be from the same range and the same manufacturer:

- Main incoming switches, incoming circuit breakers
- Surge arresters
- Residual current devices
- Miniature circuit breakers

The following specifications shall be met by both residual-current circuit breakers and miniature circuit-breakers:

- All protection devices must be capable of heavy-duty operation in most demanding environment.
- The manufacturer shall guarantee the following performance levels as defined by IEC60947-2 standard:
 - Positive contact indication through a green strip indicator operating independently to the toggle position
 - Pollution degree level 3 (Part 1, section 6.1.3.2)
 - Rated impulse-withstand voltage = 6KV (section 4.3.1.3)
 - Rated insulation voltage = 500V (section 4.3.1.2)
- Fast closing mechanism to ensure the longest possible service life. These closing mechanisms shall be designed to make the contact-closing speed totally independent of the operator's action.

- For a total safety of users, accessible parts of each protective devices, when installed in a suitable enclosure, shall provide both:
 - degree of protection IP40 (as per IEC 60529)
 - insulation class II of the front face (as per IEC 60364)
- Each modular protective devices shall provide a local fault indication, enabling to identify when the device has tripped on fault
- All miniature circuit breakers must be calibrated at 50°C without de-rating of the thermal protection current rating

13.16.1 Surge arresters

Protection of loads against destruction by lightning shall be implemented in final distribution switchboards. Each load shall be protected by a surge arrester located at an electrical distance not exceeding 30 meters.

Therefore, final distribution switchboards shall embed surge arresters compliant with IEC 61643-1 / EN 61643-11 standard. Compliance shall be proved by NF quality label printed on the device.

- The surge arrester, type 2 according to IEC 61643-1 / EN 61643-11 will limit voltage to never exceed :
 - 1,4 kV live to earth
 - 1,0 kV phase to neutral.
- Their operating voltage U_c will not be lesser than 340 V between live and earth as well as phase to neutral.
- They will be made of withdrawable cartridges, with rated maximum discharge capacity 8 kA.
- The surge arresters will be set so as to ensure the distance between its earth terminal and the incoming earth terminal block not to be more than 15 cm.
- Surge protection out of order (missing cartridge, replacement required) will be notified by an indicator on front of the switchgear.
- According to 61643-1 / EN 61643-11, the surge arrester shall be associated with a dedicated disconnecter, the opening of which will not disturb or turn off power supply to any downstream located load. This disconnecter will be made of a circuit-breaker, compliant with IEC / EN 60 898 standard.
- Disconnecting circuit-breaker shall be integrated with the surge arrester: in case of trip, it will be possible to reset it only once all required cartridges have been replaced.

13.16.2 Residual current circuit-breakers

RCCBs shall comply with the following

- International standard IEC 61008 / European standard EN 61008.
- Compliance with the standard shall be certified by the VDE organisation and its quality mark shall be visible on the devices.

- For each device, the characteristics shall be indicated on the single-line diagram as per standard IEC / EN 61008:
 - number of poles
 - rated current
 - rated residual operating current
- The rated making and breaking capacities shall be at least equal to 1.5 kA both for fault currents between live conductors and for earth-fault currents.
- The rated conditional short-circuit currents shall be greater than or equal to the prospective short-circuit current at the point of installation (as per IEC 60364). The manufacturer shall guarantee these values do not differ from the rated breaking capacity of the circuit breaker providing short-circuit protection of the RCCB.
- RCCBs located upstream of the following loads shall have a reinforced level of performance to restrict power outages to the strict minimum required for user safety:
- The reinforcement in performance means that the RCCB shall not trip in the following situations:
 - continuous 1 kHz leakage current, 8 times higher than the rated tripping threshold (as per IEC 60479-1),
 - leakage currents and transient over-voltages due to lightning strikes, switching, decoupling capacitance discharges, etc.:
 - 5 kV peak voltage for a 1.2/50 sine wave (IEC/EN 61000-4-5),
 - 5 kA leakage current for an 8/20 sine wave (IEC/EN 61008),
 - 400 A leakage current for a damped sinusoidal 0.5 sine / 100 kHz ring wave (IEC/EN 61008),
 - residual current equal to 5 times the rated residual operating current for a duration less than or equal to 10 ms
 - Very high-frequency inducted or conducted disturbances (starting at 150 kHz).
- The RCCBs must trip for fault currents with a DC component (type A as per IEC 60755).
- The same is required of residual current devices located downstream of UPSs.
- RCCBs protecting three-phase variable-speed drives shall be type B as per IEC 60755.

13.16.3 Circuit breakers protecting final-distribution circuits

Circuit breakers shall comply with the following;

- International standards IEC 60898 and IEC 60947-2 / European standard EN 60898 and EN 60947-2. Compliance with these standards shall be certified by the VDE organisation and its quality mark shall be visible on the devices.
- For each device, the characteristics shall be indicated on the single-line diagram as per standard (IEC / EN) 60898:
 - number of poles

- rated current
 - breaking capacity
- Type according to the instantaneous tripping classification
 - The specified values of breaking capacity shall be also be valid in case of short circuit between phase and protective earth
 - If not specified on the diagram, the breaking capacity shall be 6000 A minimum.
 - Circuit-breakers shall be capable of operation under ambient temperature up to 50 °C, without de-rating of their overload tripping threshold with respect to their rated operating current.
 - Circuit breakers rated up to 32 A shall be the current-limiting type (category 3 as per EN 60898 appendix). For circuit breakers rated 16 Amps, the thermal stress during a short-circuit, dissipated in the concerned circuits shall not exceed:
 - 16000 A for a prospective short-circuit current of 6 kA rms (400 V three-phase)
 - 25000 A for a prospective short-circuit current of 10 kA rms (400 V three-phase).
 - Where the line supplying the switchboard is protected by a circuit breaker rated 125 Amps or more, the protection provided by this one shall be totally selective with respect to circuit breakers located in the switchboard (up to 63 A, type B or C).
 - In compliance with international standard IEC 60364 / European standard EN 60364 / national standard, section 411.3.3, sub distribution circuit breakers protecting general-usage socket-outlets with rated current not exceeding 20 A should provide additional protection against direct contacts. These devices shall comply with international standard IEC 61009 / European standard EN 61009 / national standard ...1009 and shall have a rated residual operating current of 30 mA.

13.16.4 Baseline Reference Protective Devices

Schneider Acti 9 Family

13.17 LABELS AND CIRCUIT CHARTS

Engraved labels shall be provided indicating the purpose of any switch or control device. The description (*agreed with the Engineer*) shall be solid W/B/W 'Traffolyte' type. ('Dynotape' or other non-permanent labelling will not be accepted).

Typed or printed circuit charts shall be provided, Perspex covered and fitted to the inside of each distribution board access door. Each chart shall indicate final circuit designation, type of phasing, type of protective device, maximum earth loop impedance, and the test value of the earth fault loop impedance. Each chart shall also include the short circuit rating of the equipment or design value and the external loop impedance design value at 20°C.

13.17.1 Labelling of all outlets

The electrical reserved specialist shall include for traffolyte labelling of all electrical outlets throughout the building, including all socket outlets, light switches, isolators, spur outlets etc. Each label shall be securely fixed to the respective outlet. Adhesive labelling shall not be acceptable. Each label shall convey where the circuit is supplied from, it's circuit number and phasing and finally the nominal rating of the protective device in question. E.g. DB1/1L1/10 for a 10amp circuit supplied from distribution board DB1, which is the first single-phase circuit within this distribution board connected to the 'L1' phase.

13.18 MULTIPHASE CIRCUITS

The electrical reserved specialist shall ensure that the electrical loads are circuited and connected as indicated over the three phases. Where required phase barriers and warning labels as detailed in BS 7671 shall be supplied and installed.

All plant or switchgear containing two or three phase circuits at a voltage greater than 250V shall be marked with a Red Danger label declaring the nominal voltage.

13.19 DRAWINGS FOR APPROVAL

The electrical reserved specialist shall forward detailed drawings showing wiring details and distribution board layouts to the Engineer prior to manufacture. Drawings shall be available in AutoCAD 2014 format, .dwg files.

Approval of such drawings shall not however, exonerate the contractor for any malfunction or deficiency in meeting the specification requirements in the boards that may become apparent only after it has been brought to site and energised.

13.20 HEALTH AND SAFETY INSTRUCTIONS FOR ELECTRIC SHOCK

The electrical reserved specialist shall provide 'electrical review' first aid charts, 508mm x 381mm, wall chart for dealing with electric shock, located at each switchboard and adjacent to each sub-board.

13.21 TIME SWITCHES

Time clocks shall be digital, 16A rating with minimum 4 No. channels, which are 24 hour 7 days controllable and wall-mounted as indicated on the contract drawings. The clocks shall be wall-mounted such that they are accessible for adjustment without opening any switchboard panel or door. Terminals shall be available for connection of the remote mounted HOA switches. Time clocks/switches shall not be DIN rail mounted or integral to main switchboard. Time-switches shall incorporate voltage-free contacts for all channels. The time-clock shall be provided with a labelling legend to denote exact function of each channel.

13.22 ARC FAULT DETECTION DEVICES AFDD'S

The contractor shall make an allowance in the distribution board sizes for the installation of Arc Fault Detection Devices on all power circuits.

14 62 POWER SUPPLY & DISTRIBUTION

14.1 GENERAL

The electrical reserved specialist shall supply and install all cables, cable trays, trunking, conduits etc., and accessories to provide a complete and working distribution and wiring system generally as described hereafter and as indicated on the contract drawings. All cables shall be LSF (LSZH) insulated.

During the site visit, the contractor shall ascertain existing & proposed containment routes.

Containment installations shall be continuous throughout their duration at all times and shall be earth bonded throughout in accordance with NSAI I.S. 10101: 2020. Containment shall be mounted with lidded side facing upwards at all times. Under No circumstances shall any electrical containment be installed lid side facing downwards. If such incident occurs the electrical reserved specialist shall be requested to remove and reinstall to engineers approval as No additional cost.

14.2 XLPE/SWA/LSF DISTRIBUTION CABLES

All sub-mains and all other distribution cables shall be complete with separate circuit protective conductor (CPC) fixed to the sub-main cable by means of cable ties at 300mm intervals. Separate CPC's shall be sized in accordance with the drawings and NSAI I.S. 10101: 2020:.. Cross sectional areas (CSA's) of the various sub-main cables and other final circuit cabling shall be as detailed in respective sections of the specification or as indicated on the electrical distribution schematic.

All sub-mains shall be laid on cable tray, ladder and basket.

XLPE/SWA/LSF cables shall be:

600/1000 volt grade of the sizes detailed in the schedules/drawings with high conductivity plain copper wires.

Insulated with extruded XLPE

Cores shaped, numbered or coloured for identification and sheathed with LSF.

Armoured with a single layer of galvanised steel wires, sheathed overall with LSF. (Not in the case of Hi-Tuf cable).

Shall be manufactured by Draka UK Ltd, or equal and approved.

It is the responsibility of the contractor to ascertain all cable routes and distances associated with the site and buildings in general. No claim shall be entertained due to lack of knowledge regarding the layout of the site & buildings, ceiling structures and location of the main switchboard proposed distribution boards. For the purpose of tendering, the contractor shall allow for 30M per sub-main cable extra length than the indicative routes highlighted on the drawings.

Conductors shall be plain annealed copper with XLPE insulation. Bedding shall be thermosetting low smoke and fume compound. Armour shall be galvanised steel wire with an LSF thermosetting compound sheath.

Manufacture shall be to BS 6724, insulation to BS 6724, armour to BS 1442, Sheath to BS 6724 and shall comply with BS 4066, Pt 3 and IEC 332, Pt 3 Cat C flame tests. Conductors shall be circular or shaped, stranded or solid as determined by cable sizes.

All cabling shall be manufactured by a BASEC approved manufacturer.

14.3 LSF (LSZH) INSULATED CABLES FINAL CIRCUIT CABLING

LSF (LSZH) insulated stranded copper cable shall be used for sub-circuit wiring (230/400 volt) throughout the premises and shall be: -

600 volt grade.

Completely enclosed in Class 4 surface-mounted galvanised conduit or in dedicated mains only galvanised steel trunking system.

In accordance with BS 6004, BS 6231, type B and BS 6346.

Manufactured by BICC Ltd 6491B or equal and approved.

10 amp lighting circuits:	2.5mm ² /2.5mm ² CPC
16 amp radial circuits:	4.0mm ² /4.0mm ² CPC
20 amp radial circuits:	4.0mm ² /4.0mm ² CPC
32 amp radial circuits: (non cooker ccts)	6.0mm ² /6.0mm ² CPC
32 amp radial circuits (cookers)	10.0mm ² /10.0mm ² CPC
10 amp radial circuit (general):	2.5mm ² /2.5mm ² CPC
10 amp radial circuit (exterior lighting, facade):	2.5mm ² /2.5mm ² CPC
10/16 amp radial circuit (exterior lighting, columns)	6.0mm ² /6.0mm ² CPC

14.4 FIRE RESISTANT CABLING SYSTEMS

The electrical reserved specialist shall note that enhanced grade fire resistant cable with PH120 class shall be used throughout and loops shall only be wired using 2-core cable. A fire resistant cable with a lesser PH classification than PH120 and if not of enhanced grade status shall not be permitted on this project. The cable shall comply with the following circuit integrity standards:

- BS 5839-1:2002 Clause 26.2e Enhanced.

- BS 8434-2:2003.
- BS EN 50200 PH120.
- BS 6387 C, W & Z.

600/1000 Volt Grade stranded

2-hour Fire Rating according to IEC 331 Sheath Colour Red for Fire Alarm System Wiring Indication

2 Core & Earth Type

All cabling shall be manufactured by a BASEC approved manufacturer.

Cables shall be installed strictly in accordance with the manufacturer's requirements.

In summary enhanced fire resistant cables shall be installed as other non-metallic sheathed cables: -

Within voids they shall be clipped direct using metallic 'P' clips (to meet clause 26.2 of BS5839 for fixing of fire cable) to the underside of the floor slabs/structure at 300mm intervals or 500mm intervals if fixed to wire tray (using metallic cable tie straps). No other forms of fixing shall be acceptable. Fire alarm cabling shall be completely segregated from electrical services at all times. Prior to installation commencement the agreed fire alarm fixing method shall be agreed with the engineer. I.e. Clipped direct or a complete closed galv and tray/trunking installation. Open conduit installation shall not be acceptable.

Where conduits terminate into the control panel base, couplers and brass bushings with lead washers shall be utilised.

At each detector base, a galvanised throughway/U box is required in conjunction with 20mm PG glands, (colour = red), for safe, secure and tidy termination of the fire alarm cabling. Detectors shall be supported by bridging supports and under no circumstances should they rely solely on the ceiling slab for support.

Where located below ceiling level, all fire alarm cabling shall be contained within galvanised conduit – at all times. All drops to sounders, beacons & manual call points shall be made in 25mm flush mounted galvanised conduit. The contractor shall install surface boxes and the use of flanged couplers and brass bushings with lead washers is required.

Fire alarm cabling shall be at least 300mm apart from 230V mains cabling in all circumstances.

The cables shall be in accordance with IEC 331, BS 4066, BS 6387 Part 1 and IEC 332 Part 1 and Part 3.

They shall be screened to provide 100% protection from external electro-magnetic interference.

The cables shall have low smoke emission, low toxicity and shall not propagate a fire. They shall be halogen free and have flame retardant properties to BS6425 Part 1.

14.5 MULTI-COMPARTMENT TRUNKING INSTALLATION

The electrical reserved specialist contractor shall allow for the provision of a multi-compartment trunking system installation for the containment of 230VAC circuits extra-low voltage cabling (ELV) in separate compartments. Sufficient spare capacity shall be provided on all trunking systems to ensure that a minimum of 50% free capacity exists on all trunking systems. It shall be the reserved specialists responsibility to ensure that all containment systems are appropriately sized to meet this requirement. Indicative minimum sizes maybe provided on drawings for design intent purposes however this shall not shed the responsibility of correct sizing by the electrical reserved specialist taking into account such items as cable group factors etc.

Gusset bends shall be used at all changes in direction. All lid sections shall be fitted with at least 2 toggles. Indicative trunking sizes are indicated on the contract drawings.

The trunking shall be manufactured from 1.2mm galvanised sheet steel with inwardly turned flanges and overlapping covers and be complete with all necessary accessories i.e. couplers, end plates, bends, cross-overs, junction units etc. to give a complete and working installation. All interconnections shall be factory manufactured and the production of 'On-site' manufactured connections shall not be permitted. Copper links shall be provided on trunking to ensure electrical continuity by means of tinned copper secured by screws, nuts and shockproof washers. Where containment passes through walls and floors internal fire barriers shall be fitted such as fire rated pillows. A proprietary fire barrier such as Hamron shall be used and under no circumstances will 'Rockwool' or fibre glass wool be acceptable. All fire barriers shall be traffoylte labelled on the trunkings as detailed elsewhere in the specification documents.

All trunking shall be fixed to the walls or hung from the roof or floor structure via Unistrut brackets and 12mm diameter threaded bar at no greater than 1-metre intervals so as not to allow more than a 6mm deflection at any point on a horizontal run. Structural steel beams may be utilised where practical. Under no circumstances shall the suspended ceiling be utilised to support containment. Trunking shall be mounted with the lidded side facing upwards at all times.

Indicative main service routes are shown on the contract drawings. The contractor shall include for the completed containment installation throughout the entire project. It shall not be acceptable to install cabling without containment.

14.5.1 Dedicated Induction Loop Trunking

N/A

14.6 CAPACITY FACTORS

Sizing of trunking and conduit shall be carried out in compliance with Annex 52A of NSAI I.S. 10101: 2020:, which deals with conduit and trunking capacity factors. It is the responsibility of the reserved specialist electrical contractor to ensure that space factors are not exceeded. They shall be deemed to have taken account of this in his tender price and no adjustment to the tender price will be accepted for his failure to do so.

14.7 STEEL WIRE CABLE BASKET/TRAY

Steel wire cable baskets shall be used for structured cabling and sub mains and shall be: -

Manufactured from steel wires welded together and bent into final shape prior to surface treatment. Surface shall be galvanised with between 60 and 80 microns of zinc to BS 729:1971. Complete with all tees, elbows, crossovers, risers, reducers, supports and brackets etc.

Heavy duty with a depth as indicated on the contract drawings.

Baskets of 50mm to 200mm widths will have steel wires with a minimum diameter of 4.5mm. All other baskets will have steel wires with a minimum diameter of 5mm. 400mm and 500mm width baskets will include longitudinal wires with a diameter of 6mm and 7mm respectively, excluding the safety edge. Basket will be constructed with a 50mm x 100mm mesh configuration. All basket fittings (e.g. bends, risers, tees, crosses, reducers etc.) shall be manufacturer proprietary constructed fittings and only where not available, fabricated on site using side action bolt croppers and fastened using 25mm and 30mm counter clamps with M6 bolts and nuts, all surface treated as above. Baskets internal depth shall be 64mm. All bends shall be gusset pattern, neatly fitted and formed. Right angle bends are not acceptable. All sections of basket shall be bonded to achieve earth continuity across the entire cable basket system using the manufacturer's proprietary earthing links.

Basket shall be supported at manufacturer's recommended intervals using heavy duty ceiling pendants and brackets and will not exceed maximum spacing of supports to be 1.0m.

Cable ladder shall be used to support sub-mains cables where indicated on the drawings.

14.8 SUPPORT FOR WIRE CABLE BASKET AND TRUNKING

The electrical reserved specialist contractor shall allow for the provision and installation of a suitable support and suspension system to carry all trunking and basket installations throughout. This shall be achieved by means of suitably sized proprietary Unistrut hanger/suspension support system. These hangers shall be spaced at intervals of not greater than 1.0m and when fully loaded shall not deflect more than 5mm between supports.

Where installed in ceiling voids, all trunking & basket shall be suspended so as not to allow more than a 5mm deflection at any point on a horizontal run using Unistrut brackets secured to the underside of the floor slab using threaded rods cut to length. Where installed in roofspace, upstands fabricated in Unistrut shall be utilised to support the containment off the ceiling structure by a minimum distance of 200mm to the underside of the containment. It shall not be acceptable to lay containment directly onto the ceiling structure (e.g. the joists).

The components which comprise the cable basket/trunking support system shall be as manufactured by Boss Flamco, Unistrut or equivalent. The hangers shall be constructed from galvanised steel and shall be screwed to the building fabric. The threaded rods shall be 10mm diameter (minimum) mounted and fixed using anchors (or equivalent) suitable for each application. Unistrut shall generally be 41x41mm.

Trunkings & wire baskets/trays shall be installed face-up at all material times.

14.9 GALVANISED STEEL CONDUIT

All sub-circuit wiring where not concealed in galvanised trunking shall be contained within galvanised conduit.

Galvanised steel conduit shall comply with the following:-

Screwed heavy gauge hot dipped galvanised inside and out Class 4.

In accordance with BS 4568.

Manufactured by Walsall Conduits or equal and approved.

14.10 FINAL CONNECTIONS

All items of fixed equipment shall be provided with suitably sized final connections complying with the following:-

Heat resistant flexible cables enclosed in surface mounted galvanised steel conduit shall be utilised where connecting to a heat emitting appliances/equipment.

Final connections to all pumps, fans items of plant which vibrate etc. shall be carried out from the local isolator using LSF cables enclosed in IP65 rated PVC sheathed flexible metallic conduit as per Kopex or Adaptaflex.

14.11 DADO-TRUNKING

White dado trunking shall be installed as follows and located where dado trunking is indicated on the drawings: -

Mounting heights for dado-trunking shall be 100mm above working plane level throughout. Drops to feed dado trunkings shall be made in dado-trunking and not conduit. The contractor shall allow for 1 no. drop to each piece of dado trunking unless otherwise indicated on the contract drawings. Final positions of dado trunking drops shall be agreed on site with the engineer. 35mm steel flush boxes with earth tags shall be used for all outlets throughout.

The contractor shall ensure that the chosen manufacturers fittings such as bends, risers, tees, couplers, end-caps, internal and external 90 degree bends etc. are used throughout to ensure a dado-trunking installation, which is pleasing to the eye and unobtrusive. Poor workmanship associated with the dado-trunking installation shall not be accepted and shall be rectified at the contractor's expense. Bends fabricated on site shall not be accepted, manufacturer's fittings to be used at all times.

All dado trunking shall be grey finished in colour and end-caps shall be complete with the manufacturer's screw fittings for added security. The base shall come pre-drilled and the system complete with clip-in steel (compartment) dividers. The end cap shall comprise a single component to cover all three compartments. Separate end-cap pieces for each compartment shall not be permitted.

A minimum of 3-compartments shall be provided in all dado-trunkings.

Minimum dimensions 180mm x 75mm deep with inserts to facilitate CAT6A structured cabling manufacturer's bending radii.

At each instance of dado trunking, cables shall transfer from the containment in the ceiling void into the dado trunkings using galvanised steel conduit which shall be terminated (coupled) into the end-cap of the vertical trunking piece (within the ceiling void). Flexible conduit shall not be permitted. A minimum of one spare conduit link shall be provided for future wiring.

All socket outlets; telephone outlets, etc shall be flush mounted on the trunking and to be fitted onto matching outlet plates.

Site cutting of trunking and lid shall be kept to a minimum but, where it is necessary to carry out cutting on site, a suitable saw shall be employed to give gap free joints.

The contractor shall include for all necessary fixtures and fittings, lids, end caps etc. to complete the installation to the satisfaction of Semple and McKillop Ltd.

Dado trunking shall be suitable for the installation of CAT6A structured cabling and shall facilitate termination of all such cables and shall not require bending radii greater than the manufacturers requirements. The contractor shall include for all CAT6A inserts and all components necessary for the complete installation.

14.11.1 Power associated with Sanitary Facilities

Wiring and power provisions for intermittent extract ventilation and associated controls shall be provided sanitary facilities as indicated on the drawings. Refer to the mechanical specification and drawings for further information and make all due allowances to achieve the required operation of the system in each case.

In Toilets/Showers for Assisted Users power outlets shall be provided to facilitate a final connection to a height adjustable bench and to facilitate charging of the lift cassette/charger station on a ceiling/wall mounted overhead tracked hoist system shall be provided in suitable locations to be co-ordinated by the contractor on site. Concealed conduit drops to these outlets should be coordinated to ensure the equipment is fully workable. Refer to DoES TGD-021.3 Guidelines & Standards for Sanitary Facilities in Post Primary Schools for further guidance.

14.11.2 Power at Drinking Fountain

A double socket shall be provided near each drinking fountain to facilitate power to the fountain and to a vending machine.

14.11.3 DCC Room Ventilation

The extract fan in the DCC room shall be wired and provided with a power supply and control wiring in accordance with the manufacturer's requirements and shall be controlled by a lockable thermo-switch.

A sign shall also be provided in a prominent location in the DCC advising the school authority to regularly check that the fan is operating satisfactorily and that failure to do so may result in the DCC over heating and valuable ICT equipment being damaged in the event of the fan not working etc. This information shall also be included in the O&M manuals.

15 62 GENERAL SOCKET OUTLET AND FIXED POWER INSTALLATION

15.1 GENERAL

The contractor shall provide and install throughout the project a general-purpose socket outlet and fixed power installation as indicated on the drawings.

The contractor shall utilise the trunking, tray and dado trunking installations as specified earlier as necessary to supply socket outlets or items of fixed power.

Where socket outlets are not shown mounted on dado-trunking they are deemed to be surface mounted using 35mm deep surface boxes.

Wiring to ALL socket outlets shall be carried out in single core LSF 6491B cables forming radial circuits. Dual earths shall be provided to all ICT lab circuits.

All fused connection units, double and triple pole switches shall match in style the socket outlets in that area in which they are installed and shall be engraved with the name of the equipment or appliance being controlled e.g. fan, fridge, heater etc. with the use of Traffolyte labelling. Plastic adhesive type peel-off labels shall not be acceptable and poses an H&S risk to this particular client.

All socket outlets shall be protected by Type B 30mA RCBO's and the use of a common RCD in conjunction with individual MCB's shall not be acceptable on this project.

15.2 GENERAL POWER ACCESSORIES

All equipment supplied and installed shall conform to EN 29000 and BS 5750 in regards to manufacturing processes and quality. All Accessories fixed on dado trunking shall be dark in colour to achieve LRV value >30 in all instances and shall have outward bound rockers. If the LRV value cannot be achieved with the outlet and the background, then the contractor shall install back plates onto the sockets to achieve the LRV >30. Plastic accessories not acceptable. Approval in writing shall be received from the engineer before product orders are placed.

In instances where there are surface outlets, the reserved specialist shall provide matching steel surface back boxes in terms of colour and material (**without knockouts**) throughout which have depths of 35mm. One-gang, two-gang and dual back boxes shall be used where appropriate. Flange couplers shall be deployed throughout

The following items have been described with relevant European standards, where applicable, to indicate the performance and quality of their product. British Standards shall apply in cases where such Irish and European Standards do not exist. Where electrical equipment has not been detailed previously in this specification or on the drawings the following minimum standards will apply as outlined hereafter.

The small power installation shall be a flush installation in accordance with TGD 026, therefore most accessories shall be from the flush range of products.

15.2.1 13 Amp Switched Socket Outlets

General socket outlets shall be of the surface mounted type where applicable, but primarily shall be of the flush range, double-pole switched, out-board rockers, with dual-earth terminals to provide high-integrity earthing and in compliance with BS 1363 with suitable back boxes without knockouts.

15.2.2 USB Type A & C Outlets

The contractor shall refer to Electrical Specification Part 4 for information on the socket outlets with USB Type A&C outlets. The contractor shall allow for 50% of all socket outlets in the building to be complete with USB Type A&C outlets.

15.2.3 13 Amp Fused Connection Units

Fused Connection Units shall be switched/unswitched and in compliance with BS 1363. The fused connection unit shall be provided with a neon indicator as necessary depending on its purpose and the equipment served and as indicated on the drawing. They shall comply with BS 1363 and be fused on the supply line. Dimensions shall be 86mm x 86mm with the flex outlet up to 10mm outside diameter.

15.2.4 20 Amp Double Pole Switches

These shall be provided with a switch and neon indicator as necessary depending on item of equipment to be served. They shall comply with BS 3676 and be complete with earth terminals. Dimensions shall be 86 mm x 86 mm max.

15.3 WIRING OF MECHANICAL SERVICES

It shall be the responsibility of the electrical reserved specialist to wire mechanical equipment and plant as detailed on the contract drawings. The electrical reserved specialist shall pay particular attention to the mechanical controls drawings and narrative, which shows all wiring to be installed and wired back to the BEMS control panel within the building. The electrical reserved specialist contractor shall supply and install all associated cabling to the positions indicated on these drawings. The electrical reserved specialist shall refer to BEMS section of the specification for details of the controls.

The electrical reserved specialist contractor shall liaise with the mechanical reserved specialist throughout the duration of the contract. No claims shall be entertained due to failure on the part of the contractor to co-ordinate the installation of these respective services installations.

The electrical reserved specialist contractor shall provide a complete a 2-compartment trunking system around the perimeter of the boiler house at high-level. All cabling shall be LSF enclosed in galvanised conduit. The trunking shall be fixed to uni-strut brackets which in turn are fixed to the walls at high level to ensure that conduit drops can pass behind the trunking. Fixing the trunking directly to the walls without upstanding uni-strut brackets shall not be acceptable.

15.3.1 Sanitary Facilities (Toilets, Showers, Changing Rooms)

The electrical reserved specialist contractor shall include for wiring, power supply and final connections to intermittent extract ventilation and associated controls systems within all toilets, showers & changing rooms of the proposed project. Each facility shall be protected by individual 20A/30mA RCBO's and have local isolation provided by a 20A double-pole switch. All equipment shall be connected with 3x2.5mm² heat resistant flex throughout.

15.3.2 Water Heaters

The electrical reserved specialist contractor shall include for wiring, power supply and final connections to all water heaters. Water heaters shall be protected by individual 20A/30mA RCBO's. Each water heater shall have local isolation provided by a 20A double-pole switch as indicated on the drawings. Water heaters shall be connected with 3x2.5mm² heat resistant flex.

15.3.3 Hand Dryers

The electrical reserved specialist contractor shall include for wiring, power supply and final connections to all hand dryers.

15.3.4 CO2 Sensors

The electrical reserved specialist contractor shall refer to the mechanical specification for further detail of and refer to specialist for exact wiring details.

15.3.5 Temperature Sensors

The electrical reserved specialist contractor shall refer to the mechanical specification for further detail of and refer to specialist for exact wiring details.

15.3.6 Ventilation Toilet/Bathroom Extract Fans

The electrical reserved specialist shall be aware that the operation control of all ventilation toilet/bathroom & changing areas extract fans will be via the lighting controls PIR within each space. This will require the electrical reserved specialist to engage with the Dynalite controls specialists at tender stage and ensure that they have included for the supply, install & commissioning of all necessary 2-channel relay controllers required to interface between each local PIR and each mechanical fan within the project. Each controller shall be installed inline between the fan power supply and the fan. Each control unit shall be powered by the fan supply and the switched live shall be utilised to switched on / off each fan. All infrastructure and wiring requirements with this arrangement shall be included at tender stage including bus cabling connections between each relay controller and local Dynet network.

15.4 HOLD OPEN DEVICES

The electrical reserved specialist contractor shall be aware that all ironmongery items relating to door hold open devices, motorised doors, access doors such as mortice locks, geze over door arms, abloy locks etc shall be supplied and installed under the main contract by others but shall wired by the electrical reserved specialist under this contract. All costs associated with such items including sundry items shall be included in this tender. All connections to the installation shall be checked and verified by the supplying specialist contractor before switch-on or test.

Each door system, on every corridor door, shall be locally isolated by means of a fused connection unit, engraved, indicating non-flex outlet pattern on all doors. A fire alarm interface unit shall be provided at each hold open device.

Further detail of all ironmongery schedule and equipment can be obtained from the project architect/main contract documents.

15.5 WIRING TO MACHINERY, APPLIANCES & FITTED FURNITURE

All machinery in the various specialist rooms (if applicable) shall be wired and final connections made by the electrical contractor. All isolators and power supplies indicated to be provided by the contractor.

Where machines are located away from walls e.g. in an island/central position, the contractor shall include for providing a drop to each machine from ceiling level in Unistrut to facilitate wiring provisions and isolator mounting plates unless underfloor ducting has been requested.

16 62 PHOTOVOLTAICS INSTALLATION (PV)

16.1 INTRODUCTION

It is proposed to install a Photovoltaic (PV) Array. The PV system shall be a building integrated and grid-connected system and operate in parallel with the grid network.

The contractor must liaise at an early stage with the switchboard specialist and ESB Networks to ensure compatibility with local electrical system and grid connections.

The contractor is responsible for completion of ESB Networks NC7 form for Micro Generation. It is important that this form is completed and submitted to ESB Networks prior to energising the Solar PV Array. Failure to complete this vital part of the works may result in retention of payment.

The PV Array is to be installed on the roof space of the proposed new building as indicated on the contract drawings. The PV Panels are to be fixed to the roof structures only and not ground mounted.

The PV array is to be installed on the roof space with a minimal acceptable peak power rating using 99No 430W panels. **The delivered annual generation should be no less than 42,570kWh/yr.**

The contractor must appoint a suitably experienced design build PV contractor to complete the project in accordance with this technical specification.

Recommended PV supplier for this project are:

Rexel or equivalent

The Contractor shall take into consideration all the detailed information contained in the following sections.

16.2 FAMILIARIZATION WITH THE SITE

The contractor shall make themselves aware at an early stage of the location and orientation of the roof surface where the PV array is to be installed. The contractor shall make all due allowances at tender stage as no allowance for lack of knowledge shall be entertained Tender.

16.3 SCOPE OF WORKS

- The design and installation of a building integrated, grid-connected PV system.
- The works shall include the installation of the PV panels and associated electrical and structural work to support the panels on the roof.
- The system shall have a minimum power rating of 50kWp
- Inclusion of a suitable Fall Prevention (Fall Restraint) system MAY be included for future maintenance works, cleaning and general access to the system.

- A safe walking edge of 2400mm minimum shall be maintained from the apex of the roof to the top edge of the arrays and from the bottom edge of arrays to the eaves of roof (provided that full scaffold is installed). If open face, the distance from the roof edge will be 2000mm.
- Free walking space of 900mm minimum shall be maintained between PV system sections.

16.4 TENDER DRAWINGS

See contract drawings for details of the installation.

16.5 PROGRAM OF WORKS

The Contractor shall submit to the Engineer his planned timeline and a full method statement for the execution of the required.

16.6 DESCRIPTION OF BUILDING

The building consists of new school with a pitched roof section and a flat roof section. It is proposed that the new PV array be mounted on the flat roof section, with all inverter packs and associated equipment being located on the wall adjacent to the PV array. Contractor shall refer to architect's sectional drawings for more details.

16.7 ROOFTOP SPECIFICATIONS:

Parameter	Description	Comment
Location	Drogheda, Co. Louth	
Roof Type	Flat roof	
Roof Array Size	180m ²	
Roof Age	New Construction	
Roof Pitch	0 deg with 10 degree slope on panels	
Azimuth Angle	24 degree	
Shading Factor	0.96	
Rooftop Access	Walkway and Fall Arrest System	
Building Demand	53,750_kWh/yr	

16.8 ELECTRICAL DISTRIBUTION

The building is supplied with a 400V 50Hz 3-phase ESB supply. The utility metering arrangement and main switchboard are located in the new customer switch room adjoining the ESB sub-station to the west of the new building. A proposed new full containment system shall be installed to facilitate the distribution of all electrical cables back to this location.

The contractor shall be responsible for all tie-ins between the main switchgear and the proposed Solar PV equipment, including but not limited to the following:

- Liaise with ESB and complete ESB NC5 form on completion of installation.
- All additional roof mounted containment.
- Bigfoot system for mounting containment on.
- Fixing points and brackets as outlined within.
- Inverter packs to convert DC generated power into AC.
- Protective devices and Isolation switches for PV system as outlined within.

16.9 BACK-UP GENERATOR

NA

16.10 STANDARDS & GUIDELINES

The PV System shall be installed to the relevant Standards below and to the satisfaction of the Employer's Representative and the Supervising Engineer.

The installation must comply fully with the relevant Codes of Practice, Planning and Building Regulations and design specification. Attention is drawn to important sources of relevant information. Where Irish standards are not fully developed, additional design specifications may be drawn from UK or European codes of standards as detailed in the sections that follow:

1. Government statutory laws and regulations
2. Planning Regulations
3. National Buildings Standards and Codes
4. Health and Safety Authority Publications
5. Workplace Safety and Health Management, Practical Guidelines on the Implementation and Maintenance of an Occupational Safety, Health and Welfare Management System, Health and Safety Authority, 2006, ISBN 1-84496-033-1.
6. Code of Practice for Safety in Roof work, Health and Safety Authority, 2011 ISBN 978-1-84496-147-4.
7. Additional solar specific guidance for roof work is available from the UK Construction Skills document.
8. The System Supplier/ Product Manufacturer Guidelines
9. IS EN 61730-1:2007+A2:2013: Photovoltaic (PV) Module Safety Qualification Module Safety Qualification

10. IS EN 61215: 2005: Crystalline Silicon Terrestrial Photovoltaic (PV) Modules, Design Qualification and Type Approval
11. IS EN 60904-1: 2006: Photovoltaic Devices – Part 1: Measurement of Photovoltaic Current-Voltage Characteristics
12. IEC 61853-3 : Performance testing and energy rating of terrestrial PV modules
13. CITB- Construction Skills Solar Panel Installation
14. Leaflet GS001 11/12 in partnership with the Health and Safety Executive
15. NSAI I.S. 10101: 2020:, National Rules for Electrical Installations
16. I.S. HD 60364-7-712:2006 Electrical Installations of Buildings – Part 7-712: Requirements for Special Installations or Locations – Solar PV Power Supply Systems
17. ET201: 2009, Good Practice Guide on the Management of Electrical Safety at Work
18. General Conditions for Connection of Industrial and Commercial Customers and Generators to the Distribution System, ESB Networks, Document No: DTIS-150200-AXY
19. SEAI – Best Practice Guide – Photovoltaics (PV)
20. MCS – ECA Guide to the installation of Photovoltaic Systems (UK Industry Code)
21. IET Code of Practice for Grid Connected Solar Photovoltaic Systems (latest version UK Code including commercial system installations)
22. IEC 62446-1:2016 – PV Systems Requirements for Testing, Documentation and Maintenance.

16.11 INTEGRATION OF PV INTO ELECTRICAL GRID

The Contractor shall liaise with the ESB Networks in the design and build phase to ensure full compliance with the guidelines set down by the ESB licensing requirements.

The Contractor shall ensure the steps laid on the line www.esb.ie/esbnetworks/en/generator-connections/genconnectionexport.jsp are followed. The Contractor shall furnish the Engineer with a copy of all ESB related documentation prior to construction works starting.

The system shall comply with Embedded Generation Interface Protection (EGIP) standards as required for ESB assessment and compliance certification. The Contractor shall also include for the supply and installation of a suitable interface with the ESB grid.

16.12 MPRN FOR THE LOCATION:

The Contractor shall familiarise themselves adequately with the electrical distribution network for the proposed building and allow for any required works to connect the PV array safely into the proposed network. The Contractor shall present an electrical schematic of the proposed plan for connection following the award of the Contract. All work shall be certified as per the Electro Technical Council of Ireland (NSAI I.S. 10101: 2020) regulations and shall be permanently marked as to their function.

16.13 LABELLING

The system components must be identified with legible and durable labels to the standards of IEC 62446, identifying:

- DC Cabling
- DC Plugs and sockets
- DC switch-disconnector
- AC switch-disconnector
- Inverters
- Points of connection to the AC grid (Dual Supply Label)

16.13.1 Photovoltaic Modules

Solar PV modules must be certified to the appropriate European and Irish Standards and shall be CE marked. Modules must be provided with datasheets that state all relevant test parameters under the standard test conditions (STC) defined by the relevant standard. The Contractor shall select 'Tier 1' Solar PV panels. Solar Panels shall possess a 25-year performance warranty and a 10-year product warranty at a minimum.

16.13.2 Module Electrical Protection

If required, for the protection of individual modules or strings, string fuses or electronic protection must take account of the manufacturer's maximum module safety fuse as defined in the standard:

IS EN 61370:2007 Photovoltaic (PV) Module Safety Qualification.

String Fuses will be required if any fault current could exceed the manufacturer's safety rating.

16.13.3 Module Performance and Warranty Terms

All models must be provided with a power warranty as specified. The maximum annual power loss under the warranty after the first year must be less than 1%. Linear warranties based on a uniform decline in performance each year will be preferred to those with step changes in warranty conditions after the first year of installation.

Product warranty for the modules shall be as specified with a minimum of 10 years. Maintenance instructions shall be supplied with the modules, detailing the manufacturer's requirements, particularly with regard to cleaning techniques and materials.

16.13.4 Fall Prevention System

If required, the Contractor shall provide a Fall Prevention System suitable for the roof structure to facilitate safe future maintenance, cleaning and general access to the PV Array over its lifetime.

A safe walking edge of 1000mm minimum shall be maintained from the apex of the roof to the top edge of the arrays and from the bottom edge of arrays to the eaves of roof. Free walking space of 1000mm minimum shall be maintained between PV arrays.

The Fall Prevention System chosen must conform to EN795 and BS7883 standards and be suitable in design to match the roof construction type. The Fall Prevention System shall include for 2 number safety harnesses and associated accessories designed for use with the System provided.

16.13.5 Cables

- Where located externally or on rooftop, all power cables shall be XLPE/SWA/LSF.
- Cabling on the array side of the solar system must be adequately protected from abrasion and cuts, maximum temperatures of 80° C and provide UV and water resistance over the system lifespan.
- Double insulated solar cable to the HO7NF standard may be used, as well as single insulated cable enclosed in a conduit or multi-core SWA steel-wire-armoured for longer distances and mechanical protection.
- Cables shall satisfy IS EN 50618:2014 Electric cables for Photovoltaic Systems.
- DC cable cross-sectional areas must be sized to limit the voltage drop along the cable to less than 2.5% of the open-circuit string voltage.
- In the absence of string fuses or electronic protection, string cables must also be sized to withstand any fault currents on a continuous basis.
- AC cables shall be sized according to standard practice to maintain a voltage drop of less than 1%. Some variance above this limit is permissible with prior agreement.
- All cables shall be delivered to the site for installation in complete coils or reels with the manufacturer's name attached, indicating wire size and type of insulation.

16.13.6 Connectors

- DC connectors must be fully electrically compatible (as verified by a test certificate) as well as mechanically compatible. Only identical connectors from the same manufacturer shall be used.
- Connectors must be designed for Solar PV use and be protected against water ingress and UV exposure and touch-safe to IP21.
- Connectors shall satisfy IS EN 62852: 2015 Connectors for DC-application in Photovoltaic Systems – Safety requirements and tests.
- Connectors must not be removed from modules
- AC connectors for inverter connection must be touch safe.

16.13.7 Junction Boxes/String Combiners

- All connections in the DC circuit other than approved plug and socket connections must be inside non-conductive weatherproof enclosures that segregate positive and negative connections to prevent short circuits.
- Junctions Boxes shall satisfy IS EN 50548:2011 Junction Boxes for Photovoltaic Systems and IS EN 62790: 2015 Junction Boxes for Photovoltaic Modules – Safety requirements and tests
- Larger arrays shall use purpose constructed string combiner boxes. These may be integrated into monitoring systems and may also enclose string fuses.

16.13.8 Inverter Performance and Safety Standards

As a minimum the inverters must satisfy the requirements of:

- IS EN 50530:2010 Overall Efficiency of Grid Connected Photovoltaic Inverters

Both the maximum conversion efficiency and the Euro-weighted efficiency shall be provided from the manufacturer's test results.

Safety requirements of:

- IS EN 62109:2010 Safety of Power Converters for use in Photovoltaic power systems

And the Anti-Islanding requirements of:

- IS EN 62116:2014 Utility-interconnected Photovoltaic Inverter

16.13.9 Inverter Warranty and Maintenance Schedule

The inverter manufacturer shall provide comprehensive warranty cover as specified. Maintenance schedules for PV inverters must be in accordance with the manufacturer's recommendations.

16.13.10 Switch Disconnectors

DC switch-disconnectors (isolators) must be double-pole, load-break and rated for both the array maximum string current and voltage under all foreseeable conditions of under-temperature and over-irradiance. These need to be located on each string.

Switch-disconnectors integral to an inverter may be used for isolation, if approved by the manufacturer for this purpose.

AC switch-disconnectors at the point of grid connection must be 4-pole and be capable of being locked in the off-position. An additional AC switch disconnector is recommended for maintenance purposes if the inverter is remote from the grid connection point.

16.13.11 Electrical Protection

The inverter connection to the grid must be protected by an appropriate overcurrent device. The type and rating of the device must be compliant with the manufacturer's recommendations and the nature of the earthing and disconnection time required for the final circuit.

An RCD may be required to protect vulnerable wiring or may be required by the inverter manufacturer. If an RCD is required, then it must be an appropriate type for the inverter and the residual current rating chosen to match the manufacturer's requirements.

On exposed sites, risk assessments may require surge protection to be provided on the DC and AC sides of the PV systems.

As with lightning protection, specialist advice may be sought as to the degree of protection necessary. The array structure of the PV array shall be grounded properly using an adequate number of earthing kits. All metal casing/shielding of the plant shall be thoroughly grounded to ensure safety.

16.14 SYSTEM PERFORMANCE ASSESSMENT

The yield (kWh/kWp) and performance ratio (PR) of the system must be proven using market leading technology and must be provided as part of the technical submittal by the contractor. E.g. PVSyst or similar. PVSyst calculates the PR and irradiance of a PV system.

16.15 DOCUMENTATION TO BE HANDED OVER ON COMPLETION

The system shall be supplied with the information specified below a minimum. This information must be presented and explained to the Engineer as part of the formal handover procedure to the requirements of I.S. EN 62446:2009.

1. Basic system information (parts used, rated power, installation dates etc.)
2. System designer information.
3. System installer information.
4. Wiring diagram, to include information on:
 - Module type & quantities.
 - String configurations.
 - Cable Specifications – size and type.
 - Over-current protective device specification (where fitted) – type and ratings.
 - Array junction type, location and rating.
 - Array over-current protective devices (where applicable) – type, location and rating.
 - Details of all earth/bonding conductors – size and connection points.
 - Details of any connections to an existing Lightning Protection System (LPS).
 - Details of any surge protection device installed (both on AC and DC lines) to include;
 - Location, type and rating.
 - AC isolator location, type and rating.
 - AC over-current protective device location, type and rating.
 - Residual current device location, type and rating (where fitted).
 - Module datasheets.
 - Inverter datasheets.
 - Mounting system datasheets.
 - Fall Prevention System user operation, maintenance, warranty information and datasheets.
 - Operation and maintenance information, to include:
 - Procedures for verifying correct system operation.

- A Checklist of what to do in case of a system failure.
 - Emergency shutdown/isolation procedures.
 - Maintenance and cleaning recommendations (if any).
 - Considerations for any future building works related to the PV array (e.g. roof works).
- Warranty documentation for PV modules and inverters – to include starting date and period of warranty.
 - Documentation on any applicable workmanship or weather-tightness warranties.
 - Test results and commissioning data.
 - System Monitoring – Operating Procedures, Hardware, Software information.

16.16 OPERATING AND MAINTENANCE MANUALS/TRAINING

On completion of the works, the Contractor shall provide two copies each of the record drawings, log-book and Operating and Maintenance Manuals. The manuals shall be comprehensive and clear to enable a dedicated staff member to operate, maintain and repair the works to best practice levels without the need for specialist personnel or consultants. Operating and Maintenance manuals shall be specific to the system installed.

The Contractor shall submit a copy of each of the record drawings, log-book and Operating and Maintenance Manuals for the Engineer to review before final copies are provided.

On completion of the works immediately following the testing and commissioning of the system the Contractor shall arrange and present a training session for nominated staff of the systems in operations. The session shall include a full demonstration of the systems installed. Any faults/alarm conditions shall also be simulated using special equipment, if necessary, to encompass the full range of readouts that are likely to be encountered.

16.17 WARNING LABELS

Warning labels shall be applied at all DC and AC isolators and equipment forming part of the PV installation to identify where such currents will be present. These labels shall be adhesive in yellow with black writing – see image below. They shall also state “DC Present” and “AC Present” as applicable at each point in the electrical installation. A warning label shall also be provided in the external meter cabinet regarding “DC Present.”



16.18 ELECTRICAL INSTALLATION:-

All PV modules shall include factory fitted leads with IP rated weatherproof connectors. All interconnecting cabling between the PV panels, the inverters and all other components shall be provided under the contract. All wiring shall be in accordance with manufacturer and specialist requirements and all allowances made at tender stage for the full working solution.

All DC cabling must be double insulated. All DC connectors shall ensure fully water tight connections. DC isolators should meet all current specific regulations for use with DC power.

16.19 TECHNICAL SPECIFICATIONS FOR SOLAR PHOTOVOLTAIC SYSTEM COMPONENTS

16.19.1 Design Methodology Overview:

- System designed to deliver a 50,000 kWh/Yr energy yield
- 117 no's of 430 Wp Longi modules to be installed
- SMA Sunny Tripower 25000TL with 2 MPP and 6 String capacity has been proposed
- For low wind exposure and low ballast requirements K2 mounting systems with a 10 degree slope is proposed
- Based on -24 degree Azimuth

Holistic GUI of PV system along with Powerlink integrated energy management solution should be included as an add-on to the system. The Powerlink solution should be capable of providing actionable insights on energy management.

16.19.2 Solar Panel

The solar panel must have following specification:

- The panel must be 430Wp with a conversion efficiency of 19.8% and positive power tolerance of upto +5W.
- The junction box must be IP68 rated with 3 diodes. The panel must be made up of single glass with an anodised aluminium alloy frame.
- The panel must have a fire rating of UL Type 1 or type 2.

Equipment should be from Longi range or equal and approved

16.19.3 Features and benefits of Solar Panel specification to end user:

Longi 430Wp Solar Panel	
Features	Benefits
19.8% conversion efficiency	Higher energy conversion
Positive power tolerance upto +5W	Higher energy yield
IP68 junction box with three diodes	Bypass functionality: -Bypasses current flow from faulty panels in multi panel PV strings -Protects partially shaded PV cells array normally operated photovoltaic string in the peak sunshine in the same PV panel Blocking functionality:

	-Prevents batteries from discharging back through the PV cells providing reverse current flow protection
Lower operating current	Low resistive losses
Optimised Electrical Design	Reduced hotspot risk

16.19.4 Solar Inverter

- The inverter has inbuilt DC-side disconnection device, Ground fault monitoring, grid monitoring, DC reverse polarity protection, AC short-circuit current capability and All-pole sensitive residual-current monitoring unit.
- The inverter must have a protection class of I (according to IEC 62109-1) and overvoltage category of III for AC and II for DC (according to IEC 62109-1)
- The inverter must be a transformer-less inverter and employ Opticool cooling technology.
- Needs to be IP65 rated.
- The inverter is capable of feeding reactive power into the grid.
- Inverter must be equipped with provision to provide data analysis of generated power.
- Inverter must be compatible with BMS on modbus protocol.
- Must have provision to integrate Type 2 Surge Protection Device within the unit to protect against voltage surges.
- All information available via app
- Inverter has default warranty of 5 years and extendable up to 25 years

Equipment should be from SMA range or equal and approved

Sunny Tripower 25000TL Invertor	
Features	Benefits
Transformer-less Inverter	Higher efficiency ratings Lighter weight
Opti-cool cooling technology	Higher functional security, life expectancy and durability
Fault current monitoring according to VDE 0126	Increased electrical safety
Grid monitoring	Reliable monitoring of off grid power and solar yield
Q on Demand 24/7	Option to provide reactive power feedback to grid for better utility stability
Integrated Plant Control	Grid friendly

	Flexible and economical PV system optimisation
All-pole sensitive residual-current monitoring unit.	Increased electrical safety for personnel/users
Web connect	Data analysis of PV generation

16.19.5 Mounting Specification:

The system must be mounted on non-penetrable roof mounting systems.

Equipment should be from K2 range or equal and approved

K2 S-Dome Systems Benefits
S-Dome system is suitable for nearly all types of flat roofs.
A system for structurally challenging roofs with limited ballast options
Aerodynamically optimised as a result of wind tunnel testing
Quick and easy handling & installation

16.19.6 Electrical and Fire Safety Accessories:

- The system must employ a fireman switch to disengage DC once AC mains are disconnected.
- The switch must disconnect either when the mains are disconnected via Firemans Switch or if the temperature exceeds 70 degree C

Equipment should be from Projoy Electric range or equal and approved

16.19.7 Gateway and GUI:

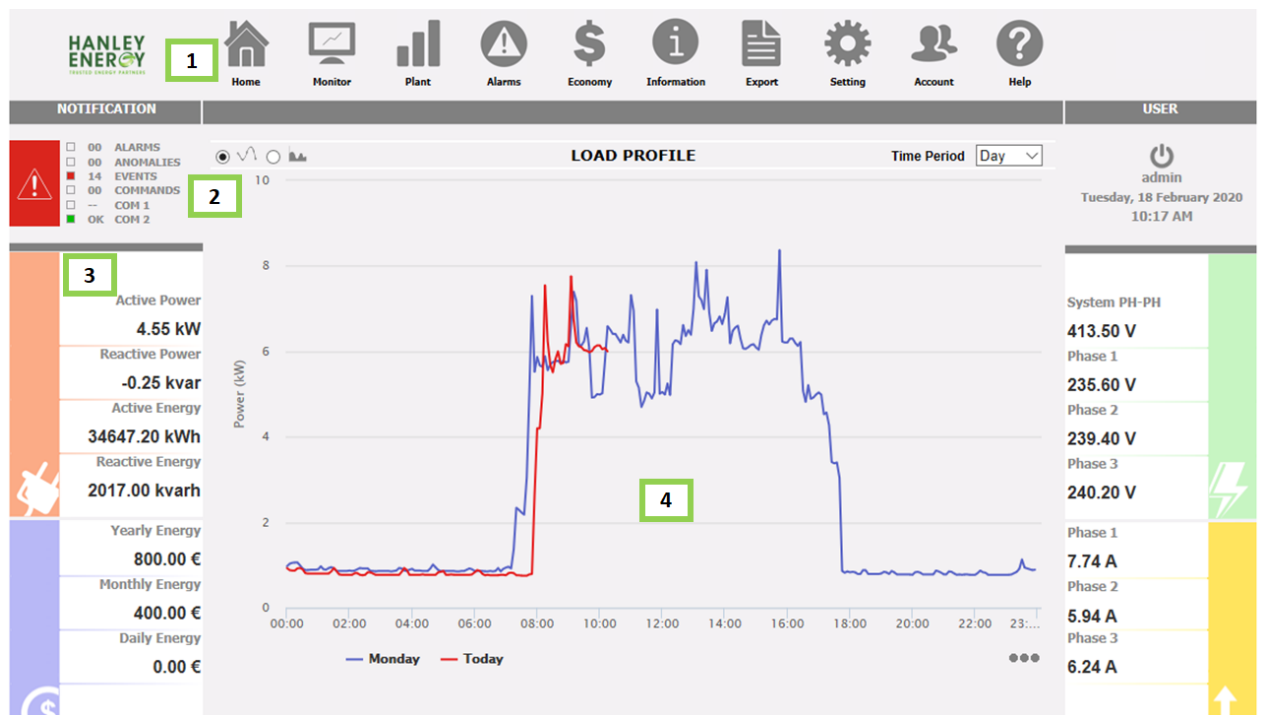
- System must employ IoT gateway to integrate PV system for monitoring and reporting
- PV system Health including alarms, events and system status
- Yield generated, power supplied to grid, system efficiency
- Display weekly/monthly yield dashboards and generate reports for analysis purposes
- Needs to have onboard memory for historical data logging

Equipment from Powerlink range or equivalent

Powerlink Gateway

Features	Benefits
IoT Ready	Microsoft Azure Certified
Flexible communication capability	Can transmit data via various communication protocols such as FTP, HTTP API, Modbus/TCP, DataPush
Local storage of system data	Reliable data logging of system data up to over 30 years
Scalable System	Modular I/O modules to monitor and manage system parameters
Inbuilt web interface	Interactive dashboard to analyse yield data and manage system comprehensively
Robust reporting capabilities	Exporting system variables and analog variables over a customer defined period in HTML format compatible with Excel

Snapshot of Powerlink Dashboard:

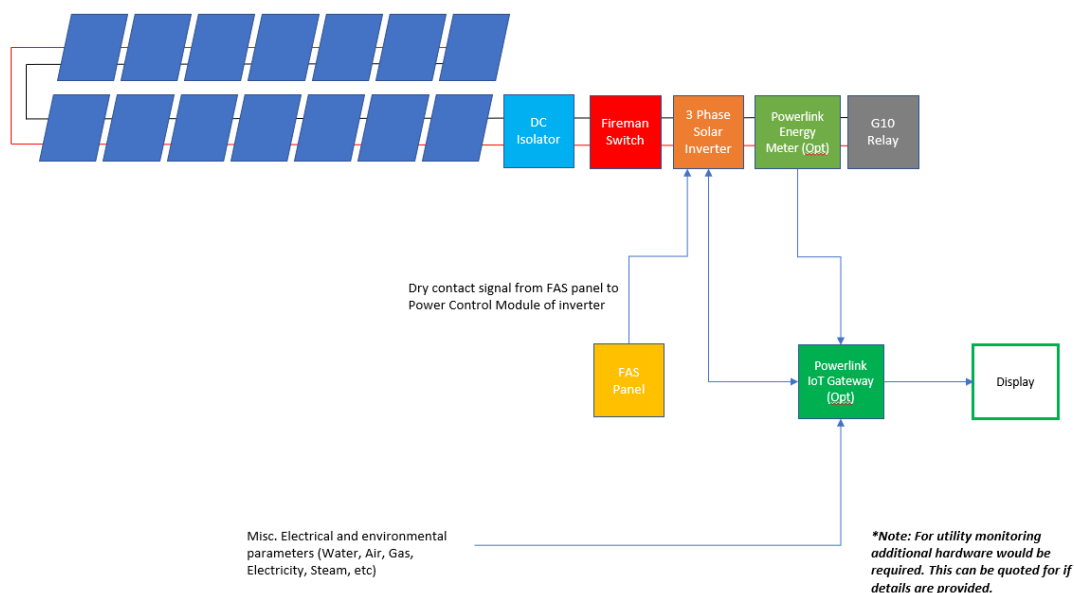


Menu Bar

- Alarms and events summary; COM ports communication status
- System summary information
- Data charts, configuration settings
- *Dashboard can be customised as per customer requirements

Schematics of PV System

Representation of Proposed System With Add-ons



16.19.8 Brief Description of System Shutdown Operation

- Arrays can be isolated using the DC isolator for maintenance
- If AC Mains are turned off, the fireman switch deactivates the DC supply to the inverter (recommended)
- If the temperature exceeds 70 degree C, the fireman switch disengages DC supply to the inverter
- If the fire alarm panel, sends in a signal (via dry contact) to the power control module of the SMA inverter, the inverter will shed AC load.

16.19.9 Add-ons to system to be included

- 32 inch display screen located at the admin entrance area for displaying PV system operation
- Powerlink PV Gateway to the schools ICT network
- Powerlink EM340 3 phase Energy Meter to be installed to analyses the generation of the PV array and the usage in the school with respect to the Utility supply.
- Configuration of the entire system.

16.20 CONDITIONS OF APPOINTMENT OF SPECIALIST INSTALLERS

Prior to appointment of specialist installer and condition of tender, the following information must be submitted to the engineer via the main contractor.

16.20.1 Supplier/ Installer

Certification that the inverter proposed meets EN50438 or G83.

Letter from Manufacturer stating that the supplier is qualified to install their equipment.

Copy of Insurance policy from both supplier and installers

16.20.2 Installers Training & Competency

Manufacturer Training Certificate

Accredited Training Certificate (e.g. REIA/City & Guilds)

Other training certificates

RECI registration details

16.20.3 Manufacturer and Product Certification

Manufacturer ISO 9001 Certification or Details of manufacturers quality system

Declaration of Conformity (CE)

EN50438 or G83 Test Certificate/Connection Agreement

Minimum 5 years commercial installation and 3 Letters of reference from previous clients.

16.21 SPECIALIST SUPPLIER

A specialist supplier of the above equipment and system, contact details are as follows:

Rexel Energy

David Good

Davig.good@rexel.ie

0873950062

Or equal & approved.

17 63 LIGHTING

17.1 TGD COMPLIANCE LIGHTING REQUIREMENTS

The general lighting installation shall be as indicated on the drawings and as specified hereafter. As part of current edition of TGD guidelines, the electrical reserved specialist shall ensure as a minimum that the lighting installations comply with the following conditions.

- a) Minimum IP40 luminaires with prismatic diffusers to be used. Particular lighting schedule shall take precedents at all times.
- b) LED type fittings to be used where specified by the engineer in particular lighting schedule. Refer to description of works section.
- c) All linear fittings shall have screw-in end caps.
- d) Disabled WC shall have a minimum 200lux at 700mm aft. All other toilets should have minimum 120lux.
- e) Light fittings shall comply with the particular lighting schedule in all instances. Failure to do so will result in engineer not issuing PC for the project.
- f) All fittings shall be properly & adequately supported to the building structure throughout. The contractor shall ensure fixing methodology shall be compatible with the different types of ceiling finishes.
- g) Artificial lighting power consumption of 2.5watt/m² per 100lux shall be the maximum in all areas of the building.
- h) Lighting detectors shall be located in the centre of the ceiling in rooms and have a range that reaches the furthest wall from it.
- i) The detectors shall be ceiling mounted and incorporate 3 control elements; photocell control, daylight control & absence control.
- j) Clear instructions on the operation of the lighting controls shall be provided in each space. This shall be in accordance with labelling section of the specification.
- k) Luminaires shall be programmed to switch off after 8 mins of inactivity in office space and 5mins for corridors. Refer to lighting control section.
- l) Lighting levels shall be recorded on a room per room basis by the electrical reserved specialist and their lighting supplier. These recordings shall be provided as part of the general lighting commissioning certification for the project. They shall ensure that 350 lux is always available at 700mm affl in all general office spaces.
- m) Commissioning certificates as outlined in TGD031.1 appendix B shall be issued by the contractor as part of the works prior to PC being considered by the engineer. Refer to lighting controls section for further detail.

17.2 SPECIAL LIGHTING REQUIREMENTS

The lighting Installations throughout shall be LED lighting, with a mixture of recessed, surface, suspended installations. Refer to lighting schedule for detail.

17.3 DESCRIPTION OF WORKS

The electrical reserved specialist shall engage with a lighting manufacturer sub-specialist for the supply, installation, commissioning & demonstrations of the lighting installations

for this project. The installation shall consist of a mixture of surface and suspended lighting installations within the classrooms, surface and recessed luminaires within corridors and surface installations in back of houses. Some be-spoke luminaires such as feature luminaires shall occur although all kept to a minimum.

Generally, the lighting installation shall consist of LED recessed luminaires supplied through LSF cabling contained within galvanised trunking and conduit. Each lighting circuit shall be protected by an MCB – size as denoted on the distribution board schematic and as indicated on the various circuit references on the lighting drawings. Associated light switches shall be mounted at 1100mm above FFL to the top of the faceplate.

The following British Standards are relevant to the lighting installation.

Luminaires	B.S. 4533 and B.S. 5225
Fluorescent tubes	B.S. 1853
Lamp holders	B.S. 1875 and B.S. 5042
Ballasts	B.S. 2818

17.4 HIGH FREQUENCY TYPE

N/A for this project as LED lighting shall be deployed.

17.5 MOUNTING ARRANGEMENTS

Where luminaires are to be mounted on suspended ceiling grid, they shall under no circumstances rely solely on the grid for support. Typically for a 1500mm linear fluorescent type fitting, 2 no. 6mm threaded rods shall fix the fitting to the actual building roof/ or floor structure. It is also a requirement outlined in the DoES technical documents, that all light fittings must be independently supported to the main building structure. The electrical reserved specialist shall account for this in their tender.

Final connections to luminaires shall be via flex from a galvanised conduit BESA box. All BESA boxes and galvanised conduit associated with the general and emergency lighting wiring installation shall be fixed to the cable trunking or roof structure, if this is deemed a more practical approach by the engineer.

The architects sectional drawings shall be viewed to understand the complex nature of the ceiling layouts in general. There are no suspended luminaires throughout the installation.

All luminaires shall be earthed in strict compliance with NSAI I.S. 10101: 2020:.

Where sloped ceilings are provided, luminaires in such situations shall follow the same alignment of the ceiling and be surface/recessed mounted on the ceiling slopes.

17.6 EARTHING OF LUMINAIRES

All luminaires shall be provided with a 1.5mm² green/yellow CPC to bond the metalwork of the luminaire to the lighting circuit forming a continuous earth path.

17.7 CLEANLINESS OF LUMINAIRES

The electrical reserved specialist shall ensure that luminaires are suitably protected during all building works. The electrical reserved specialist shall also ensure that when luminaires are being handled that gloves shall be worn by the electrician to protect the luminaires from marking, scratches etc. All labels and tags shall be carefully removed from all luminaires. Luminaires shall be carefully cleaned prior to handover so that they are clean and free from all finger marks, grease, paint etc. at the date of practical completion. All luminaires shall have protective coverings installed immediately after being fixed in place to avoid dust ingress and potential damage no exceptions.

17.8 FACTORY VISIT

Before approvals on any lighting can be obtained, the electrical reserved specialist in conjunction with their lighting sub-specialist shall arrange for a factory visit for the architect, engineer & client to inspect sample pieces of each proposed luminaire type. The visit shall be to the manufacturing plant and all costs for arranging and facilitating the visit shall be borne by the electrical reserved specialist and his sub-specialist.

17.9 EXTERNAL LIGHTING

Exterior luminaires shall be installed at locations as indicated on the contract drawings. These luminaires shall be controlled by the lighting controls identified on the contract drawings in the admin office.

18 63 LIGHTING CONTROLS MANAGEMENT

18.1 OVERVIEW

Classrooms shall operate generally in true absence detection with a 2-gang 1-way push-to-make retractive switches (MK 'Grid Plus' range or equivalent) by the entrance door and one 1-gang 1-way push-to-make retractive switch by the white-board. The switch by the whiteboard shall serve as an 'over-ride off' for the row of luminaires nearest the whiteboard and shall be wired in parallel with one of the gangs at the door i.e. to achieve a 2-way over-ride control scenario (indicated as 2-way switches on the contract drawings). Both whiteboard over-ride switch rockers shall be. The switch rocker at the door controlling the luminaires in the main body of the room shall be supplied in a distinguishable colour i.e. red, while the 2-way switched arrangement for the whiteboard luminaires shall use white rockers.

By way of control, all luminaires in the classroom shall be linked to one microwave detector (sensor) so that all lights respond in the same manner to the automatic control signals. A minimum maintained illuminance of 300 LUX shall be achieved on the working plane. All luminaires shall carry DALI ballasts to facilitate dimming/regulation. The contractor shall ensure that the lighting requirements as set out in the TGD documents are satisfied, in particular 500lux in specialist rooms.

The detectors shall generally be ceiling mounted* and incorporate three control elements:

- Photocell Control
- Daylight Control
- Absence Control

*Note: in some rooms, two sensors have been shown where ceiling heights are excessive and/or do not lend themselves to one ceiling mounted detector. In such cases, more than one sensor may be shown in wall-mounted locations which shall be wired in parallel to achieve the same objectives as outlined within this section.

The lighting within each teaching area / classroom shall operate as follows:

- Upon entering the room, the user can switch on the lighting by pressing the (red coloured) light switch at the door. (This will activate all luminaires within the room.)
- Each space shall be provided with a detector which shall have regulating photocell capability to hold lights off depending on daylight influx. The regulating photocell shall detect the level of natural light entering the room and adjust the artificial light output to maintain a minimum lighting level of 300-LUX. (i.e. the sensor to be based on photocell control to turn off the lights where daylight levels are adequate, daylight sensing to dim the lights as required to 'off' in response to the changes daylight levels and absence detection to turn lights off when rooms are not occupied).

- To switch off (over-ride) the row of lights nearest the whiteboard while the room is still occupied, the user shall operate the relevant (white coloured) switch at (a) the whiteboard or (b) at the door – both of which shall be in white to distinguish them from the lighting control for the luminaires in the main body of the room. To switch the whiteboard lights back on again, the user simply pushes either of the over-ride switches.
- All classrooms and teaching spaces shall work on absence detection and shall no persons be detected in the room for a period of 10-minutes, all lighting shall switch off automatically.
- The contractor shall ascertain the full extent of wiring details from the manufacturer/specialist supplier to achieve the full and proper operation of the system and make all due allowances at tender stage.

The control of lighting in offices, other staff areas and corridors shall operate in the same manner as for the classrooms.

In the case of small stores, time delay-off switches shall be utilised. In toilets, sensors in conjunction with manual on/off switches shall be utilised or as shown otherwise on the electrical drawings.

Lighting switches and associated services in the Sports Hall shall be flush mounted.

The controls shall be set up so that a minimum light level of 300lux is available at 700mm above FFL in classrooms. Details of settings to be applied to each detector including individual room LUX levels, sensitivity levels and time lags shall be agreed with the engineer prior to installation. For the purpose of tendering the following preliminary guidelines shall be used:

- lighting level required 300-500lux
- Sensitivity:- variable sensitivity range 50-50,000 lux
- Detection Range:- 360° detection pattern providing coverage as per specification below
- Absence Detection:- 10 minute inactivity switch lights off
- Mounting heights and exact positions for all devices shall be as per manufacturer's requirements and optimum positioning shall be established by the contractor's elected lighting controls firm.
- Refer to lighting controls section below for specification of all lighting control sensors

18.2 INITIAL LAMP START UP (BURN IN)

The contractor shall direct the lighting controls specialists, to programme each sensor to operate the initial 100hour burn in period of all fluorescent lamps. Thereafter the sensors shall be set up as per the detail above. Individual room per room commissioning certificates to confirm that this has occurred by the lighting specialist shall form part of this contract and be included in the O&M manuals.

18.3 PRESENCE DETECTORS

There shall be a number of different presence detector types installed in this project as described in Part 4 Equipment Schedule. Each type of sensor shall carry warranty of at least 12-months.

Wiring associated with sensors including DALI wiring shall be provided and contained within galvanised conduit. It shall not be acceptable to install cabling without containment.

All presence detectors shall conform to Part 4 Equipment Schedules specification and shall have the following features:

- Programmable from ground level using handset.
- Can be set to either Presence (Auto On/Auto Off) or Absence (Manual On/Auto Off).
- Variable time out setting 10sec – 99min.
- Lux Hold Off feature with Lux Time Hysteresis to prevent switch cycling
- Separate Off and On sensitivity level adjustment to prevent nuisance triggering.
- Read back of detector settings using UNLCDHS handset for trouble shooting/diagnoses.
- To be capable of operating in conjunction with a manual override using retractive and standard on/off switches. (Retractive switch required for Absence Mode).
- Suitable for flush or surface mounting. Contractor to allow for surface mounting boxes for all detectors.
- Direct Dim (DD) Detectors to feature programmable maintained light level.
- DD Detectors feature adjustable (0-999hrs) Lamp Burn-in to prolong lamp-life.
- DD Detectors to be programmable as 2-Channel detectors to Switch/Dim window row lights and Switch inner row lights.
- DD Detectors to feature programmable Fade Value & Time, after occupation lights dim to the Fade Value before switching off.
- DD Detectors to feature Step Down Output Level to maintain low level illumination when area is unoccupied.
- DD Detectors to feature manual light level output override using centre biased retractive switch.

Note: IR Handset to be provided for end user override.

All lighting control sensors to be complete with manufacturer's proprietary surface mounting back box and to be fitted where recessed mounting is not feasible.

18.4 COMMISSIONING OF ALL LIGHTING CONTROLS

Individual room by room commissioning certificates shall be completed and provided. Detailing of the settings shall be provided. These documents shall form part of the O&M manuals and shall be handed over to the engineer prior to any Client demonstrations taking place. Commissioning shall include an initial set-up followed by a full demonstration to the engineer followed by a Client demonstration (all on separate days). 3 No. further visits to adjust and set if necessary all sensors to the users' requirements in the school post handover. These additional visits shall take place approximately 3-months, 9-months and approaching 12-months after hand-over.

18.5 LIGHT SWITCHES

Light switches shall be from the same range of accessories as outlined in the power section and in Part 4 Equipment Schedules. Surface boxes to be without knockouts and to be of matching colour to the switch. They shall be fitted with an earth terminal and comply with BS 3676. Contacts shall be rated at 10-amps.

Where an indicator switch is specified, a 'Grid Plus Frontplate' shall be used in conjunction with a 'Mounting Frame' to contain a 20A double-pole switch module with integral indicator unit module with red neon.

Lighting switches shall be gridswitch rocker operated pattern type of 10 Amp rating generally mounted at 1100 mm above finished floor. Retractive switches to be used in conjunction with automatic detectors as outlined above and as indicated on the electrical drawings. Manual ON/OFF switches to be used elsewhere.

Switches shall be surface mounted throughout (apart from in SENU where flush installation is required). Galvanised Steel Conduit (Class 4) shall be used to contain all cabling to and between luminaires and to switch drops.

Multiple way gridswitches have been indicated on the drawings. Where more than one phase is used at a gridswitch, phase barriers shall be used and a 400 Volt Red warning label shall be provided and located on the face of the gridswitch.

Cover plates for surface light switches & sockets shall be as specified.

18.6 WIRE GUARDS

The contractor shall include for the provision of protective wire guards for ALL electrical devices within the Sports-hall for ball impact purposes which shall include but is not limited to the following:

- Directional exit signs & twin spots
- Presence detectors & photocells
- Temperature sensors
- Intruder alarm PIR's
- Fire alarm beacon and detectors

- PA system communicators
- Smoke detectors
- Speakers in general
- Other electrical devices indicated on the electrical drawings

All wire guards shall be manufactured from mild steel and powder-coated appropriately with an epoxy resin suitable for external use, RAL coloured to match the adjacent building fabric finishes. Maximum 50mm square sections within each guard.

18.7 LIGHTING CONTROLS COMMISSIONING RECORD SHEETS

As part of current edition of TGD guidelines, the electrical reserved specialist shall ensure that the following conditions are met in relation to the lighting controls commissioning.

- a) All lighting controls shall not be commissioned until all spaces have been fully decorated and furniture provided in them.
- b) Individual room per room commissioning certificates shall be completed by the electrical reserved specialist and their specialist lighting control agent to comply with the DoES commissioning certificate layouts below. (Part A & Part B certificates)
- c) Original signed copies of Part A & Part B lighting control certificates shall form part of the O&M manuals and shall be handed over to the client on completion of the project.
- d) Part A commissioning certificate shall be completed by the contractor, controls specialists and signed off by the engineer and client representative.
- e) Part B commissioning certificate deals with the settings on each detector throughout the building. Commissioning of the individual detectors shall be witnessed by the specialist controls firm, contractor and consultant. A minimum notice of 7 days shall be given to the consultant when commissioning is scheduled.
- f) The electrical reserved specialist shall ensure that their lighting control specialists allows for a minimum 2 no. re-visits to the building after it has been occupied for one month to make adjustments to the lighting controls as deemed necessary by the engineer and/or client. They shall also allow for a further visit 12 months after practical completion to re-check that each detector is operating correctly. New re-commissioning certificates as detailed below shall be issued to the client & consulting engineers.

18.7.1 Lighting Controls Commissioning Certificates (Part A Cert)

The follow lighting controls commissioning certificates template shall be deployed for the commissioning of the lighting controls throughout.

Lighting Controls Commissioning Certificate (May 2014)		
Part A		
Project Name:		Roll No:
Address:		
Project:		
Introduction: This certificate shall be completed by the contractor, lighting controls specialist, engineer & building representative and will be used by the building authority in the future to assist in ensuring that lighting controls are operating correctly & efficiently.		
We the contractor & controls specialists confirm that the lighting controls installed are in full compliance with the Departments Technical Guidance documents & SMcK specification documents for lighting controls for this project.		
We the contractor & controls specialist confirm that Part B recorded data relating to the lighting controls is an accurate account of the settings applied to the lighting detectors in each teaching space		
We the contractor confirm that a signed copy of the lighting controls commissioning certificate (May 2014) Parts A & B is included in the operation & maintenance manual handed over to the building representative on completion of this project.		
We the contractor confirm that all lighting controls throughout this project have been properly commissioned by our controls agent for the lighting controls installed.		
Confirmation of the above elements:		
We the undersigned confirm that all of the above elements have been concluded.		
Building Services Consulting Engineers (Company Name):		
Seample & McKillop Ltd		
Name: (Printed)	Signed:	Date:
Electrical reserved specialist (Company Name):		
Name: (Printed)	Signed:	Date:
Lighting Controls Commissioning Firm (Company Name):		
Name: (Printed)	Signed:	Date:
Client Representative:		
I the undersigned confirm that I've been fully briefed on the operation of the lighting controls in each teaching space and I'm satisfied that they are operating correctly.		
Name: (Printed)	Signed:	Date:

18.7.2 Lighting Controls Commissioning Certificates (Part B Cert)

The follow lighting controls commissioning certificates template shall be deployed for the commissioning of the lighting controls throughout.

[illegible]

19 63 EMERGENCY LIGHTING INSTALLATION

19.1 GENERAL

The emergency lighting installation shall comply with IS3217: 2013/A1:2017 and EN1838: 1999.

The contractor shall provide and install a complete emergency lighting system as indicated on the contract drawings and as specified hereafter.

Emergency luminaires shall normally operate in maintained mode where they take the form of an integral conversion. All 'Exit' box-signs shall operate maintained and wired off the local lighting circuit. Recessed and surface mounted LED down-lighters and bulkheads that are totally self-contained shall be non-maintained. All emergency fittings shall incorporate Ni-MH battery packs capable of maintaining the luminaire for 3 hours in the event of a mains failure.

The completed emergency lighting system shall comply in its entirety, and be certified upon completion, with the following National Standard, IS 3217:2023 "Code of Practice for Emergency Lighting" published by the N.S.A.I. normative documents and subsequent amendments (if any) where, when and if applicable.

All emergency lighting equipment shall show and signify compliance by CE Marking being present in a visible location as defined by the applicable directives.

All safety signage utilised in conjunction with the emergency lighting system must comply with the Health and Safety Authority's Safety and Health at Work (Signs) Regulations 1995 (S.I. No. 132 of 1995).

All emergency luminaires & components shall confirm to EN60598-2-22.

19.2 SYSTEM DESCRIPTION

The entire emergency lighting system shall be designed and installed such that Central Test Systems are capable of testing each emergency luminaire and/or circuit in a manner as defined by IS 3217:2023. A central test unit shall be located at each electrical lighting distribution board location as per the contract drawings. Din rail CTU's shall not be acceptable.

A single specialist emergency lighting company shall be appointed to supply, commission and certify the entire emergency lighting system. These companies shall have specific competency in the field of emergency lighting design, manufacturing, test, supply, commissioning and certification.

19.3 LED LUMINAIRES

Refer to Part 4: Equipment Schedule for the technical specification required for self-contained emergency luminaires. A combination of luminaires with open area and escape route optics for surface and recessed mounting shall be utilized as indicated.

19.4 CONVERSIONS

All normal lighting luminaires defined within the lighting systems specification and/or drawings which are required to be converted to emergency lighting function, to provide emergency lighting back up in the event of a power failure, shall conform with the following specification. All inverters utilised shall be fully enclosed type (either metal or plastic can). All batteries utilised integral to luminaires shall be high temperature Nickel Metal Hydride (Ni-Mh).

All conversions shall wherever possible, be integral to the original luminaire only following specialist assessment, investigation and test, to ascertain the suitability for conversion from an electrical, electronic, mechanical, thermal, EMC, serviceability and safety viewpoint. In the event that integral conversions cannot be undertaken due to any of the above reasons, remote conversions are acceptable of the piggyback enclosure type if, and only if, access to the emergency lighting equipment can be made without removal of the original luminaire from the ceiling, wall or floor. In the event that the piggyback conversion option cannot be undertaken due to the above reason, remote conversions are acceptable of the remote enclosure type if, and only if, the interconnecting wiring between luminaire and remote gear is suitably protected mechanically, is fire rated as defined by IS 3217: 2013 or equal, is suitability sized in relation to C.S.A. for the required load and distance travelled to minimise volt drop between source and load to 3% and is also electrically suitably rated for the required purpose in terms of voltage and high frequency and/or DC characteristic.

All conversions shall not affect the Ingress Protection Classification (IPXX) of the original luminaire and shall not affect the photometric performance of the original luminaire and shall also not affect the Safety Classification of such luminaire (Class I, II, III). Overall responsibility of recertification of the original luminaire following the conversion process specific to the EMC and LV Directive, Ingress Protection Classification, Safety Classification and performance criteria shall be that of the specialist conversion firm. All conversions shall be undertaken off site in a specialist facility and all conversions shall undergo complete performance and safety tests upon completion. It is preferable that the conversion progress is carried out by a specialist firm operating a quality assurance program in line and detailed by IS/ISO 9001/EN 29001:1989.

All lamps utilised as part of the emergency lighting system shall be suitable for the required purpose and be of major brand name manufacture only and available within the Republic of Ireland ex-stock for a minimum period of 10 years following installation completion. All lamps shall be professional long life variants. All fluorescent lamps shall be tri-phosphor variety.

All metals and plastics utilised as part of the emergency lighting luminaires shall be suitable for the required purpose and in line with the following specifications:

Metals: All metals used shall be either bright mild steel, Zintec, galvanised steel, stainless steel, aluminium or brass finished in either polyester powder coated paint to specified R.A.L. colour(s) or other surface treatment to specified finish(s).

Plastics: All plastics used shall be polycarbonate or equal and approved with the following properties: High Temperature Rating, U.V. stabilised, Low Smoke and Fume (LSF), self-extinguishing and non-halogenous.

19.5 SIGNS

All exit signs of the decorative 'hanging blade' variety which use top lit illumination shall have the running man, arrow and door symbols, outlined by deep engraving into plastic diffuser to achieve high definition of symbols. The background colour of the blade shall be green as defined by ISO 3864 and the running man, arrow and door symbols shall be white. All pictograms must be silk-screened only to diffuser surfaces. All diffuser material either blade type or normal shall be polycarbonate. All exit and emergency exit type signs shall be complete with pictogram labels to IS: 413, ISO 6309 and BS 5499.

19.6 INVERTER MODULES

All inverter modules used in emergency lighting luminaires shall be fully encapsulated by a metal or plastic can such that no components or conductive surfaces at L.V. or higher tension are accessibly upon removal of louvre, diffuser and/or gear tray for preventive or remedial maintenance purposes.

19.7 LUMINAIRE DESIGN

All luminaires shall be so designed such that they may be installed and fixed easily to required surfaces. All luminaires shall provide areas for easy cable access and have internal cable ways if required. All exit signs, conversions, interface units, central test units etc are to be from a single source supplier to Engineers approval

19.8 CONVERSION COMPANIES

The following companies are suggested and recommended companies for the carrying out of the conversions to the required standard:

- NEL
- Emcon
- Profile
- ELF

19.9 TESTING AND CERTIFICATION

A series of central-test units shall be deployed at locations indicated on the contract drawings which shall enable testing of defined zones as described on the drawings. This system shall comply with IS3217:2023, Code of Practice for Emergency Lighting, which states: - "Each emergency lighting system should have a suitable facility for simulating failure of the normal supply for test purposes. The facility should not interrupt the normal lighting supply to the area concerned. After the test period the emergency lighting system should be automatically restored to its normal state."

The test unit is specified as follows:

Multi-zone central-test units, which allows circuits from respective distribution boards to be grouped together on selectable zones for testing. Each circuit is wired to normally-closed multi-pole relays, which are energised by a central-test unit to interrupt the permanent supply. Again, the normal supply shall not be interrupted, in compliance with IS3217: 2023. The contractor shall determine quantity of multi-pole relays, remote interface units required and include accordingly.

The systems (back of house) shall be as central test unit Multi-zone 'ELT' system to support the required amount of zones and sub-circuits

Din rail mounted central test relay units shall not be acceptable under any circumstances.

It is the responsibility of the electrical contractor to provide all necessary cabling and relays/contactors etc for the complete operation of the system.

The complete emergency lighting system shall be tested and commissioned and the various completion certificates as listed in IS3217: 2023 shall be issued to the office of the consulting engineers. A copy of these certificates shall form part of the O&M manuals. Practical Completion or Handover of the building shall not be achieved without this carried out in its entirety.

19.9.1 Provision of Central Test Zoning Chart

The contractor shall include for the provision of an A3 sized chart at each central test location. These charts shall indicate the overall building floor plans and the location of all emergency luminaires and show room names and test zones. Each chart shall be located adjacent the local lighting distribution board contained within A3 sized glazed panels. A copy of all information shall be included in the O&M manuals.

19.10 SYSTEM WARRANTY

All components, including batteries, in the emergency lighting installation shall have a full system warranty for a minimum period of 3 years provided that battery life has been maintained by the correct testing schedule. Any component found to be defective within this period of time shall be replaced free of charge to the client

20 64 COMMUNICATIONS CAT6A DATA & VOICE CABLING

20.1 INTRODUCTION

The works to be carried out under this contract shall comprise of the installation and testing of a complete Category-6A voice and data structured cabling solution. The contractor shall allow for employing the named specialist installer to supply, install, terminate and commission the structured cabling network as detailed on the contract drawings and hereafter in this specification.

The electrical reserved specialist shall supply and install all necessary cable containment associated with the structured cabling installation. All voice & data & CCTV IP cable, accessories and cable installation within wire basket and/or conduit shall be provided and installed by the specialist sub-contractor. The specialist sub-contractor shall install all cabling. All cabling shall emanate from the respective local comms cabinet position as indicated on the drawings and shall be contained on a dedicated galvanised wire basket system with conduit links to the various data outlets are located. Fiber backbone is now a requirement by the DoES and shall be provided between the main comms cabinet (Main Distribution Frame MDF) and all intermediate comms cabinets (Intermediate Distribution Facility IDF) including the link to remote comms cabinets.

20.2 SCOPE OF WORK

The specialist sub-contractor shall provide all labour and materials for installation of the communication system as noted on drawings and in this specification. The specialist sub-contractor appointed shall supply, install, terminate and test all hardware necessary to complete a functional structured cabling system fully compliant with this specification and in the drawings, to the satisfaction of the consulting engineers.

20.3 WORKMANSHIP

All work shall be done in a thorough and conscientious manner according to the highest standards of care within the industry and shall be subject to inspection and acceptance by the DoES or its agents, consultants and others and by the proper authorities. It is expressly understood and agreed that such observations and inspections by the client, its other contractors and consultants shall not relieve the contractor from any responsibility for the proper supervision and execution of the work described in this request for proposal, or agreed to at a later date.

20.4 DESCRIPTION OF WORK

The structured cabling network installation within the project shall comprise the installation of a main distribution cabinet and intermediate cabinets as indicated on the design drawings. This shall include fibre runs using external grade fibre from the main comms cabinet to external Lucy pillars for networking of external IP CCTV equipment, if the proposed run exceeds the 90meter limitation set out for structured cable, to the nearest comms cabinet.

The main cabinets (MDF) shall be 42u in size and located in the main Data Communications Centre (DCC) room. Intermediate cabinets shall be provided on secondary floors and within existing blocks of the building to service all internal data and voice requirements.

The specialist contractor shall be responsible for the supply and installation of an end-to-end SYSTIMAX Solutions X10D, CAT 6A, Class EA, structured cabling solution in line with the guidelines set out in below in product requirements of this specification.

The system proposed must comprise all necessary SYSTIMAX CAT 6A connectors; patch panels, backbone cabling, floor distribution cable and communications cabinets as required.

In addition, the specialist shall provide CAT6A Patch leads, equating to **100%** of the total points installed, 1 x 1mt and 1 x 3mt cable per outlet unless specified otherwise.

Active kit and wireless provision also forms part of this project and must be supplied by the specialist structured cabling contractor. Please refer to wireless section of this specification for active and wireless specifications and requirements.

The contractor shall provide and install single core 16mm² 6491B stranded copper cables emanating from the new switchgear main earth bar, to each comms cabinet.

20.5 PRODUCT REQUIREMENTS/MATERIALS SCHEDULE

All components required and installed as part of the structured cabling infrastructure must be All components supplied and installed as part of the structured cabling infrastructure must be from the **same manufacturer**.

No other cabling system is permitted for installation on this project.

Materials used shall be as follows--

- 6A, Class EA Connectors – SYSTIMAX Solutions MGS600 (Refer to Appendix document that accompanies this specification)
- 6A, Class EA Patch panels – SYSTIMAX Solutions M2100 panels (Refer to Appendix document that accompanies this specification) Please note that each patch panel requires 24 x MGS600 modules as per specification above!
- 6A, Class EA Patch leads – SYSTIMAX Solutions X10D patch cords (Refer to Appendix document that accompanies this specification) 50% of total points, 1mt & 3mt required.
- 6A, Class EA Cable (UTP grade) 3091B cable – SYSTIMAX Solutions. (Refer to Appendix document that accompanies this specification)
- OM4 ready, Lazerspeed 550, 12 Core Fibre optic cable – SYSTIMAX Solutions (Refer to Appendix document that accompanies this specification)
- LC Fibre patch panels complete with LC termination cassettes – SYSTIMAX Solutions (Refer to Appendix document that accompanies this specification)
- LC Duplex OM4 Fibre optic patch cords – SYSTIMAX Solutions (Refer to Appendix document that accompanies this specification) At least 2 x 3mt duplex cords must be provided for each fibre optic link installed.

All other components to create a fully functional SYSTIMAX X10D system must be supplied, including Faceplates, modules, dust covers, voice backbone cabling, voice termination boxes, krone strips etc.).

20.6 STANDARDS COMPLIANCE:

General standards: Comply with applicable standards as already referenced in product requirements of this specification.

Comply with following application standards:

- Voice, facsimile, modem, Switched 56, T-1, and ISDN
- RS-232, RS-422, and RS-485
- IEEE 802.3 1Base5, 10BaseT, 100BaseT, 1000BaseT, and 10GBaseT
- IEEE 1394B transfer modes S100 and S400
- IEEE 802.5 (token ring) at 4 megabits per second and 16 megabits per second at 100 meters (328 feet)
- TP-PMD technology at 100 megabits per second
- ATM at 155 megabits per second, 622 megabits per second, and 1 gigabit per second using parallel transmission schemes
- AES/EBU digital audio and 270 megabits per second digital video
- 77 channels (550 megahertz) of analogue broadband video
- Comply with following BAS application specifications:
- Operating voltages for dry locations: 0 to 30 Vac at 60 hertz, 0 to 70.7 Vac for audio frequencies, and 0 to 60 Vdc
- Operating currents at 25 degrees C (77 degrees F) ambient temperature
- 1 current-carrying pair per cable: 1.5 amperes on each conductor
- 2 to 4 current-carrying pairs per cable: 3.36 amperes for all pairs
- Audio frequencies and 1 current-carrying pair per cable: 1 ampere on each conductor

20.7 SPECIFIC STANDARDS COMPLIANCE

- TIA/EIA-568-B.1
- TIA/EIA-568-B.2 (including 568-B.2-10)
- ISO/IEC 11801
- CENELEC EN-50173
- UL, ULC, and ACMA

20.8 CAT6A DISTRIBUTION CABLING

The specialist contractor shall install floor distribution cabling using unshielded twisted pair (UTP) SYSTIMAX Solutions X10D, 3091B grade cable as per the specification supplied above. This cable complies with Class EA standards and forms part of the preferred solution for this project.

LSZH cable will be Solid copper conductors with non-halogen high-density polyethylene (HDPE) insulation and a low smoke, zero halogen, compound jacket to achieve a LSZH rating by applicable IEC standards

For this installation the SYSTIMAX Solutions system mandated shall offer a full system, application warranty and be comprised of the same product set end-to-end on the system.

No mix and match of product sets will be permitted.

No re-conditioned products are permitted.

Product specification sheets have been provided for the core products of the system in this specification

The following applications within the building shall be run across the structured cabling network:-

- The Data Network
- The Voice Network
- The IP CCTV Network Internally & Externally
- Access Control

20.9 PERFORMANCE

Channel performance shall be 10 gigabits per second channel performance, comply with following performance requirements:

The 10 gigabits per second UTP cabling channel solution shall be designed specifically for 10GBaseT application but shall also support other emerging multi-gigabit applications

The UTP channel shall exhibit superior alien near-end cross talk (NEXT) performance, improved insertion loss performance and guaranteed channel performance up to 500 megahertz. The channel alien NEXT performance shall be guaranteed for installed UTP channels with up to 4 connectors and up to 100 meters (328 feet) in length.

The channel performance, including alien NEXT performance, shall be guaranteed for worst-case configuration of 6 cables around 1 cable.

Cable performance specifications: Comply with following cable performance specifications. Data shall be guaranteed performance for worst-case channels utilizing 4-pair series cables with full cross-connects, consolidation points (CPs), and work area outlets (i.e., 4 connectors in a channel) for length up to 100 meters (328 feet).

A full breakdown of the cable requirements for this project can be found with reference to the drawings provided in conjunction with this specification

20.10 CARE IN INSTALLATION & TESTING.

No cable shall exceed 90 metres to any one point. If a cable exceeds the specified distance, a new remote distribution cabinet must be installed. The specialist contractor at no additional cost must replace any cables, which are shown to be in excess of 90 metres by the test results. These results will not be accepted and signed off until verified by an approved 10G testing tool from Fluke networks or Pentascanner.

- MOD-TAP testing will not be acceptable as part of this project in proving 10G compliance,
- A fully calibrated Fluke or Petascanner must be used. No other testing tool will be permitted.
- Tests results must be supplied in PDF format direct the software application, i.e. Fluke Linkwire.
- Word documents and X'cel spreadsheets will not be accepted.
- Any files provided not directly linked to the testing software will not be accepted.

Every care shall be taken during the installation of the cabling and any cabling found to be damaged during testing shall be replaced free of charge under this contract.

20.11 FIBRE OPTIC BACKBONE CABLING

As part of this project, OM4 ready fibre optic backbone cabling must be supplied and installed from the main distribution frame (MDF) to all Intermediate Distribution Frames (IDF) that form part of this project. Contractors should refer to the project drawings and site drawings indicating the various cabinet positions. Works shall include external grade fibre run from main comms cabinet position to external lucy pillars for termination within to network external IPCCTV equipment where applicable.

The mandated cable for this project is SYSTIMAX Solutions Lazerspeed 550, 12-core as per the specification provided under product requirements appendix.

All fibre shall terminate into LC, fibre optic patch panels supplied and installed as part of this project. This will include all LC couplers, Connectors, pigtails as required to complete a fully functional system. The Specialist Contractor will in addition be responsible for the supply of LC fibre optic duplex leads to connect into the client's active equipment, so provision should be made for these as part of the response.

A minimum of 2 x 3m fibre duplex patch cords must be provided for each respective fibre link.

20.12 STRUCTURED CABLING OUTLETS

Structured cabling outlets shall be provided and installed with final connections at both ends by the specialist contractor.

All outlets shall be configured as per the project drawings and shall be flush mounting, with IDC connections. The RJ45 CAT 6A connectors supplied must be from the same manufacturer as the floor distribution cable, i.e. SYSTIMAX Solutions. No mix and match will be permitted as an application warranty is required.

SYSTIMAX Solutions **MGS600** modules shall be used fitted with the complaint, faceplates, shutters and dust covers.

Contractors should refer to the project drawings for this project for a full breakdown of the outlets that shall be required.

The electrical reserved specialist shall supply the RJ45 outlets onto which the specialist will supply 25mm x 10mm modules to fit the accessory grid. Faceplates shall be Metalclad. PVC/plastic faceplates are not acceptable. The specialist contractor shall advise the electrical reserved specialist of the compatible outlet manufacturers to suit the connectors.

All terminated network points and leads shall be clearly labelled in a format to be agreed prior to installation

20.13 MAIN COMMS ROOM AND LOCAL COMMS ROOMS

In order to support the structured cabling system, the specialist contractor shall make provision for central communications cabinet/cabinets

Cabinets shall be as per the following specification--

Main Cabinets (MDF)

- Size: 42u, 1000mm wide x 1000mm deep
- Mesh front door with security locking system. (No Glazing)
- Steel ventilated, wire mesh rear door with security locking system
- Lockable side panels
- Ventilated top cover
- Vertical cable management
- Vertical cable tray
- 19" panel mounts fitted front and rear
- Cross member supports
- 1 x 4-way low-noise fan tray
- Retractable cabinet feet (castors for transportation only)
- Cable management (1u for every 48 RJ45 ports installed)
- 2 x 9-way 13-AMP power distribution unit

Remote distribution cabinets (IDF)

- Size: 42u, 1000mm wide x 800mm deep
- Mesh front door with security locking system. (No Glazing)
- Steel ventilated, wire mesh rear door with security locking system
- Lockable side panels

- Ventilated top cover
- Vertical cable management
- Vertical cable tray
- 19" panel mounts fitted front and rear
- Cross member supports
- 1 x 4-way low-noise fan tray
- Retractable cabinet feet (castors for transportation only)
Cable management (1u for every 48 RJ45 ports installed)
- 2 x 9-way 13-AMP power distribution unit

The specialist contractor should refer to the project drawings for a full breakdown of the communications cabinets to be supplied as part of this project.

20.14 TELEPHONE DISTRIBUTION CABLING

The telephone backbone system installed as part of this project will use BT Ireland specification CW1308 multicore cable, providing a minimum of 2-pair modularity to each outlet.

The specialist contractor should refer to the building layout drawings when making provision for the voice backbone infrastructure. The multi-core cable must be sized to cover the total number of voice points shown, whilst allowing for 30% future capacity.

The specialist installer shall include for termination of the voice backbone cables at both ends.

A minimum of 30-pair CW1308 cable shall run from the Eircom DP location, to the main comms cabinet (MDF) at the DCC room terminated at both ends by the contractor. (PABX supplied by client outside of contract. In addition, a 30-pair cable shall also be run from the MDF to all the IDF (intermediate Distribution Frames) comms locations.

It shall be the responsibility of the specialist contractor to provide a TJF (Test jack frame) at the main Eircom DP location, complete with 20-Pair Krone strips. It shall be the responsibility for the specialist contractor to terminate and test all CW1308 multi-core cables at the Krone strips and at the patch panel end, within the communications cabinets and to distribute throughout the building.

The responsibility for termination onto the main PABX (excluding the TJF) shall lie with service provider, i.e. BT Ireland, Eircom Business etc.

Telephone outlets shall be provided in the locations as indicated on the drawings.

20.15 ACTIVE EQUIPMENT

Provided by others

20.16 WIRELESS ACCESS POINTS (WIFI)

Wiring & termination only shall be provided under this contract. Active equipment outside of contract.

20.17 RJ45 PATCH LEADS AND TELEPHONE ADAPTERS

The specialist contractor must make provision for 1 x 1m and 1x 3m CAT 6A RJ45 Patch cord for each data outlet. The patch cords must be from the same manufacturer as the installed system.

For each voice outlet, the contractor must supply 1 x 1m CAT 6A patch cord and 1 x switchable telephone adapter.

20.18 TESTING AND COMMISSIONING

Upon completion of all termination works, the specialist contractor shall test the full permanent link of each outlet of the installed system. The permanent link incorporates all cabling up to the point of, but excluding the patch cords

For testing the permanent link on copper cables, fully calibrated fluke meters or Pentascanners must be used. The official Fluke or Pentascanner testing heads must be used in conjunction with these tools and no alternate testing heads or Mod taps shall be permitted.

Evidence of testing tools used, calibration dates etc. will be sought by the Consulting engineers prior to testing taking place.

All cable tests must ensure that—

- There is cable pair continuity
- Cable polarity has been maintained
- Cable pair shorting does not exist
- Cable length does not exceed 90 metres.
- NEXT measurements

All fibre optics installed as part of this project must be tested using a fully calibrated OTDR meter. A light source test on the fibre is not permitted as part of this project.

Upon completion of the testing, 2 sets of tests results must be provided in a PDF format on a CD to the consulting engineers. These will show both the Fluke/Pentascanner results for the copper and the full OTDR testing on the fibre.

20.19 SYSTEM WARRANTY

Upon practical completion of the project, the specialist contractor will be required to warranty the CAT 6A system for a period of no less than 20 years.

The warranty supplied shall be a **system or application warranty**, guaranteeing that when all the products are installed, they will perform to the CAT 6A standard as per ISO 11801. A 'product based or material' warranty is not permitted for this contract and should the specialist contractor proceed with an uncertified system, the cabling will be replaced at the contractors own cost.

An independent audit will be required by the manufacturer before project sign off to ensure that an application warranty can be issued. It will be the responsibility of the specialist contractor to arrange this with the manufacturer prior to completion.

Failure to present a completion warranty direct from the manufacture will result in a delay in payment to all concerned parties.

20.20 LABELLING

All outlets and patch panels at either end of the cabling system shall be indelibly labelled, using an appropriate machine, i.e. Brother printer. The exact format of the labelling shall be agreed with the consulting engineer.

Labels must not be hand written and must follow a sequential pattern. All outlet and patch panel labelling shall be documented indicating exact room location within premises for ease of identification during maintenance and fault finding exercises. This document must be submitted as part of the 'As Installed' documentation.

20.21 LIAISON WITH EIR

The contractor shall be responsible for liaison with Eir in bringing the new lines to the building. The contractor in conjunction with the specialist installer shall also ensure that the lines are distributed to the required locations within the building. These works shall be in accordance with the main contractor's programme of works.

In addition to this, the contractor shall liaise with the telecoms hardware provider to ensure that all required power supplies, connectors, patch panels etc. have been provided for.

20.22 DAMAGES

The specialist contractor will be held responsible for any and all damages to portions of the building caused by it, its employees or subcontractors; including but not limited to:

- Damage to any portion of the building caused by the movement of tools, materials or equipment.
- Damage to any component of the construction of spaces "handed over" to the Contractor.
- Damage to the electrical distribution system and/or other space "handed over" to the Contractor.

- Damage to the electrical, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the Contractor or other actions of Contractor.

20.23 SPECIALIST MANUFACTURER

For this contract the electrical reserved specialist shall select from the following cabling manufacturers;

- Systimax/Commscope
- Krone
- Brand Rex
- Draka UC Connect

Note the tender submission must be based on approved installers of the products listed above.

20.24 BASELINE SUB-SPECIALIST

Kedington Ltd

21 64 PUBLIC ADDRESS INSTALLATION

21.1 GENERAL

The electrical reserved specialist shall connect to the existing one-way public address system installed within the existing school to provide a single platform for the entire building.

The public address system shall enable each classroom and each zone to be independently addressable from the desk mounted paging stations, the multi-zone amplifiers shall be linked together to allow operation as one complete integrated system, allowing paging in groups, globally or individually as required.

As per current TGD update, loudspeakers in all special educational needs unit (SENU) classroom accommodation shall have local volume control. Each loudspeaker shall be located such that a teacher has easy access to volume control so that he or she can switch it on/off or adjust the volume level as required. On occasions the volume can create noisy distractions for certain pupils which can result in behavioural outbursts.

Speakers shall be installed as indicated on PA drawings. All speakers shall be wall-mounted, operate at 100V, with side mounted integral volume control, steel vandal proof body painted white RAL9010, and have tapping facilities for 3watts and 6watts. External speakers shall be 15W and IP67 rated horn-type speakers.

All new speakers shall be addressed from the master control position in the proposed administration office. Final positioning of the speakers and equipment shall be agreed on site with the engineer but are indicatively located on the drawings.

21.2 SYSTEM MANUFACTURE

All equipment shall be manufactured by TOA, InterM, Bosch or equal and approved and installed by an approved Infocomm gold level audio system provider installer.

21.3 PAGING AMPLIFIER REQUIREMENTS

The system will comprise of a master switch (TOA VM2000 or equal & approved) interfaced with a new selector-switching module so that all speakers can be addressed individually as necessary. All speakers shall be wired separately back to head-end equipment location.

The number of zones will dictate the number of amplifiers required and shall be determined by the specialist installer in conjunction with the main contractor and all allowances made at tender stage. The zones for the school shall be confirmed with the Consultant and the Client during construction.

The master switch shall have an audio output to enable recording. A message broadcast board shall be incorporated. This will be automatically triggered via a TOA digital program timer.

21.4 WIRING OF THE INSTALLATION

Wiring between the master switch and speakers shall be by means of 2core 2.5mm² stranded flexible cable. Wiring shall be contained in the main trunking spine provided by the contractor to facilitate all other extra low voltage service wiring as specified earlier in this document.

21.5 24U WALL MOUNTED PA RACK

All items of PA equipment shall be housed within a wall mounted rack unit located in the admin office (location to be agreed prior to installation). The PA rack unit shall be as per the following specification, and fitted with accessories as indicated below: -

- - 600x600 open cabinet frame
- - glazed front door with secure locking system
- - steel ventilated rear door with secure locking system
- - steel ventilated side panels with secure locking system
- - 600x600 fully ventilated top cover
- - 19" mounting rails fitted front and rear of cabinet
- - cross member supports
- - cabinet feet x 4
- - 4-way, 600x600 low noise fan tray
- - 9-way Power distribution strip
- - earthing kit
- - baying kit (vertical and horizontal)
- - lacing bars (as required)
- - blanks (as required)
- - velcro straps (as required)
- - brush panels (as required)
- - trim strips (as required)

21.6 CABLING REQUIREMENTS

The contractor shall include for all cabling and equipment wiring requirements for the complete and proper operation of the system.

The contractor shall liaise with the specialist installer prior to submission of his tender to ensure that all wiring, containment and power supplies have been allowed for in the overall tender figure. It is the responsibility of the contractor to verify all requirements prior to submitting his tender. No claims shall be entertained post tender.

21.7 COMMISSIONING AND TESTING

The system shall be commissioned and tested by the specialist installer who shall be certified technology specialists (CTS) and approved by the engineer. Installation shall include 12 months warranty. Commissioning documentation shall be included in the O&M manuals at handover.

22 64 INDUCTION LOOP INSTALLATIONS

22.1 GENERAL

This contract shall include for the installation of an IR induction loop for the main GP hall together with neck loops and amplifier equipment to have a fully functional system as detailed below. Induction loop shall also be required at the reception desk for the main entrance and the SENU entrance.

22.2 DESCRIPTION OF WORKS

The electrical reserved specialist shall employ an audio induction loop sub-sub specialist for the supply, installation, commissioning & demonstrations of induction loops.

The electrical reserved specialist and their sub sub-specialists shall provide complete Audio Frequency Induction Loop Systems (AFILS) at the positions specified, in accordance with Part M of the current building regulations to inductively transmit speech and audio programme material, so that it may be received by wearers of hearing aids equipped with a "T" (Telecoil) facility, or by users of suitable loop receivers.

The system in the GP hall shall transmit audio from the school PA system. The system shall allow for the connection of an auxiliary audio input to be used for the connection of audio visual equipment.

The systems shall include metal loss compensation adjustment to account for steel within the floor construction. All induction loop equipment shall be centrally located in the comms room rack and linked to the rooms with the appropriate noise cancelling cable.

22.3 DESIGN PARAMETERS

The Audio Frequency Induction Loop systems (AFIL), shall comply with the following:

- IEC 60118-4:2014 Induction-loop systems for hearing aid purposes - System performance requirements.
- BS 8300:2009+A1:2010 Design of buildings and their approaches to meet the needs of disabled people.
- Building for everyone – Inclusion, access and use – NDA.

A specialist induction loop system supplier shall be appointed for the supply and commissioning of the induction loop systems. The specialist supplier shall:

- Prior to loop design, provide evidence that the background magnetic noise in the areas designated for loop coverage is within the limits of the standard, BS EN 60118-4:2006
- Prior to install, show that cross-talk between adjacent loops will be less than 40dB on normal signal level.

- Prior to install, provide evidence that the effect of metal within the structure of the building has been adequately assessed and, compensated for by loop design and or loop driver selection.
- Prior to install, provide calculations to demonstrate that the field strength and frequency response of the proposed systems will meet the requirements of the standard BS EN 60118-4:2006

22.4 RECEPTION OUTLINE SCHEDULE OF EQUIPMENT

1 No. Ampetronic CLC1-CD, compact small area & counter induction loop driver with desktop Microphone, which shall be the non-gooseneck type and with a flat base which shall rest flat on the reception counter.

22.5 MAIN GP HALL SCHEDULE OF EQUIPMENT

Infrared (IR) induction loop system shall be provided within this space consisting of 1 No. Sennheiser SZI 1015 2-watt infrared induction loop radiator (or equal & approved) with integrated modulator providing up to 400m sq. coverage, c/w swivel adaptor (GZG 1029) and mounting plate (GZP 10).

22.5.1.1 Other equipment (non-exhaustive list)

The following shall also be provided:

- 10 No. IR receivers as Sennheiser EKI 830.
- 10 No. Induction neck loop for use with the receivers as Sennheiser EZT 3011
- 1 No. charging unit for 10 receivers as Sennheiser L300-10-10, to include universal power supply.
- 3 No. Kramer VM-3AN balanced stereo distribution amplifiers.

22.5.1.2 Wiring

The electrical sub-specialist contractor shall include for all wiring required for the complete, proper and safe operation of the audio and induction loop systems and all allowances in respect of containment, wiring, power supplies etc. shall be included for at tender stage. The electrical sub-specialist contractor shall ascertain the full extent of wiring in conjunction with their sub-sub specialist installer pre-tender. No claims shall be entertained post tender.

22.6 CLASSROOMS SCHEDULE OF EQUIPMENT

N/A

22.7 BASELINE PRODUCT MANUFACTURER

For this contract the baseline product manufacturers are Amptronic & Sennheiser.

22.8 REFERENCE SUB-SPECIALIST

SKS Communications Ltd or equal & approved.

23 64 DISABLED PERSONS' CALL SYSTEM

23.1 GENERAL

The contractor shall allow for the installation of a disabled person call alarm system in all disabled persons' WC's as indicated on the drawings. The system shall comprise, over door indicators, central remote indicator unit/panel located in the admin office, reset buttons local power supply unit(s) and low level pull cords.

All units shall be surface mounted with the exception of the panel in the admin office that shall be a single panel that can easily identify as to which bathroom the alarm has been raised. This shall be by means of a visual indicator and engraved text under the indicator. Individual indicator units shall not be accepted.

The main control panel shall contain voltage free relay contacts to enable transmission of a signal to the fire alarm panel. This function shall be enabled, and the link made to the fire alarm panel verified.

23.2 OPERATION

The system allows a person to call for assistance by pressing any section of the switch strips mounted around the walls at low level; a reassurance illuminated light integral within the end cap of the switch strip confirms that a call has been made to the reception. An over door indicator will also inform staff that help is required. This indicator will remain present until the reset button has been pressed. The system operates at 12V DC from a power supply unit fused at 3A. This unit will be located as shown on the drawings.

23.3 WIRING DETAILS

The contractor shall liaise with the specialist supplier prior to submission of his tender to ensure that all wiring, containment and power supplies have been allowed for in the overall tender figure. It is the responsibility of the contractor to verify all requirements prior to submitting his tender. No claims shall be entertained post tender.

24 66 TRANSPORT EVACUATION LIFT

24.1 PASSENGER LIFT, PLATFORM LIFT & MOBILE PORTABLE LIFT

The installation of one new passenger lift is to be provided within the extension. A number of electrical related builder's works is required within the lift shafts, for example double socket, telephone line, lighting to 300lux, 40A TPN supply. As part of the electrical contract, the contractor shall include for all electrical attendances relating to the lift installation. Therefore they shall make direct contact with their main contractor to obtain a full schedule of electrical attendances from their preferred lift specialists prior to tender submission.

Exact locations of all equipment shall be agreed on site with engineer and the lift specialist installer to suit the lift control panel.

A live telephone connection is also required and is to be located at the lift shaft. Exact location to be agreed on site with engineer and the lift specialist installer to suit the lift control panel. This telephone line shall be a designated analogue Eircom phone line which shall be terminated at both ends by the contractor and shall be connected to the auto dialler in the lift control panel by the lift specialist installer.

25 67 FIRE ALARM INSTALLATION

25.1 GENERAL

The proposed installation provided shall be L2/L3 coverage as defined by IS3218: 2024 and as illustrated on the accompanying drawings. The system installed shall have an open protocol. "Managed" with closed protocol systems shall not be acceptable. In addition, a wireless installation shall not be acceptable by the engineer.

The contractor shall allow for the purchase, supply and installation by a specialist installer of the complete fire alarm system as specified hereafter and as detailed on the drawings.

The system shall be wired utilising loop arrangements as detailed in the generic schematic diagram on the drawings. The specialist Installer shall consult with the engineer if they wish to deviate from this schematic.

As part of the fire safety strategy development process contained within IS3218:2024, during the tender period the contractor is required to review proposed fire alarm design with their fire alarm specialist and evaluate if additional coverage or devices are required over and above that detailed in this specification and indicated on drawings to meet the coverage called for. If necessary, should additional equipment be deemed necessary all costs shall be included during tender period. Following appointment of the contractor's fire specialist and prior to commencement of installation, the contractor shall arrange a meeting in the consultant's office to review the design/installation/commissioning proposals and obtain agreement and sign off by all parties as part of the design development and implementation process.

Fire alarm strobes shall be provided with red lens covers and shall be fully synchronised. All sounders must be mounted on the loop

The main fire alarm control panel shall be located where indicated on the drawings.

The system shall be capable of controlling 100 devices per loop as an absolute, c/w 6 No. loop cards fitted and tested.

The fire detection system specified as follows shall fully comply with the following standards:

EN 54 Parts 2 and 4

IS3218: 2024

BS 5839 Part 1 2002

BS 5839 Part 2 1990

BS 5839 Part 4 1990

BS 5445 Part 5

BS 5445 Part 7

BS 5445 Part 8

Any deviation or non-compliance with these standards or with any of the following minimum requirements must be clearly highlighted to the engineer at the earliest possible opportunity.

25.2 WIRING OF FIRE ALARM SYSTEM

The loops shall be wired using 1.5 mm² / 2 core zero halogen, low smoke, flame retarding screened, PH120 enhanced grade cable and meeting the standard laid down in BS 5839 part 1 2002 and BS 6387 categories C, W and Z LL2E1.5R and BS8434: 2003. The automatic and manual devices together with interface units shall be wired in loops starting and finishing at the control panel in accordance with the drawings. All outstations shall be connected directly to the 2 core detector loops, including sensors, break glass units, sounders and interface relay units. All detection and control functions are performed by the main / control panels via the detector loops. Loops shall not be teed under any circumstances and loop installation shall be planned to accomplish this. Cables shall be contained in on galvanised wire basket and where not possible be installed in galvanised steel conduit or clipped direct to the building fabric.

25.3 EXTERNAL CABLING ROUTES

Ancillary outbuildings such as art room, PE hall etc. are to be served from the fire alarm system with cabling traveling from the extension across the external areas. To serve these buildings, contractor to allow for non-fire resistant armoured cable to BS5467/BS6724, in the underground duct between buildings. As this cable is not fire resistant it must be run directly into a fire resistant enclosure and joint at the entry to the building to connect to the fire resistant cable to prevent it jeopardising the integrity of the circuit.

Contractor to allow for fire resistant enclosures at every exit/entry point for the fire alarm cable to all buildings.

25.4 ACCESSORIES

All fire alarm equipment denoted on the contract drawings shall be as detailed hereafter. Equipment shall be based on the Hochiki 'ESP' and Apollo range of devices or other equal & approved manufacturer with an OPEN PROTOCOL. All devices and panels shall be recessed unless specifically detailed to the contrary.

25.5 SENSORS

Smoke and heat sensors shall be complete with a common base suitable for surface mounting to a standard or recessed BESA box. Sensors shall be 'soft addressed' from the main panel and shall incorporate an integral line isolator for short circuit protection and an integral LED to indicate the condition of the device and to enable that particular device to be identified in the field from the main panel controls. Both smoke and heat sensors shall be capable of providing an analogue output of smoke levels or temperature suitable for the main panels to process and interpret. Smoke, heat and smoke/heat sensors / sensor sounders shall be three part devices with a base, electronics module and removable, disposable chamber.

25.6 SMOKE DETECTORS

These shall be looped powered. The smoke detectors shall comply with BS 5774 Part 7 and EN 54; they shall be of the analogue addressable type. They shall be of the optical type unless otherwise specified. These detectors shall be installed in accordance with the system drawings and IS3218: 2013. A common base shall be used to allow interchange with ionisation and heat detectors. This detector shall be suitable for use in conjunction with the control panel specified and be complete with a line isolator.

25.7 HEAT DETECTORS

These shall be looped powered. Heat sensors shall comply with BS 5445: Part 5 and shall be configured at the main panels to operate simultaneously in both fixed temperature and Rate of Rise modes. These detectors shall be installed in accordance with the system drawings and IS 3218:2013. A common base shall be used to allow interchange with ionisation and optical detectors. In certain areas it may be necessary to restrict the sensors to fixed temperature mode only. This programming will be carried out during the course of the contract from the main panel, maximum temperature to be advised.

25.8 COMMON BASE

All detectors shall use a common base, which shall be suitable for Besa box mounting. This will allow interchanging of devices if necessary and also protect the integrity of the loop if the devices are accidentally removed. Where mounted on a suspended ceiling automatic detectors shall be provided with a recessed mounting kit and wooden back pattress.

25.9 CALL POINTS

Manual Call Points shall be suitable for flush mounting and be supplied complete with plastic box, test probe and fitted with a non-frangible element. A special key to test shall be supplied with each unit. All call points shall be individually soft addressed from the main panels and contain an integral LED to denote operational mode and to enable that particular device to be identified 'in the field' from the main panel controls. All call points should have the ability to be tested without generating an alarm condition. Manual call points shall comply with IS3218: 2013. All call points shall be located at 1100mm above finished floor level.

25.10 SMOKE/HEAT SOUNDER UNITS

The Smoke/Heat /Sounder unit shall contain an integral sounder within its base, together with both an optical smoke detector and a fixed temperature heat detector. These shall be looped powered. Programming of these functions will be carried out at the main panel and the engineer shall advise details during the course of the contract. The units shall comply with BS5445: Part 5, BS5446: Part 1 and BS5839: Part 2.

25.11 SOUNDER BASES

These shall be looped powered. The sounders shall be electronic with adjustable volume control with a maximum sound level of at least 100dB(A) at 1m, and complying with the frequency requirements of BS5839:2002 and IS3218 2013. Each sounder shall be suitable for connecting directly to the detector loop and shall be soft addresses by the main panels. Each sounder shall be complete with integral short circuit isolating device.

25.12 BEACONS/STROBE UNITS

These shall be addressable looped powered units with high intensity LED's. They shall have the ability to vary the flashing frequency. Operating temperature range shall be between -10°C and +50°C. The units shall comply with IS3218: 2013. (Hochiki Model ref CHQ-AB or equal & approved.)

25.13 DOOR RELEASE TO ACCESS CONTROL OPERATED DOORS

The contractor shall allow for the provision of an interface on the fire alarm system to automatically de-energise the magnetic locking devices, which hold shut all access controlled doors and. 1 No. interface shall be required for each door latch device. This shall be provided by means of a loop-powered interface, which shall de-energise the magnetic contact regardless of the status of any other switching device at the door. In other words, the interface contact has overriding control at all times. The door controller shall be fitted with an interface to permit interconnection of the fire alarm signal cable and in the event of the fire alarm being activated the access-controlled doors shall all fail safe to the open state.

25.14 FIRE ALARM INTERFACE UNITS

The contractor shall allow for an interface to the various items of equipment or plant as indicated on the drawings. These shall include the roller shutter door for the kitchen servery, boiler control panels, door-hold-open devices, access controlled doors, gas proven panels and other devices as indicated on the drawings. The contractor shall include for all final connections to the various devices/panels.

25.15 AUTOMATIC OPENING VENTS

Refer to architect's specification for full details of AOV's to be provided. The following comprise outline electrical provisions and outline wiring details based on the Architect's specification, however it shall remain the contractor's responsibility to ascertain full rewiring requirements from their supplier for each AOV and make all due allowances at tender stage.

- The activation of any detector within the stairwell shall operate the respective AOV
- Include for the installation and connection of the manufacturer's smoke detector (not shown on drawing) supplied with the system in 2C 1.5mm² Firetuf FT120. Detector location to be at top of stair-core in each case.
- Manufacturer's break-glass units and manual controls to be wired back to panel in accordance with the manufacturer's requirements.
- Power supply to control panel

25.16 VOLT-FREE CONTACTS

Provision shall be made within the fire alarm panel for a set of volt free contacts to enable interconnection to a digital communicator supplied under the Intruder Alarm Installation. When the fire alarm triggers, a fire alert signal shall be transmitted to the 24-hour monitoring station. Allow for 4C 1.5mm² Firetuf 'Plus Enhanced' PH120 cable enclosed in galvanised steel conduit between the fire alarm panel and intruder alarm panel.

25.17 SYSTEM MANUFACTURER

Advanced Electronics Ltd, multi-loop Panel MX range with Hochiki ESP open protocol detectors. Or equal & approved

25.18 NON-COMPLIANCE WITH SPECIFICATION

The contractor shall ensure that the above systems comply fully with this specification and standards quoted and detailed drawings. He shall advise of any deviation prior to submitting a quotation based on using any of the aforementioned systems.

25.19 PROVISION OF ZONE/LOOP CHART

The contractor shall include for Fire Alarm Zone/Loop Chart. This chart shall indicate the overall building floor plans and the location of all items of Fire Detection and show room names. The chart shall be located adjacent the Fire Alarm Panel contained within an A3 sized glazed panel.

25.20 TESTING AND COMMISSIONING

The system manufacture or his representative shall fully commission the system in accordance with IS3218: 2024. Upon completion the commissioning agent shall hand over a signed certificate in accordance with Appendices of the IS3218 standard. The contract shall include for three demonstration of the system by the Specialist Installer to the Employer when the installation is complete. Three demonstrations shall be allowed for on three fully separate days with at least three weeks between each demonstration. Before the system is handed over to the employer for acceptance, the system shall be fully 'soak tested' for 1 week.

The date of the Architects Practical Completion Certificate shall be taken as the handover date unless otherwise agreed in writing. The complete installation shall be tested and commissioned by the contractor and typed certificates in accordance with IS3218:2013 standard shall be issued to the Employer as part of the 'As Installed' documentation. As part of the 'As Installed' drawings, wiring arrangements and sound levels shall be recorded on the drawings for review by the engineer. Practical Completion or Handover of the building shall not be achieved without this carried out in its entirety.

25.20.1 Commissioning shall include:-

An audibility test of the alarm devices. Audibility level readings shall be taken in each room using an instrument complying with BS 5969, type 2 with slow response and 'A' weighting. The levels shall be recorded on the As-Installed drawings.

All trigger devices i.e. manual call points, heat, and smoke detectors shall be tested for correct operation.

A mains failure test shall be carried out to verify and standby battery system complies with the requirements of this specification.

Prior to commissioning the electrical contractor shall provide a certificate of installation and testing of the system, See appendices of IS3218: 2013.

The installation and commissioning certificates shall not be accepted unless it is accompanied with the record drawings and user manuals and the system log book.

25.21 MAINTENANCE

The contractor shall include for monitoring the installation and pay all costs for the first 12 months of operation, which shall include 24 hour (4 hour call out period maximum) response to system faults and free parts and labour warranty for the duration of this maintenance contract.

Additionally, regular servicing and maintaining of the installation shall be carried out at quarterly intervals during the maintenance period. During this period the contractor in conjunction with the specialist installer shall submit to the Engineer a full report in duplicate including details of tests carried out and any faults found with the system and corrective action taken.

25.22 ANCILLARY OUTPUTS

The control panel shall be equipped with auxiliary relay outputs, which shall be programmable from any actuating device on any loop. This should be capable of being expanded if required, by the simple inclusion of additional modules.

The following items of equipment shall be provided with a fire alarm link that shall de-energise the equipment in the event of a fire alarm condition:

- Boiler control panel
- Gas slam shut valve
- Public address system, to be muted when fire signal is received
- Lifts
- All door hold open devices and automatic assisted doors
- Accessed controlled doors
- Automatic opening vents
- Other items indicated on the contract drawings

26 68 DISABLED REFUGE SYSTEM

26.1 GENERAL

The contractor shall supply and install an emergency voice communication (EVC) system designed especially for use with the wheelchair refuge areas. The system shall enable Fire Officers/Building Management to keep in contact throughout an emergency with these areas. The system shall meet BS9999:2008, BS5839 part 9 (2011) and BS8300:2009. All equipment shall be surface mounted.

In the event of a fire, or other emergency, staff evacuate wheelchair-restricted customers to a designated place of safety (Refuge Area). Staff then activate the Refuge Area Remote Unit, which lights a Refuge Occupied indicator on the main control panel. The Fire Officer, or Building Manager, can communicate with the occupants held within the refuge areas, either on an individual basis or by using the 'all-call' option.

Each activated refuge system has an auto-listening facility to monitor activity in the refuge area. As each disabled person is moved to safety, the system can be reset via a key operated switch on the refuge area remote unit. Wiring of the system shall be 2C & earth 1.5mm² Firetuf 'FT120' enhanced grade PH120 fire cable.

26.1.1 Master Control Panel

Master control and slave panels shall be provided as outlined in Part 4 Equipment Schedule and as illustrated on the schematic drawings. They shall incorporate all refuge outstations and disabled WC alarm outstations (panel to be expandable) shall be installed at the main entrance near the fire alarm panel as indicated on the contract drawings. The controller shall have a backlit LCD and a handset inside a hinged door. The system shall be interfaced with the fire detection system.

230VAC input with 14V internal power supply

Fully-monitored Battery backed for 24 hours in quiescent mode then 3 hours in full power.

Fully networkable

The system shall be fully monitored and faults reported back to the master control panel.

RAL9005 30% Glass black colour

The system shall be able to communicate with disabled refuge remotes, fire telephone remotes, emergency/stewards telephone, roaming telephones and disabled toilet alarms from the master control panel.

Indicators for 'power', 'incoming call', 'refuge areas active', 'system healthy', 'processor restart', 'common fault', 'processor fault'.

Mounting height 1400-1500mm AFFL.

As Baldwin Boxall 'CARE2' system or equivalent.

26.1.2 Outstations

The disabled refuge remote shall provide clear, hands-free, two-way communication between person(s) in any of the refuge areas and building control (or fire officers) during an evacuation event. The unit supplied shall be of Type B outstation as defined in BS5839-9:2011 - for use by the public and disabled persons requiring assistance. The disabled refuge outstations on the system shall remain permanently 'active', however, by fitting an optional module they can remain in 'standby' mode until activated by the fire panel.

Disabled Refuge Remote Units shall have the following features:

- Green colour
- Induction loop output to feed external amplifier.
- Surface mountable
- Calls shall be reset at the control panel.
- Hands free operation.
- Speech steered.
- Powered from the line.
- One remote unit shall be installed per refuge area.
- The outstations in the external play areas (3 No.) shall be minimum IP65+ rated (to be custom made)
- Mounting height 900-1200mm AFFL

The contractor shall obtain exact wiring requirements from the specialist supplier. The system shall be radial wired and all wiring shall be in 2C 1.5mm² enhanced grade PH120 cable.

27 68 INTEGRATED DOOR ACCESS & DOOR INTERCOM INSTALLATION

27.1 GENERAL

The electrical reserved specialist shall include the installation of a TCP/IP Door Intercom and integrated door access Installation.

The electrical reserved specialist and their sub-specialist shall note proposals put forward on traditional analogue solutions will not be acceptable. The baseline system manufacture for Door Intercom is Comelit with Paxton Net2 as the access control element.

Please note that the access control and door entry systems shall be in full compliance with PSA 67: 2022 which include all the requirements of EN179, EN1125 and EN13637.

The electrical contractor must, at an early stage in the contract, engage with their security specialist to ensure that they are fully qualified and competent in the workings of the above mentioned standards and that they are fully trained and certified to commission the access control systems to the above standards.

The electrical contractor must engage with the main contractor at an early stage to ensure that the door schedule and the ironmongery for same are compatible with the access control strategy set out in the electrical contract documents and co-ordination between all parties is conducted.

27.2 DESCRIPTION OF WORKS

The electrical reserved specialist shall employ a security sub-specialist for the supply, installation, commissioning & demonstrations of the entire TCP/IP door intercom and access control proposed for this project as described here and on tender design intent drawings. The installation shall be based on TCP/IP protocol. At the main entrance into the school building a vandal resistant stainless steel video and audio outdoor intercom with keypad & prox reader shall be installed which shall enable communication between the main entrance and the school admin office. A remote away from home App shall be provided that will enable the school authority to answer door entry, monitor calls and enable remote access should the need arise. The keypad and Paxton Net2 fob provision shall enable staff to gain entry into the building without the need to buzz the admin office. The Paxton fob reader shall be fully integrated into the outdoor panel. The indoor unit shall be wall mounted full-duplex hands-free door entry monitor with 4.3" 16/9 touch-screen colour display as per Comelit 'Icona' range or equal and equivalent. Clarification required on any item of the proposed system shall be requested in writing from the engineer during the tender period as no claims shall be entertained thereafter.

In addition to the main door entry installation, an access control installation on a number of internal doors between each 'wing' of the school and all final escape doors to external environment or external play spaces shall be provided. As the majority of these doors are also alarmed for monitoring purposes, the proposed access control shall interface with 3rd party Intercall system to temporarily disable the door alarm when access control is authorised. Due to the nature of this project, the staff fob readers at each door shall be vandal resistant and IP rated for the readers located on the external leaf of any door or located within the outdoor teaching space. No form of push to exit buttons shall be provided. Emergency green break glass units will be necessary though to comply with fire regulations. The access control shall be interfaced with the fire alarm to fail safe on a fire condition.

The access control system shall control the movement of users through access points. Users will be identified at access points by presenting a token to a reader. At intercom entrance panels, PINs or codes and readers shall be used. The access control system shall be administered using a PC supplied and installed under this contract. This PC shall be located within the comms room or electrical switchroom as confirmed by the engineer on site. The access control software shall have a client/server structure to facilitate operation on multiple PC's. Equipment used shall be covered by a manufacturer's guarantee against electrical failure for a minimum of 5 years. The access control system should be capable of supporting 50,000 users and shall be based on the Paxton 'Net 2' system.

27.3 ACCESS DOORS

The access control system must comply with PAS 67-2022, and with the following standards as outlined.

EN1125 – emergency escape door – panic hardware shall be installed on all emergency escape doors, for this type of door, access controlled locks as equivalent to Dorma 9000 must be used (the compliant EN1125 electronic panic bars should also be included under this package).

EN179 – escape routes – this type of door shall be complete with a mechanical means of exit – i.e. Handle to open door from inside – free egress from the protected area. Abloy EL560 type sash lock, or strike lock with a mechanical handle from the inside to exit shall be provided for these door types. (The EN179 compliant mechanical handles shall be included under this package).

EN13637 – Delays on escape route doors – for all exit doors on an escape or emergency exit route, that are fitted with access control, a delay for 15 seconds shall be incorporated into the access control system. The locking mechanism used for this type of door shall be an Abloy EN 13637 compliant lock. The specialist contractor must have completed training on the product and be certified to install it. (The compliant electronic panic bars should also be included under this package for this door type). Refer to the drawings for details and descriptions of the required systems.

Escape Door Systems Lock Packages
352M.80— Double Doorset



door 19, 21, 22,
25

Package Information

QTY	EDS352-EPED-DBL-UNI	
1	FF1386D10-GB---00	EDS 1386 EPED DISPLAY TERMINAL W/O INTERFACE
2	FF352M.80-----Q91	352 MOTORISED,12-24V DC C/W 25MM STRIKE (EN 13637)
2	1386S00VT-----00	EDS INTERFACE FOR LOCKING DEVICE

Technical Specification:
 Voltage— 12-24V
 Voltage Rating—12/24V DC +/- 15%
 Break In Resistance—5000N
 Monitoring Contact and Armature Contact Integrated
 Fail Unlocked—Yes
 Non Handed
 Silent Operation

Standards:
 BS EN 13637 Electrically Controlled Exit Systems
 The above can also be overlaid on top of a BS EN 179 and BS EN 1125 Abloy UK Solution.
 (For more information please see the Abloy Compliant Specification Handbook)



Door Type A

Escape Door Systems Lock Packages
352M.80— Single Doorset



Package Information

EDS352-EPED-SGL-UNI	
FF1386D10-GB---00	EDS 1386 EPED DISPLAY TERMINAL W/O INTERFACE
FF352M.80-----Q91	352 MOTORISED,12-24V DC C/W 25MM STRIKE (EN 13637)
FF1386S00VT----00	EDS INTERFACE FOR LOCKING DEVICE

Technical Specification:

Voltage— 12-24V
Voltage Rating—12/24V DC +/- 15%
Break In Resistance—5000N
Monitoring Contact and Armature Contact Integrated
Fail Unlocked—Yes
Non Handed
Silent Operation

Standards:

BS EN 13637 Electrically Controlled Exit Systems
The above can also be overlaid on top of a BS EN 179 and BS EN 1125 Abloy UK Solution.
(For more information please see the Abloy Compliant Specification Handbook)



Door Type B

All equipment outlined above and required for the successful installation of the access control system, including access control ironmongery, shall be provided by the electrical contractor for this project. Careful co-ordination is required at an early stage between the main contractors ironmongery specialist and the electrical contractor to ensure the access control system is installed to satisfy PSA requirements.

27.4 SYSTEM REQUIREMENTS - PC

27.4.1 Server

The server shall be a PC with a current Microsoft Windows® 10 operating system. The system database containing all system and user information shall be held at the server PC. There shall be no limit to the number of PC's that can run the client software. Additional software licences shall not be required to install the client software. PCs running the client software shall be connected to the server PC via TCP/IP LAN/WAN/VPN etc. The system shall be capable of supporting at least 5 simultaneous clients.

27.4.2 PC Requirements

Supply, installation and configuration of the PC shall be carried out under this contract and shall have the following minimum specification:

- Intel® Core™2 Quad Processor (or equivalent)
- 8GB RAM or greater
- Minimum 50GB free disk space
- DVD-ROM drive
- 256 colours @ 1024 x 768
- USB2 or Ethernet

27.5 CONTROL UNITS

27.5.1 Networked Controllers

The system shall comprise of single door control units as this ensures maximum system resilience through fully distributed intelligence. The control unit shall connect to the central server using an RJ45 plug into a standard TCP/IP Ethernet network. This greatly increases the flexibility of installation options on sites that have LAN/WAN networks.

Each single door control unit shall be capable of supporting 2 readers and/or 2 keypads for card plus PIN on both sides of the access point. No additional power supply unit shall be necessary at the access point to power readers, exit buttons and typical door locks.

Control units must be able to 'make their decisions locally' in the event of communications with the server PC being interrupted and can continue to operate as normal, with a buffer to retain at least 2,000 events per door controller. If total power failure these settings should be maintained for a minimum of 28 days before data is lost.

Control units shall be fitted with fault finding LEDs to enable quick and easy maintenance and fault diagnosis. To ensure fast accurate reporting and responsive administration, control units should plug directly into a TCP/IP network. Control units shall be fitted with FLASH memory enabling high speed firmware upgrades over the network.

The control units shall support 50,000 unique card IDs. Control units shall be able to automatically unlock the door during specified time periods. Must be easily configurable to work with wide range of 3rd party reader types.

The controller should comprise of the following:

- Built-in 100 Mbps Ethernet socket
- Two controlled voltage free relays
- Two reader ports (12v)
- One Intruder Alarm port and relay
- RS485 data line connector
- Switchable termination resistors with LED
- Tamper Input
- Exit button terminal
- PSU input terminal
- Door contact input
- Diagnostic LED next to the function concerned

Each controller must have the capacity to integrate with fire alarm systems, intruder alarm panels and volt free inputs from 3rd party systems. All controllers shall be networked. Refer to the access control schematic for details. Final wiring schematics shall be obtained from the sub-specialists by the electrical reserved specialist prior to any works proceeding on site.

27.5.2 Control Units Power Supplies and Housings

It is a requirement to power the control unit and associated locking hardware using a POE (802.3af - 802.3at type 1) or POE+ (PoE+ 802.3at type 2) power supply from a single RJ45 connection to a POE/POE+ enabled data network. It shall be possible to power the control unit and associated locking hardware using a 2A 12V DC power supply.

The required power supplies shall be housed in steel cabinets in the ceiling voids within the vicinity of each door, and incorporate a tamper switch. Space shall also be provided for a backup battery to supply power for an extended period in event of power failure (Minimum 7 Ah), unless using POE/POE+ where it is assumed a UPS will be used to provide backup power.

Mains failure must be reported to the access control system.

27.6 SYSTEM REQUIREMENTS - DESKTOP READER

A desktop reader shall be included for token administration at server/client or both. The desktop reader shall connect to the PC via the USB port, and have status LED's. No additional software shall be required.

27.7 TOKENS

The access control system should store a unique 8 digit user number. In order to ensure maximum security, tokens must only transmit their number after encrypted passwords have been exchanged between token and reader. Low security protocols such as EM4100 can also be used at customers discretion.

27.8 COMMUNICATIONS

27.8.1 TCP/IP to RS485 Converter

The control units shall have a built in TCP/IP Ethernet connection along with an RS485 connection, allowing direct connection to the LAN, connection to other controllers via RS485 or a combination. The system shall be capable of managing up to at least 200 TCP/IP remote interfaces. The 485 TCP/IP Ethernet interface shall be capable of auto-negotiating speed and duplex up to 100mbps/full duplex. The system must be able to support multiple TCP/IP converters on the same system and in conjunction with any other style of converter installed.

27.9 CABLING

27.9.1 Control Unit to Reader

Each access control readers should come with 5m of included cable. Where extensions are required, 10 core screened cable - Common Reference (CR) 9540 is to be used, with crimp connections terminated within an enclosure labelled. The contractor shall make allowance for this at tender stage. Length of allowable cable extensions from control unit to reader should be up to 50m.

27.10 SOFTWARE

The access control software shall use a familiar style user interface, preferably similar to Windows Outlook®, enabling intuitive use. The software must also be available in multiple languages to suit the installation.

27.10.1 Database

A SQL Server Express database shall be used for the storage of user data and events. The software shall be capable of importing and exporting user data in .vcf, .csv or .txt formats.

27.10.2 Client/Server Structure

The system shall support multiple clients, without extra licence charges being levied.

27.10.3 Access Permissions

Access levels shall be used to administer the control of who is allowed through which access points and what times they are allowed through on a minute by minute basis. This ensures optimum flexibility.

The access control system shall support a minimum of 250 such access levels. The system should be able to cope with giving alternative access permissions to some or all staff during bank holidays or special days.

27.10.4 Reporting

User and system events should be shown in real time. Filtering options to select all events, access events, alarm events and system events during customised time periods.

The software must have the ability for the user to configure their own custom reports. Reports should allow selection of date, time, users or user groups and access points. The reports should be configured within the access control user software and not a 3rd party application. A simple wizard shall be used to configure reports to make configuring and saving reports as simple as possible.

27.10.5 Users

The system shall be capable of supporting up to 50,000 unique card ID's. Users must be able to have as many active tokens as required. User tokens should be able to be designated as lost. The system should be capable of setting a valid date range for user. Outside this date range any cards for that user will be invalid. The system should have user definable fields that can be tailored by the system administrator to store address or other relevant information.

27.10.6 Departments

Users can be grouped into departments. Departments can be used when generating event reports and setting access permissions.

27.10.7 Operators

Any user may be given operator rights allowing them to log onto the software and administer the system. The software shall support at least 100 operators. The system shall allow the restriction of operator privileges in certain areas of the software.

27.10.8 Access Control Alarms

The following alarms must be handled by the access control system; door forced open, door left open, power supply mains failure, control unit housing tamper, door monitoring alarm. Each alarm event is reported in the event log. Alarm events can be acknowledged by an authorised operator.

In addition, alarm reporting via other mediums, such as SMS and Email, shall be supported. An alarm sounder shall be generated local to each sensitive access point. The exact nature of the sound and time delay before sounding is configurable for each type of alarm and each door.

27.11 SYSTEM REQUIREMENTS - READERS

27.11.1 Proximity reader

Reader fascias shall be interchangeable for aesthetic flexibility. Reader shall be rated to IPX7 suitable for external and internal use.

Electronics shall be completely encapsulated in a watertight potting compound. Reader should be capable of operating within the temperature range -35°C to 66°C.

Dimensions (mm) P50 - 50w x 100h x 15d



illustration of indoor reader



illustration of Vandal outdoor reader

27.12 SYSTEM REQUIREMENTS – PROXIMITY KEYFOBS

Proximity devices use secure Hitag2 125kHz technology as used in the Paxton Access transponder devices. Keyfobs shall have a lifetime guarantee against electrical failure.

Keyfobs are passive and are not reliant on an internal battery to exchange data with a proximity reader.

Dimensions (mm) 40h X 14d

27.13 SYSTEM REQUIREMENTS - FEATURES

27.13.1 Security Lockdown

The system proposed shall have a lockdown facility. Lockdown is the facility to secure the site through a single action by disabling access through selected doors. This includes disabling exit buttons and relocking doors held open by time zones. Only users that are specified as being exempt will retain their normal access rights to all doors, including those that are part of the lockdown.

27.13.2 Site Graphics

The access control system shall allow for multiple site graphics to be imported in either jpg or bmp format. The site graphics shall show the live status of doors including door open/closed, valid token, invalid token and alarm conditions. In the event of an alarm the site graphic should pan to the appropriate part of a site graphic. With IP cameras being proposed on this project these should also be displayed on the site graphics.

27.13.3 Card Printing

The access control system shall have the ability to print cards using a standard Windows® card printer. The card designer program shall allow unlimited configurations, with multiple templates saved for each user group. The ability to import company logos and background images, overlay watermarks, static text fields and layers are all required components.

27.13.4 Landlord Tenant

N/A for this project.

27.13.5 Temporary Access Permissions

The system shall have the ability to enable temporary access. This allows a user temporary access to a door or area for a specific period of time. When the time has expired the access level will revert to the original access level for the user/group of users

27.13.6 Double Tap Trigger

The system shall have the ability to double tap trigger. When a user presents a token twice in quick succession it shall kick start a rule in to trigger an action i.e. hold door open, talk to the lighting control or raise an alarm etc.

27.13.7 Email a Report

The system shall have the ability to generate reports. At a specific time or from a specific event a report can be emailed to the school management authority.

27.13.8 Open door for specified amount of time trigger

The access control system shall have the ability to allow individual or groups of user's individual door open times. For this specific project with slow moving patients, a wheelchair user shall have an extended time period to access a door.

27.13.9 Net2 Entry Integration with Net2 Software

This shall only be applicable in instances that the Net2 entry panel is proposed. Streamlined Net2 Entry and Net2 software integration - specific Net2 Entry events can trigger actions within the Net2 software. For example, on gaining access from the monitor, this will also turn on lighting controls in this area.

27.14 SPECIFIC SYSTEM REQUIREMENTS - INTEGRATION

27.14.1 Intruder Alarm

The access control system shall integrate with a wide range of 3rd party intruder alarm systems. Integration can be achieved by using an intruder alarm momentary key switch input and status output. The access control software shall distinguish between users who can arm or disarm the intruder alarm system. The system must deny access to unauthorised users if the alarm is set.

The system shall have the ability to have multiple alarm setting and un-setting points and different alarm zones if required.

27.14.2 IP Cameras

The access control system shall be able to display moving images from any IP cameras on the local or wide area network. Links to IP cameras are able to be placed in the relevant positions within any site graphics used.

27.14.3 NVR Surveillance

The access control system shall integrate with popular NVR surveillance software. Software integration shall be achieved through local area or wide area network. Any access point can be associated with one or more IP cameras. IP camera footage of any event can be activated from the access control event log by a single click via a camera symbol in the event stream history.

27.14.4 Lift Control

N/A

27.14.5 Integration with Door Entry/Intercom System

The access control system shall integrate with a Comelit TCP/IP door entry system combining door entry with key features of Net2.

Visitors shall initiate video & audio calls via the bell button on the external panel. Visitor access can be granted via a push button on the hands free display in the admin office or via the away from home App on an authorised users portable device. When connected to Net2 system, staff access to the building shall be gained by using a pin code and/or proximity reader.

27.15 DOOR ENTRY INSTALLATION

The baseline specification shall be Comelit TCP/IP system range Icona & Vandelcom and Paxton Net2 access control unit.

27.15.1 Admin Office Indoor Station Monitor

This shall allow a person inside a building to identify a visitor before they are granted entry. The person can grant or deny access as appropriate via their touchscreen monitor and open the exterior door. The indoor unit shall be wall mounted full-duplex hands-free door entry monitor with 4.3" 16/9 touch-screen colour display as per Comelit 'Icona' range or equal and equivalent. Illustration below.



27.15.2 Outdoor Entry Vandal Resistant Panel

At the two main entrances into the school building a vandal resistant stainless steel video and audio outdoor intercom with keypad & prox reader shall be installed which shall enable communication between the main entrance and the school admin office. The installation shall be recessed throughout. A remote "Away From Home App" shall be provided that will enable the school authority to answer door entry, monitor calls and enable remote access should the need arise. The vandal resistant panel should be made from corrosion resistant marine grade stainless steel and have an IP55 rating to meet the most demanding environments. The intercom shall be based on Comelit 'vandelcom' range. Illustration below.



27.16 WIRING/INTEGRATION OF ACCESS CONTROL

Wiring, containment, power supplies, interfaces and final connections shall include in this contract. The electrical reserved specialist shall liaise with his security sub-specialist for specific wiring requirements. All wiring shall be installed in accordance with and comply with the current NSAI I.S. 10101: 2020 electrical regulations, NSAI I.S. 10101: 2020:. The contractor shall include for all wiring required for the complete, proper and safe operation of the system and all allowances in respect of containment, wiring, power supplies etc. shall be included for at tender stage to meet the manufacturer's requirements. No claims shall be entertained post tender.

27.17 SPECIALIST SUPPLIER

Baseline reference Paxton Access Net 2 for access control and Comelit for Door Intercom.

27.18 SPECIALIST INSTALLER

Pauric Rushe

CTI Business Solutions

Manager / CCTV-Network Engineer

0851299717

pauric@cti.ie

28 68 SECURITY PROTECTION CCTV INSTALLATION

28.1 GENERAL

The electrical reserved specialist shall allow employing a PSA (Private Security Authority) licenced security specialist for the purchase, supply, installation & commissioning of the IP Analytical CCTV installation associated with this project. The system shall be installed to EN50132 Parts 1-7.

The installation of the new IP CCTV installation shall integrate with an external PA installation which shall operate via a single front end managed user platform which also fully integrates ANPR camera, associated software and future facial recognition cameras and associated software. It shall be noted that solutions proposed based on a combination of IP Analytical CCTV cameras with beams and/or PIR's shall not be accepted under any circumstance. Systems with 3rd party equipment interfaces as part of the proposal shall not be acceptable. The installation shall consist of a number of cameras positioned strategically around the site and within the building. A site audit by the appointed contractor's security specialist shall be carried out prior to installation to finalise/fine tune proposed camera locations that are indicated on the design drawings. This shall be in the presence of the consulting engineer and no major deviation from the drawings shall be permitted.

The managed IP CCTV platform shall be monitored after building hours by a PSA licenced monitoring company in accordance with PSA33:2014. The costs for the first 1-year monitoring shall be included within the contract.

An additional camera will be located in the external car park across the road, a wireless kit is to be provided to allow for remote connection to the main school CCTV system. This camera is to be monitored from the head end computer; the electrical supply for it will be taken from the local mini pillar within the carpark serving the lights & EV chargers.

The electrical reserved specialist shall provide all attendances for the security sub-specialists. This shall include supply and install of conduits to the various locations as details on the drawings. A 20mm conduit shall serve no more than 2 No. camera points. The electrical reserved specialist shall liaise with their security specialist at the time of time to ascertain the full extent of attendances required.

All cameras shall be wired in CAT6a cabling as part of the structured cabling upgrade works. External duct grade CAT6a cables shall be used for cameras that are located externally on columns. All CCTV cables within the main building shall be terminated in a dedicated 'CCTV patch panel within the comms cabinet. Where applicable, any CCTV cables for equipment located on poles/externally on the site shall terminate within a dedicated CCTV patch panel within the appropriate luci-pillars, together with all necessary PoE switches. The security specialist shall be responsible for providing all necessary PoE switches, servers etc. for the CCTV installations throughout and shall refer to data cabling schematics which highlight comms cabinet locations in order to ascertain the quantities of switches required.

Front end software shall be provided within the proposal that will enable the client to remotely monitor using devices including iPhone, iPad and PC.

The main contractor shall supply and install all wire ways and segregated cable containment systems to all CCTV point locations. The specialist security systems installer shall position the cameras, monitors, controllers etc.

All new cabling shall be contained within wire basket/trunking and galvanised conduit throughout. It shall not be acceptable to install cabling without containment. At proposed camera positions, the structured cabling shall be crimped with a RJ45 connector to enable direct connection into the cameras. Termination onto the back of a RJ45 faceplate is not required.

The electrical reserved specialist shall ascertain the extents of the proposed cabling routes from the infrastructure drawings and make all due allowances in his tender. No claims shall be entertained post tender due to lack of knowledge of the existing installation.

The complete IP analytical CCTV installation shall afford the monitoring and recording of all images from number of network based Megapixel cameras. Images shall be stored on a Network Video Recorders installed within a comms cabinet located in the security room. Images from each static camera will be recorded for 35 days at 25 frames per second (fps), full resolution, 10 hours continuous recording per day. All PTZ cameras shall record at min 20fps.

Under this contract, the specialist sub-contractor shall supply, install and commission a CCTV system in accordance with this specification. Upon satisfactory completion and testing of this system, the specialist installer will provide a commissioning certificate for this system. The system will be maintained for a period of 12 months after handover.

Final location and mounting height of all cameras shall be agreed on site with the engineer prior to commencement of CCTV works on site otherwise any camera and/or equipment required to be moved as instructed by the engineer shall be at no expense to the contract.

These cameras shall be fully functional as described below. Monitors shall be provided (sizes & spec detailed below) and located in the security room and remotely within the principal's office wall mounted. Full operation and control including playback shall be available from the principal's office.

Due to the remote location of the school carpark, CCTV cameras will be required to monitor this area. Two external cameras to be mounted on lighting poles, the one closest to the school to be provided with a data point facing the school; linked back to a mini pillar/dist board where power and switch are located, the second camera is ran back to this location also.

Contractor to allow for an external wall mounted data point pointing towards the carpark and linked back to the naming CCTV network. Contactor to ensure the positioning of two data points is not obstructed or blocked by trees. Ubiquiti point to point nano station links to be used.

28.2 EQUIPMENT SPECIFICATION

All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer's system and as specified below. All systems and components shall have been thoroughly tested and proven in actual use. All systems and components shall be provided with an explicit manufacturer warranty. Any equipment not mentioned below or indicated on the contract drawings but necessary for the full, complete and proper functioning and operation of the system shall be included.

This section of the specification details the minimum requirements for this IP Self learning Analytics CCTV project. This Security Video Surveillance System shall include but is not limited to the following:

- Network Video Management Software (NVMS)
- Network Video Recording Hardware (NVR)

28.2.1 Related Requirements:

- All related equipment must be:
 - From the same manufacturer
 - Able to function autonomously during a failure of one of the related sections
 - Able to communicate bi-directionally
 - Interfaced through digital communication protocols including, but not limited to:
 - ASCII
 - Hexadecimal Data Transmissions
 - Must be provided as a "turnkey" solution
 - The following sections related to this section:
 - Video Surveillance Control and Management Systems
 - Video Surveillance Monitoring and Supervisory Interfaces
 - Digital Video Recorders and Analog Recording Devices
 - Video Surveillance Systems Infrastructure
 - Video Surveillance Remote Positioning Equipment
 - Transportation Signaling and Control Equipment – License Plate Recognition

28.2.2 Administrative requirements

Coordination

Coordinate with engineer regarding camera network configuration and estimated bandwidth utilization prior to connection of cameras to owner's network.

Provide a schedule with a list of participants to attend weekly coordination and progress update meeting until job completion.

28.2.3 Submittals

Submittals described in this section shall be submitted by the main contractor and their security sub-specialist with the original tender submission. Refer to form of tender documentation for completion.

28.2.4 Product Data

Submit manufacturer technical specifications, typical installation drawings, system overview drawings and sample images of items included in this section.

It is the duty of the contractor to provide a working system. Any omissions or errors or differences between this document and the contractor's submitted proposal shall be clearly outlined in a separate document labelled "Tenderers Proposal Details".

28.2.5 Qualification Statements

Manufacturer/Security Sub-Specialist

- Submit confirmation and details of manufacturer's warranty, extended warranty, and replacement policies.
- Submit list of available manufacturer provided, fee based professional services available to the contractor or the client including but not limited to: training, installation, commissioning, remote diagnostics and integration with 3rd party software and hardware systems.

Electrical Reserved Specialist

- Submit confirmation that sup specialist contractor is licensed to install video surveillance and security equipment as required by the authority having jurisdiction. That is PSA.
- Submit history of contractor certification(s) for items in this section.
- Submit references with contact information where contractor has installed items in this section.
- Submit confirmation that installer has received manufacturer training and is certified by the manufacturer on this equipment and that the training the installer received is current.

28.2.6 Maintenance material submittals

Spare Parts

- Deliver to the client in its original packaging, two spare fixed internal dome camera, two spare fixed bullet cameras
- Spares shall be housed in an environment and condition recommended by the manufacturer and shall be clearly labeled with "SPARE: DO NOT REMOVE", manufacturer part number, and date of delivery to the client. These shall be located in the security room and handed over in the presence of the consulting engineer.

- All packaging for spares must be kept in good condition and used as appropriate for any Returns to Manufacturer (RMA).

28.2.7 Quality assurance

Qualifications

- Manufacturer shall have been in business for more than 5 years.

Installers

- All camera installation, configuration, setup, program and related work shall be performed by authorized integrators/electronic technicians certified by the manufacturer.
- Certification for authorized integrators/electronic technicians shall include at a minimum the installation and service of the equipment provided.

28.2.8 Warranty

The main contractor shall provide a single written document outlining the warranty of the manufacturer(s) product and the contractor's installation, on a single document. The document shall warrant complete installation of all services and equipment to be free from defects in materials and workmanship for a period of no less than two (2) years, starting with the date of final system acceptance which shall be the date of the engineer's practical completion certificate and not necessarily the date of installation.

The main contractor and their security specialist shall provide any software maintenance patches and version updates or upgrades at no-additional cost to client for a period of at least three (3) years.

The main contractor security specialist provides a cost budget for up to three (3) years for the maintenance and upgrades to the system. The budget must clearly define all contractor and manufacturer costs expected.

28.3 NETWORK VIDEO MANAGEMENT SERVER(S)

28.3.1 Baseline Manufacturer(s):

- Avigilon™ Server Hardware and Storage Expansions
- Design based on Avigilon™ server Hardware and Storage Expansions
- Other Manufacturers shall be considered under an equal & approved process evaluated by the engineer as set out in section 3 of the main electrical specification product & system approvals

The Video Management System shall allow the use of off-the-shelf computers, servers, storage and switches from any manufacturer with components that meet the minimum requirements.

- Contractor shall supply all 19" rack support rails, mounting kits, and cable management modules to install Video Management server.
- The Performance requirements for the VMS server are as follows:
 - Form Factor: 2U Rack Mounted
 - Processor: Quad Core 2.0 GHz
 - System RAM: 4 GB
 - Hard Drive: SATA-II 7200 RPM Enterprise Class
 - Internal Storage Hard Drive(s): SATA-II 7200 RPM in RAID5 configuration
 - Min 1TB internal usable storage shall be included
 - At least two Network Interface(s): minimum 1GbE per port
 - Operating System shall be certified to work by the Video Management Software's manufacturer and be Windows 8 or greater

28.4 NETWORK VIDEO MANAGEMENT WORKSTATION(S)

28.4.1 Baseline Manufacturer:

- Avigilon™ server Hardware with Internal Storage
- Design based on Avigilon™ server Hardware with Internal Storage
- Other Manufacturers shall be considered under an equal & approved process evaluated by the engineer as set out in section 3 of the main electrical specification product & system approvals

The Video Management Workstation shall allow the use of off-the-shelf computer components that meet the minimum performance requirements.

The Performance requirements for the VMS workstation are as follows:

- Form Factor
- Processor: Intel® Dual Core Xeon 2.0 GHz
- System RAM: 2 GB minimum
- Hard Drive: SATA-II 7200 RPM
- Network Interface: 1x1GbE minimum
- Video Card: PCI Express, DirectX 10.0 compliant with 256 MB RAM (NVIDIA GeForce 600 series or better)
- Operating System shall be certified to work by the Video Management Software's manufacturer and be Windows 8 64-bit or greater.

28.5 NETWORK VIDEO MANAGEMENT STORAGE

28.5.1 Baseline Manufacturer:

- Avigilon™ Storage Expansions
- Design based on Avigilon™ Storage Expansions
- Other Manufacturers shall be considered under an equal & approved process evaluated by the engineer as set out in section 3 of the main electrical specification product & system approvals

28.6 NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS)

28.6.1 Baseline Manufacturer:

- Avigilon™ Control Center 5.x
- Design based on Avigilon™ Control Center 5.x
- Other Manufacturers shall be considered under an equal & approved process evaluated by the engineer as set out in section 3 of the main electrical specification product & system

Contractor shall provide all applicable Network Video Management Software (NVMS) modules and licenses required to provide a complete and fully functional integration.

The NVMS shall be installed on hardware which meet or exceed the manufacturer's recommended requirements:

The design and performance requirements for the NVMS software are as follows:

The NVMS shall be available as a stand-alone software offering or pre-loaded on turn-key workstations and servers running Microsoft Windows with configurable storage.

The NVMS shall be available in a staged licensed software solution at three levels:

- Enterprise
- Standard
- Core.

The NVMS shall be an enterprise level software solution that shall be scalable from one client, server and camera up to:

- 100 servers per Site.
- 128 cameras per server or 20,000 cameras per Site

Indefinite number of concurrent client to Site connections, limited only by the bandwidth capability of the network and server.

The NVMS shall consist of server software applications and client software applications.

The NVMS shall include a gateway software application that connects mobile devices and other thin clients to the NVMS.

- The NVMS mobile client shall be supported by:
 - Android mobile devices
 - Apple mobile devices.
- The NVMS thin web client shall be supported by:
 - Internet Explorer, Chrome, and Firefox web browsers on Windows desktops.
 - Safari, Chrome, and Firefox web browsers on Macintosh desktops.

The NVMS shall be available in the following languages:

- Irish
- English

The NVMS shall permit server and client software applications to be installed and run on both the same computer or on separate computers.

The NVMS shall support storage and processing of video and audio.

- Audio and video must be recorded natively from the camera with no transcoding.
- Audio and video must be synchronized regardless of frame-rate, resolution or bitrate.

The NVMS shall support High Definition Stream Management (HDSM)[™] architecture which includes:

- Support for industry standard compression formats including but not limited to:
- JPEG2000
- MJPEG
- MPEG-4
- H.264
- The client and server machine shall communicate resolution real estate such that the server machine acts as a video proxy and shall know the maximum monitor resolution supported by the client machine.
- Support for reducing the required client bandwidth and processing power of a megapixel video stream by transmitting only the fraction of the video stream that is visible in the video display tile. (e.g. If a user is viewing a 5MP camera in a 352x240 resolution tile then a CIF representation of the 5MP image shall be transmitted).
- Support for reducing the required client bandwidth and processing power of a multi-megapixel video stream by transmitting only the relevant portion(s) of the whole scene when the client is zoomed-in to view only a portion of the scene.
- Support for “data-aging”, enabling a low quality and high quality stream to be recorded under the same logical ID. After an administrator defined period of time, the higher stream would be deleted and the lower stream would remain until the end of the desired retention period.
- The NVMS shall provide the ability to reduce the image rate of recorded JPEG and JPEG2000 video over time as a means of increasing record time. The image rate can be reduced to one half or one quarter of the original image rate. This setting can be configured separately for each JPEG and JPEG2000 video source.
- The NVMS shall provide the ability to record and maintain a primary and secondary video stream for a set amount of time before the primary stream is discarded as a means of increasing record time. This setting can be configured separately for each H.264 video source.
- High Definition Stream Management (HDSM) shall be supported for local users, remote users and mobile devices.

The Network Video Management Software (NVMS) shall support recording and management of video and audio sources through the use of industry standard drivers. These drivers shall include:

- ONVIF Profile S
- Publicly Published API

The Network Video Management Software (NVMS) shall support recording and management of video and audio sources including but not limited to:

- Avigilon™ IP H.264/JPEG2000 Cameras and Encoders
- Rialto™ Analytic Appliances
- ACTi Cameras/Encoders
- Arecont Cameras
- Axis Cameras/Encoders
- Bosch
- Panasonic Cameras/Encoders
- Pelco Cameras

The Network Video Management Software (NVMS) shall support dewarping of live and recorded video for otherwise supported cameras fitted with an Immervision Panomorph lens.

The Network Video Management Software (NVMS) shall support dewarping of live and recorded video for the Oncam Grandeye Evolution line of cameras.

The NVMS shall support receiving digital input triggers and triggering digital outputs through an I/O board.

The NVMS will provide the mechanism by which individual alarm(s) from a 3rd party system (access control, etc.) can be pre-selected and configured to be monitored, and in turn trigger event driven video operations.

The NVMS shall support recording and monitoring video and audio streams from sources with bandwidth up to 90 Mbit/sec, frame rate up to 60 fps, and video resolution up to 29 MP (6576 x 4384).

The NVMS shall support the decompression of H.264 video through the client graphics card/graphical processing unit instead of using the client processing power.

The NVMS shall require no proprietary recording hardware, no hardware multiplexer or time-division technology for video and audio recording or monitoring.

The NVMS shall not limit the storage capacity and shall allow for upgrades of recording capacity without additional licensing.

The NVMS shall secure video and audio data by securely transmitting all command and control data via TCP/IP using cryptographic keys based on SSL to prevent eavesdropping or tampering.

The NVMS shall support software level integration via an Application Programming Interface (API). The API integration shall include but not limited to:

- Bi-directional alarm event processing for monitoring and acknowledgement
- Receiving card access activity events
- Receiving digital input events
- Receiving intrusion zone events

The NVMS shall support integration with the following systems:

- Paxton Net2
- Comelit

The NVMS client shall provide alarm management operations specific to access control through the use of the client graphical user interface. Including but not limited to:

- Occurrences for “Alarm” and “Reset” conditions for each of the pre-selected access system alarms will be processed and managed from the NVMS system’s Live View workspace.
- In a section reserved for displaying alarm notifications or from an alarm viewer.
- Alarms can also be acknowledged from the camera display tile.
- Once an initiated alarm occurrence is acknowledged from the NVMS system, it should be automatically acknowledged and processed in the access system alarm monitor queue without further operator intervention.

The NVMS shall have an easy process for upgrading versions:

- Are capable of being upgraded from one version to another without having to uninstall the previous version.
- Are capable of being upgraded from one edition to another without having to uninstall the application.
- Automatically detect if video or audio source firmware is out of date with respect to the current installed software and upgrade it.
- Automatically detect if client application software is out of date with respect to the current installed server software and upgrade it.

The NVMS shall run as a service configured to automatically start when the server or workstation is powered on, and automatically recover from failure or attempted tampering.

The NVMS shall allow users to monitor and administer the system from:

- A single client application for monitoring live and recorded video and audio.
- A single window for administrating all system connections.
- Any client located on the network.

The NVMS shall provide an automatic discovery solution that will easily find devices and systems by:

- Automatically discovering server instances that run on computers connected to the same network as the client.
- A search functionality to discover server instances running on computers connected on a different network segment than the client by using IP addresses or hostnames.
- Automatically discovering video and audio sources that are connected to the same network as the server.
- A search functionality to discover video and audio sources that are connected on a different network segment than the server.

The NVMS shall allow manually discovered server instances, video and audio sources to be visible to all users of a single client workstation.

- Network settings for all server instances will be identical for all users of a single client workstation.

The NVMS shall provide multiple methods for providing fault tolerant solutions to maintain high availability recording in mission critical installations including:

- The ability to cluster and synchronize up to 100 servers into a Site without a management server. In the event of a server failure, the system is able to continue running and other servers can take over the failed server's tasks.
- The ability to maintain a centralized system administration so that the same operation and system configuration settings are shared between all servers in a Site. This allows the same user login details and other configurations to be used across a Site, and ensure that the settings remain active even if a server fails.
- The ability to connect a video or audio source to multiple NVRs to achieve redundant recording.
- The ability to create a failover connection for a video or audio source. If the NVR that the video or audio source is connected to goes offline, then the failover NVR will take over the connection.

The NVMS shall support receiving Simple Network Management Protocol (SNMP) messages from servers and alert users.

The NVMS shall detect if the video or audio signal is lost and alert the system administrator.

The NVMS shall provide the capability to rename all video and audio sources and NVRs.

The NVMS shall record video and audio streams based on a recording schedule that can be defined individually for each video source. The schedule shall include but not limited to the following parameters:

- Recording Mode
- Continuous
- Motion
- Digital Inputs

- Alarms
- POS Transactions
- License Plates
- Time and Date Settings
- Daily
- Weekly
- The NVMS shall provide the ability to manually trigger recording.
- The NVMS shall provide a pre-event and post-event recording option.
- The NVMS shall provide a reference frame recording option in the absence of events.
- The NVMS shall perform motion detection on each individual video source with adjustable sensitivity, threshold and detection zones.

The NVMS shall perform analytics event detection on each individual video stream sourced from a device possessing adaptive video analytics capabilities.

- The NVMS shall allow users to connect individual video sources to analytics appliance channels.
- The NVMS shall allow users to configure events based on classified object motion detection.
- The NVMS shall allow configured analytics events to be used as alarm and rule triggers.
- The NVMS shall allow users to mark analytics detection as a true or false positive and send this data to the analytics appliance or analytics camera. This data will be collected and sent on a per video source basis to improve the accuracy of the analytics enabled device.

The NVMS shall provide the ability to set a maximum recorded video retention time for each video source.

The NVMS shall perform dynamic bandwidth management to ensure the total bandwidth does not overload the system.

The NVMS shall authenticate users before granting access to the system. Access rights for each user can be defined individually for each user, and shall include but not be limited to:

- View live images
- Use PTZ controls
- Lock PTZ controls
- Trigger manual recording
- Trigger digital outputs
- Broadcast to speakers
- View recorded images
- Export images
- Backup images
- Analytics teach by example
- Manage saved views

- Manage maps
- Manage web pages
- Manage virtual matrix monitors
- Initiate collaboration sessions
- Manage user sessions
- Listen to microphones
- Setup cameras
- Setup general settings
- Setup network settings
- Setup image and display settings
- Setup compression and image rate settings
- Setup image dimension settings
- Setup motion detection settings
- Setup privacy zone settings
- Setup manual recording settings
- Setup digital input & output settings
- Setup microphone settings
- setup speaker settings
- Setup analytics settings
- Setup sites
- Setup name
- Manage site
- Setup site view
- Setup user and group settings
- Setup Active Directory Synchronization
- Setup Corporate Hierarchy
- Setup alarm management settings
- Setup POS transaction settings
- Setup LPR settings
- Setup email settings
- Setup rule engine settings
- View site logs
- Connect and disconnect cameras
- Import and export settings
- View Server Status
- Setup servers
- Setup name
- Setup schedule settings
- Setup recording and bandwidth settings
- Setup scheduled backup settings

The NVMS shall provide the ability to rank access rights based on a user's position within a corporate hierarchy.

- Ranked users may only administer changes to users and groups that are subordinate in rank.

- The corporate hierarchy can be used to enforce the authority of a parent site over the user and group settings of one or more child sites.

The NVMS shall allow the creation of site families.

- A child site can be connected to an appropriately licensed parent site.
- The parent site will have control over the group and user privileges and information of a child site.

The NVMS shall support multiple credentials to gain access to the system including, but not limited to:

- The ability to import members of Active Directory groups as users in the NVMS.
- Changes made to members in the Active Directory are automatically synced with the NVMS.
- Users imported from the Active Directory can be added directly to existing permission groups.
- Using Windows credentials to authenticate users.
- Accept user credentials entered into the NVMS user database.

The NVMS shall provide the ability to schedule backups of recorded video with associated events to a local folder or mapped network drive.

The NVMS shall provide the ability to create and schedule alarms and corresponding actions including:

- Provide the ability to email users and system administrators when an event or system health error occurs.
- Provide the ability to schedule when email notifications are sent.
- Provide the ability to include camera images in email notifications.

The NVMS shall maintain an event log. Including but not limited to the following events:

- Server events
 - Server application starting up
 - Server application shutting down
 - Server application terminated unexpectedly
 - Server application low on resources
 - Server application installation error
 - License expires soon
 - License expired
 - Database error
 - Data initialization error
 - Data volume failed
 - Data volume recovered
 - Data volume size reduced
 - Data write error
 - Data upgrade started
 - Data upgrade completed

- Data upgrade failed
- Data recovery started
- Data recovery completed
- Data recovery failed
- Bookmark save failed
- Network connection found
- Network connection lost
- Email send error
- Server hardware event
- Backup started
- Backup completed
- Backup failed
- Server connection lost
- Device Events
 - Connection created
 - Connection removed
 - Connection created to standby server
 - Connection removed from standby server
 - Connection failure
 - Connection restored
 - Network packet loss unacceptable
 - Network packet loss acceptable
 - Motion detection started
 - Motion detection ended
 - Video analytics event started
 - Video analytics event ended
 - Tampering detected
 - Recording started
 - Recording ended
 - Recording interrupted
 - Recording resumed
 - Digital input activated
 - Digital input deactivated
 - Firmware upgrade started
 - Firmware upgrade completed
 - Firmware upgrade failed
- User Events
 - User login
 - User logout
 - Server setting changed
 - Site setting changed
 - Device setting changed
 - Device connected
 - Device disconnected
 - Digital output triggered
 - Bookmark added
 - Bookmark updated
 - Bookmark deleted
 - PTZ moved

- PTZ idle
- Export performed
- Speaker activated
- Speaker deactivated
- Virtual matrix monitor opened
- Map added
- Map updated
- Map deleted
- View added
- View updated
- View deleted
- Web Page added
- Web Page updated
- Web page deleted
- Site View updated
- Custom keyboard command triggered
- Alarm Events
 - Alarm acknowledged
 - Alarm auto acknowledged
 - Alarm triggered
 - Alarm assigned
 - Alarm unassigned
 - Alarm purged
- POS Transaction Events
 - POS transaction started
 - POS transaction ended
 - POS transaction exception
- License Plate Recognition Events
 - License plate detection started
 - License plate detection ended
 - License plate watchlist match

The NVMS shall have the capability to schedule and execute any of the following actions in response to any of the events listed above:

- User Notification Actions
 - Display on-screen message
 - Send an email
 - Play a sound
- Monitoring Actions
 - Start live streaming video
 - Create Bookmark
 - Open a saved view
 - Start live streaming on a virtual matrix monitor
 - Open a map on a virtual matrix monitor
 - Open a web page on a virtual matrix monitor
- Device Actions
 - Reboot camera

- Trigger digital output
- PTZ Actions
- Go to Preset
- Run a Pattern
- Set Auxiliary
- Clear Auxiliary
- Alarm actions
- Trigger an alarm
- Acknowledge an alarm

The NVMS shall provide the ability to escalate alarms from one user or group to another if the alarm is unacknowledged for a preset duration.

The NVMS shall provide the ability to create customized on-screen messages and email notifications.

The NVMS shall provide a maintenance log and audit trail of all system errors and events.

The NVMS shall support the operation of a License Plate Recognition system that include:

- The ability to define a region of an image where license plate detection is performed. Detected license plates shall be stored with the video data.
- The ability to create a Watch List that is used to create events when specific license plates are detected in the images being analysed.

The NVMS shall provide the ability to enable and configure PTZ control on the RS-485 interface of a video source.

The NVMS shall support PTZ protocols. Including but are not limited to the following:

- American Dynamics Sensormatic
- AXSYS
- AXSYS DCU
- Honeywell Diamond
- Pelco D

The NVMS shall provide the ability to change the network settings for a video and audio source including:

- A change in image quality and image rate parameters for a single video source shall not affect the settings of other video sources.
- The ability to enable a secondary stream for live viewing.
- The ability to change the exposure, iris, IR filter, backlight compensation, gain, priority, sharpening, saturation, focus, and white balance settings for a video source.
- The ability to change the image dimensions for a video source.

- The ability to rotate the image 90°, 180° or 270° for a video source.
- The ability to add privacy zones to a video source to block unwanted areas in the image field of view.
- The ability to set a maximum recording duration for manually triggered recording for a video source.
- The ability to change the input, output, gain and volume for an audio source.

The NVMS shall support the use of uni-directional and bi-directional audio.

- The NVMS shall support full-duplex two-way audio communication.
- The NVMS shall provide the ability to link any audio source to any video source.
- Able to link multiple audio sources to a single video source.
- Able to link an audio source to many video sources.
- The NVMS shall provide the ability to synchronize audio and video on playback regardless of video, audio, network, or storage parameters

The NVMS shall provide the ability to set a maximum for bandwidth transmitted to the Control Center Client application from the Control Center Server application.

The NVMS shall provide the ability to manage operator access to the NVMS and assets, including:

- Ability to automatically log in to an NVR.
- Ability to override user access to an NVR if there are insufficient licenses.
- Ability to automatically log out of an NVR when the application is left idle.
- Ability to save and restore the window layout.

Ability to control the system using a PC keyboard or joystick.

Ability to import and export system settings such as maps, views, web pages, users and groups.

The NVMS shall support live or recorded video monitoring of 1 to 64 video streams simultaneously on a single monitor with the following standard layouts:

- Full Screen
- 2 x 2
- 3 x 3
- 4 x 4
- 5 x 5
- 6 x 6
- 8 x 8
- 1 + 5
- 1 + 7
- 1+ 12
- 2 + 8

The NVMS shall support live or recorded video monitoring in a customizable video display beyond the standard layouts.

The NVMS shall offer a Matrix Application Module to provide remote control of multiple monitor displays, including video walls that can be controlled by an unlimited number of users with appropriate rights and permissions.

- A monitor display connected to the Matrix Application Module shall be able to simultaneously display video streams from multiple sites.

The NVMS shall support the ability to bias the displayed video to a lower frame rate or to a lower image resolution if the client network bandwidth or processing power is insufficient for displaying the video at full frame rate and image resolution.

The NVMS shall support the ability to display image overlays. Including but not limited to the following:

- Camera Name
- Camera Location
- Playback Timestamp
- Live Timestamp
- Record Indicator
- Motion Activity
- Video Analytics Activity
- License Plate

The Video Analytics Activity overlay shall provide a color-coded bounding box around moving objects categorized as humans or vehicles.

The NVMS client software shall:

- Not limit the number of monitors used for monitoring video and audio streams connected to a single workstation.
- Support monitoring live and recorded video and audio streams simultaneously on the same monitor.
- Support viewing the same live or recorded video stream at different zoom levels and areas of interest.
- Support the ability to switch from live to recorded video on demand for an instant replay of recently recorded video.
- Support the ability to share the application window display in a joint session with other users for collaborative investigations.
- Support the creation of unlimited views with unique layouts of video streams.
- Support the ability to toggle between tiled and full-screen view.
- Support the ability to save views.
- Support the ability to cycle through views (guard tour) based on a specified interval.
- Display all video sources connected to the system.

- Support the ability to drag and drop sources from a system tree. Sources include but are not limited to:
 - A video/audio source for live and recorded display.
 - A predefined layout view of video/audio sources.
 - Third party or integrated devices
 - Web pages
 - Graphical maps

The NVMS shall support the ability to configure how the system tree is displayed.

- The system tree of video sources, maps, saved views and web pages can be organized into virtual folders that are represented as branches within the Site.
- Users can be granted access to individual items or entire folders within the tree.
- New items added to a folder automatically inherit the permissions of that folder.

Alarm and Digital Output Management:

- The NVMS shall support monitoring alarms.
- The NVMS shall support the ability to designate one or more regions/tiles in a window for displaying video directly linked to triggered alarms and rules.
- The NVMS shall support the ability to acknowledge alarms from the designated video display area.
- The NVMS shall support the ability to manually trigger digital output:
 - Through the use of a pre-configured software “button”.
 - Through the use of a hard-wired dry alarm contact connected to a supported input/output device.
- The NVMS shall support the ability to assign alarms to users.
- The NVMS shall support the ability to acknowledge alarms.
- The NVMS shall support the ability to bookmark alarms.

The NVMS shall support creating bookmarks for recorded video and audio. Bookmarks can be:

- Viewed from multiple sources
- Displayed on the timeline during playback
- Used as a search criteria for recorded video and audio. Search criteria can include but are not limited to:
 - Name
 - Description
 - Bookmark Creator
- The NVMS shall support protecting a bookmark so the video and audio data is never overwritten.
- The NVMS shall support private bookmarks that are only visible to the user who designated a bookmark as private, and the system administrator.

The NVMS shall support the ability to create a map that represents the physical location of cameras and other devices throughout the surveillance system.

- Maps shall be created from images stored in standard image formats. Including but not limited to the following:
- JPEG
- BMP
- PNG
- GIF
- Maps shall have the ability to contain links so as to create a hierarchy of interlinked maps.
- Maps shall support the ability to drag and drop a video source from the map into a window for live or recorded video and audio monitoring.
- Maps shall support the creation of a link to a preset section of a video source.
- Cameras in a map are highlighted when an alarm linked to the camera is triggered.
- Maps shall support the ability to include a link to a web page and view the web page in the application window.

The NVMS shall support physical and digital zooming and panning on live and recorded video streams.

- The NVMS shall support controlling mechanical pan-tilt-zoom, iris, and focus as well as setting presets and patterns.
- The NVMS shall provide the ability to name pan-tilt-zoom presets.
- The NVMS shall support the ability to center a PTZ camera's field of view by clicking anywhere on the video image where the PTZ supports this function.
- The NVMS shall support the ability to click and drag to define an area for the PTZ camera to optically zoom and center on, where the PTZ supports this function.
- The NVMS shall support controlling mechanical pan-tilt-zoom camera on-screen display and auxiliary controls.
- The NVMS shall support locking PTZ controls.
- The NVMS shall support control of a mechanical pan-tilt-zoom camera with a USB joystick

The NVMS shall support the ability to create PTZ guard tours by combining a set number of presets that are run in sequence or random.

The NVMS shall support playback of recorded video and audio.

- Forward and reverse playback of recorded video and audio at variable speeds.
- Audio and Video shall synchronously playback when:
 - Audio and video sources are linked
 - Audio and video sources populate different tiles within a synchronized playback layout.

The NVMS shall support the navigation of recorded video and audio. Including but not limited to the following methods:

- Calendar
- Timeline
 - The NVMS shall support a timeline that displays all connected video sources and the corresponding motion and recording events.
 - The NVMS shall support a timeline that can display the entire time range down to one second of recorded video and audio.
 - The NVMS shall support a timeline that can synchronize video displayed on multiple tabs to the same point in time.
- Events.

The NVMS shall support searching through recorded video and audio based on various search criteria. Including but not limited to the following parameters:

- Time
- Date
- Video source
- Alarm(s) and/or Event(s).
- Motion in user defined areas (pixel search).
- Point of Sale transactions
- License Plate detection events.
- Bookmarks
- The NVMS shall support performing a search through a series of thumbnail images.
- Thumbnails can be based on the entire image region or a pre-selected area.
- Thumbnails can be stacked to support an automatic secondary search when looking at a large timespan of video.
- The NVMS shall support the ability to take a snapshot of a live or recorded image and export it from the system.

The NVMS shall support the ability to export recorded video in the following formats including but not limited to:

- Native
- JPEG
- PNG
- TIFF
- AVI
- WAV
- PDF
- Print

The NVMS shall support the ability to export recorded audio in WAV format.

The NVMS shall support the ability to export a live stream of images in the following formats:

- JPEG
- PNG
- TIFF

The NVMS shall support the ability to export video in Native format. Native format exported video shall:

- Digitally sign recorded video and audio using 256-bit encryption so video can be authenticated for evidentiary purposes.
- Be able to export video from one or multiple camera streams simultaneously.
- Support reviewing of exported video and audio in a secure client.
- Support reviewing of backed-up video and audio in a secure client.
- Support exporting of video in lower frame-rates than originally recorded.
- Support exporting of a designated area of video from the camera's field of view.
- Include camera properties. Including but not limited to:
 - Time zone
 - Recorded video and audio parameters
 - Event/alarm metadata
 - Vector motion and transactional data
 - Authentication keys to validate source authenticity/validity.
- Support additional exporting into Native or open formats.

Prior to installation, the Network Video Management System shall be configured and tested in accordance with the manufacturer's instructions.

Develop, install, and test software and databases for the complete and proper operation of systems involved. Assign software license to client.

The specialist sub-contractor is responsible for the entire programming and setup of the system such that no additional programming is required. Programming shall include the setup of all available features of the software.

Perform a full system back-up at completion of initial programming and deliver the configuration to the client.

Perform field software changes after the initial programming session to "fine tune" operating parameters and sequence of operations based on any revisions to the client's operating requirements.

28.7 CCTV CAMERAS

The CCTV sub-specialist shall allow for the supply of all cameras types associated housings and brackets as necessary for a complete working installation. They shall refer to the equipment schedule for the data sheets on the acceptable camera parameters.

There are a number of different type of cameras proposed for this project as follows:

- Internal fixed dome

- External fixed
- External dome PTZ
- External ANPR

The type and quantities are identified on the camera schedule above and contract drawings. The following baseline camera manufacturer shall be used for comparative tender. The Megapixel requirement of each camera is listed on the camera schedule.

Avigilon Vandal Resistant/Outdoor Fixed Bullet-Type Network Camera

- Avigilon Fixed Bullet-Type Network Camera with Scene Adaptive Infrared Illumination

Design based on Avigilon Vandal Resistant/Outdoor Fixed Bullet-Type Network Camera

- Avigilon H3 Fixed Bullet-Type Network Camera with Scene Adaptive Infrared Illumination

Other camera manufacturers shall be considered under an equal & approved process evaluated by the engineer as set out in section 3 of the main electrical specification product & system approvals

Each camera shall meet the following certifications and standards;

28.7.1 Certifications and Standards

Each camera shall carry the following Electromagnetic Emissions Certifications:

- EN 55022 Class B
- FCC Part 15 Subpart B Class B
- IC ICES-003 Class B

Each camera shall carry the following Electromagnetic Immunity Certifications:

- EN 55024 Class B
- EN 61000-4-2
- EN 61000-4-3
- EN 61000-4-4
- EN 61000-4-5
- EN 61000-4-6
- EN 61000-4-11

Each camera shall carry the following Certifications:

- UL 60950
- CSA60950

Each camera shall meet relevant parts of the following video standards:

- SMPTE 296M (HDTV 720p)

Each camera shall meet the following standards:

- MPEG-4:
- ISO/IEC 14496-10 AVC (H.264)

Networking:

- IEEE 802.3af (Power over Ethernet)
- IEEE 802.1X (Authentication)
- IPv4 (RFC 791)

Each camera shall meet the following mechanical environmental standards:

- IK10 Impact Rating
- IEC 60529 IP66

Each camera shall meet the following ONVIF API compliance versions:

- 1.02
- 2.00
- Profile S

28.7.2 Camera Warranties

All equipment provided shall be backed by a minimum manufacturer parts and labour warranty of:

36 months for all parts and labour from date of purchase

During the warranty period, manufacturer shall provide direct support to the client via phone and email, access to training and education in the form of documents, videos or other materials via the web.

28.7.3 Internal 3MP Fix Dome Camera Specification

PRODUCT	High Definition H.264 Day/Night IP Dome Camera Series 2.0-H3-DO1 and 2.0-H3-DO2 3.0 Megapixel Day/Night H.264 HD Outdoor Dome Camera
Division 28	Electronic Safety and Security
Level 1	28 20 00 Electronic Surveillance
Level 2	28 23 00 Video Surveillance
Level 3	28 23 29 Video Surveillance Remote Devices and Sensors

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall support 100BASE-TX and PoE 802.3af network interfaces for streaming video and control data over standards compliant networks.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall operate in the Avigilon Control Center (ACC) environment with support for automatic detection of cameras, encoders and NVRs in the same broadcast domain.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall be ONVIF compliant.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall have multi-streaming support including different frame rate, bit rate, resolution, quality and compression format from an individual camera.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall have a built-in web server to make video and configuration available in a standard browser environment. The built-in web server shall support multiple users with different permission levels and unique usernames and passwords.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall support user configuration of network parameters including: Static IP address; Subnet Mask; Gateway; and Control Port for control communications.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall support user configuration of camera parameters including: Camera Name; Location and Logical ID.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall support user configuration of image acquisition parameters including: Exposure Control; Flicker Control; Iris Control; Day/Night Control; White Balance Control; Colour Saturation and Sharpening.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall support a mode that automatically removes the IR filter and enters a monochrome mode when the available light drops below a set threshold.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall support user configuration of a fully customizable motion detection mask within the camera field of view.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall support user configuration of up to 4 privacy zones within the camera field of view.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall support remote zoom and focus control of the lens and performing automatic focus.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall support user configuration of compression format, compression quality, maximum bit rate, key frame interval, and image rate per individual camera.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall have input/output terminals for connecting alarm inputs and alarm outputs.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall have an audio input for connecting external microphones.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall have an audio output for connecting external speakers.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall have a video output for connecting external monitors.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall support UDP transport.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall be remotely upgradeable over an IP network for feature enhancements and investment protection.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall have a 3-axis pan-tilt-twist gimbal system for positioning the lens and image sensor.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall have tamper resistant screws.

The High Definition H.264 Day/Night IP Dome Camera Series (with 2.0-H3-DO1-IR) shall have built in IR Illumination.

The High Definition H.264 Day/Night IP Dome Camera Series (with 2.0-H3-DO1-IR) shall provide uniform illumination in the dark under 0 lux, up to a maximum distance of 15 m (50 ft.).

The High Definition H.264 Day/Night IP Dome Camera Series (with 2.0-H3-DO1-IR) shall provide zoom adaptive IR for the most effective illumination at all zoom positions.

The High Definition H.264 Day/Night IP Dome Camera Series (with 2.0-H3-DO1-IR) shall provide content adaptive IR to prevent image saturation while maintaining optimum scene illumination.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall have a vandal proof dome cover.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall be functional in outdoor environments.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall have a built in heater.

The High Definition H.264 Day/Night IP Dome Camera Series (including 2.0-H3-DO1 and 2.0-H3-DO2) shall meet or exceed the following design and performance specifications.

HIGH DEFINITION H.264 Day/Night IP Dome CAMERA SPECIFICATIONS (Model # 2.0-H3-DO1 and 2.0-H3-DO2)

A.	Image Sensor:	1/2.7" progressive scan CMOS
B.	Active Pixels:	1920 (H) x 1080 (V)
C.	Imaging Area:	5.9 mm (H) x 3.3 mm (V) 0.231" (H) x 0.129" (V)
D.	Minimum Illumination:	DO1 – 0.2 lux (F1.2) in colour mode; 0.02 lux (F1.2) in monochrome mode DO2 – 0.4 lux (F1.6) in colour mode; 0.04 lux (F1.6) in monochrome mode
E.	Dynamic Range:	69 dB
F.	Lens:	DO1 – 3-9 mm, F1.2, P-iris, remote focus and zoom DO2 – 9-22 mm, F1.6, P-iris, remote focus and zoom
G.	Angle of View:	DO1 – 35° - 98° DO2 – 15° - 35°
H.	Image Compression Method:	H.264 (MPEG-4 Part 10/AVC), Motion JPEG
I.	Image Rate:	30 (all resolutions)
J.	Streaming:	Multi-stream H.264 and motion JPEG
K.	Resolution Scaling:	Down to 768 x 432
L.	Motion Detection:	Selectable sensitivity and threshold
M.	Electronic Shutter Control:	Automatic, Manual (1/6 to 1/8000 sec)
N.	Iris Control:	Automatic, Manual
O.	Day/Night Control:	Automatic, Manual
P.	Flicker Control:	50 Hz, 60 Hz
Q.	White Balance:	Automatic, Manual
R.	Privacy Zones:	Up to 4 zones
S.	Audio Input/Output:	Line input/output, I/O mini-jack (3.5 mm)
T.	Audio Compression Method:	G.711 PCM 8kHz
U.	Video Output:	NTSC/PAL, A/V mini-jack (3.5 mm)
V.	External I/O Terminals:	Alarm In, Alarm Out; terminal strip
W.	IR Illumination (option):	850 nm wavelength, 15 m (50 ft.) max. distance of IR illumination at 0 lux

Electrical Specifications

A.	Power Consumption:	10 W with external power 10 W with IEEE 802.3af Class 3 PoE
B.	Power Source:	VDC: 12 V +/- 10%, 10 W min VAC: 24 V +/- 10%, 12 VA min PoE: IEEE802.3af Class 3 compliant
C.	Power Connector:	2-pin terminal block

Network Specifications

A.	Network:	100BASE-TX
B.	Cabling:	CAT5
C.	Connector:	RJ-45
D.	API:	ONVIF compliant (www.onvif.org)
E.	Security:	Password protection, HTTPS encryption, digest authentication, WS authentication, user access log.

- | | | |
|----|----------------------|---|
| F. | Protocols: | IPv4, HTTP, HTTPS, SOAP, DNS, NTP, RTSP, RTCP, RTP, TCP, UDP, IGMP, ICMP, DHCP, Zeroconf, ARP |
| G. | Streaming Protocols: | RTP/UDP, RTP/UDP multicast, RTP/RTSP/TCP, RTP/RTSP/HTTP/TCP, RTP/RTSP/HTTPS/TCP, HTTP |

Physical & Environmental Specifications

- | | | |
|----|-------------------|---|
| A. | Dimensions: | 152 mm x 109 mm
6.0" x 4.3" |
| B. | Weight: | 1.28 kg (2.82 lbs) |
| C. | Dome Bubble: | Polycarbonate, clear |
| D. | Body: | Aluminum |
| E. | Housing: | Surface mount, vandal resistant |
| F. | Finish: | Powder coat, cool gray 2 |
| G. | Adjustment Range: | 360° pan, 180° tilt (122° tilt with -IR option), 180° azimuth |
| H. | Operating Temp: | -30°C to +50°C (-22°F to 122°F) |
| I. | Storage Temp: | -10°C to +70°C (14°F to 158°F) |
| J. | Humidity: | 20 - 80%, relative humidity (non-condensing) |

Certifications and Regulations

- | | | |
|----|----------------------------|--|
| A. | Certifications: | <ul style="list-style-type: none"> • UL 60950 • CSA 60950 • EN 60950-1 • CE • ROHS • WEEE |
| B. | Environmental: | <ul style="list-style-type: none"> • IK10 Impact Rating • Meets IP66 Weather Rating |
| C. | Electromagnetic Emissions: | <ul style="list-style-type: none"> • FCC Part 15 Subpart B Class B • IC ICES-003 Class B • EN 55022 Class B |
| D. | Electromagnetic Immunity: | <ul style="list-style-type: none"> • EN 55024 • EN 61000-4-2 • EN 61000-4-3 • EN 61000-4-4 • EN 61000-4-5 • EN 61000-4-6 • EN 61000-4-1 |

28.7.4 Internal PTZ Camera Specification

These cameras shall be IP HD Megapixel and shall incorporate the following features as a minimum requirement:

VIDEO	
Image Sensor	1/3" Exmor CMOS
Chipset	Ambarella
Resolution	2 MegaPixel
Effective Pixels	1944(H) x1092(V)
Scanning System	Progressive
Electronic Shutter Speed	1/3s~1/30,000s
Min. Illumination	Colour: 0.05 Lux/F1.6, B/W:0.005Lux/F1.6
S/N Ratio	>55dB
Video Output	BNC(1.0Vp-p/75Ω)
ENCODE	
Compression	H.264/MJPEG
Resolution	1080P(1920×1080)/720P(1280×720)/D1(704×576/704×480)/CIF(352×288/352×240)
FPS – Main Stream	1080P/D1 (1~25/30fps)/720P(1~50/60fps)
FPS – Sub Stream	D1/CIF(1 ~25/30fps)
Bit Rate	H.264: 448K~8192Kbps, MJPEG: 56K~20480Kbps
FEATURES	
Day/Night	Auto(ICR)/Colour/ B/W
Backlight Compensation	BLC/HLC /DWDR (Digital WDR)
White Balance	Auto, ATW, Indoor, Outdoor, Manual
Gain Control	Auto/Manual
Noise Reduction	2D/3D
Privacy Masking	Up to 24 areas
Digital Zoom	16x
LENS	
Focal Length	5.1mm~61.2mm (12xOptical zoom)
Max Aperture	F1.2~F2.1
Focus Control	Manual
Angle of View	51.3°~4.64°
Close Focus Distance	100mm~1000mm
PTZ FUNCTIONS	
Pan/Tilt Range	Pan: 0°~360° endless; Tilt:-2°~90°, auto flip 180°
Manual Control Speed	Pan: 0.1°~300°/s; Tilt: 0.1°~120°/s
Preset Speed Pan:	300°/s; Tilt:200°/s
Preset	80(ICR-SD) ,255(Pelco-P/D)
PTZ Mode	5 Pattern, 8 Tour, 5 Auto Scan, Auto Pan
Speed Setup	Human-oriented focal length/ speed adaptation
Power up Action	Auto restore to previous PTZ and lens status after power failure
Idle Motion	Activate Preset/Pan/Scan/Tour/Pattern if there is no command in the specified period
Time Task	Auto activation of Preset/Pan/Scan/Tour/Pattern by preset-time
Protocol	Pelco-P/D (Auto recognition)
NETWORK	
Ethernet Port	RJ-45 (10/100Base-T
Wi-Fi	N/A

Network	Function	IPv4/IPv6, HTTP, HTTPS, SSL, TCP/IP, UDP, UPnP, ICMP, IGMP, SNMP, RTSP, RTP, SMTP, NTP, DHCP, DNS, PPPOE, DDNS, FTP, IP Filter, QoS, Bonjour
ONVIF		ONVIF Profile S
Max	Online Users	20
AUDIO		
Interface		1/1 channel In/Out
Compression		G.711a/G.711u (32kbps) /PCM (128kbps)
OTHER INTERFACES		
Memory	Slot	Micro SD, Max 64GB
RS-485		N/A
Alarm		2/1 channel In/Out
GENERAL		
Power	Supply	AC24V/1.5A (±10%), POE+(802.3at)
Power	Consumption	<12W
Working	Environment	-10°C ~ 60°C/Less than 90% RH
IP Rating		N/A
Vandal	Resistance	N/A
Dimensions		Φ 198mm×158mm

28.7.5 External PTZ Camera Specification

These cameras shall be Megapixel and shall incorporate the following features as a minimum requirement:

Protocol	IPv4/IPv6, HTTP, HTTPS, SSL, TCP/IP, UDP, UPnP, ICMP, IGMP, SNMP, RTSP, RTP, SMTP, NTP, DHCP, DNS, PPPoE, DDNS, FTP, IP Filter, QoS, Bonjour
ONVIF	ONVIF Ver. 2.0 conformance
Max. User Access	20 users
Auxiliary Interface	
Memory Slot	Micro SD, Max 32GB
RS485	1
Alarm	7/2 channel In/Out
General	
Power Supply	AC 24V/3A (±10%) / DC12V optional
Power Consumption	17W, 35W(IR on, Heater on)
Working Environment	-22°F ~ 140°F / -30°C ~ 60°C Less than 90% RH
Protection Level	IP66
Dimensions	Φ229.6(mm) x 381.5(mm)

28.7.6 External 3MP Bullet Camera Specification

The bullet camera shall be compatible with self- learning video analytics. They shall be equipped with built-in adaptive infrared illumination

PRODUCT	High Definition H.264 IP Bullet Camera Series 3.0W-H3-BO1-IR , 3.0W-H3-BO1-IR , 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR 3.0 Megapixel WDR HD Bullet Camera
Division 28	Electronic Safety and Security
Level 1	28 20 00 Electronic Surveillance
Level 2	28 23 00 Video Surveillance
Level 3	28 23 29 Video Surveillance Remote Devices and Sensors

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall support 100BASE-TX and PoE 802.3af network interfaces for streaming video and control data over standards compliant networks.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall operate in the Avigilon Control Center (ACC) environment with support for automatic detection of cameras, encoders and NVRs in the same broadcast domain.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall be ONVIF compliant.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall have multi-streaming support including different frame rate, bit rate, resolution, quality and compression format from an individual camera.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall have a built-in web server to make video and configuration available in a standard browser environment. The built-in web server shall support multiple users with different permission levels and unique usernames and passwords.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall support user configuration of network parameters including: Static IP address; Subnet Mask; Gateway; and Control Port for control communications.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall support user configuration of camera parameters including: Camera Name; Location and Logical ID.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall support user configuration of image acquisition parameters including: Exposure Control; Flicker Control; Iris Control; Day/Night Control; White Balance Control; Colour Saturation and Sharpening.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall support a mode that automatically removes the IR filter and enters a monochrome mode when the available light drops below a set threshold.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall support user configuration of a fully customizable motion detection mask within the camera field of view.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall support user configuration of up to 4 privacy zones within the camera field of view.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall support remote zoom and focus control of the lens and performing automatic focus.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall support user configuration of compression format, compression quality, maximum bit rate, key frame interval, and image rate per individual camera.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall have input/output terminals for connecting alarm inputs and alarm outputs.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall have an audio input for connecting external microphones.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall have an audio output for connecting external speakers.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall support UDP transport.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall be remotely upgradeable over an IP network for feature enhancements and investment protection.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall have tamper resistant screws.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall be functional in outdoor environments.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall have a built in heater.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall have built in IR Illumination.

The High Definition H.264 IP Bullet Camera Series (with 2.0W-H3-BO1-IR) shall provide uniform illumination in the dark under 0 lux, up to a maximum distance of 30 m (100 ft.).

The High Definition H.264 IP Bullet Camera Series (with 3.0C-H3A-BO2-IR) shall provide uniform illumination in the dark under 0 lux, up to a maximum distance of 60 m (200 ft.).

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall provide zoom adaptive IR for the most effective illumination at all zoom positions.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall provide content adaptive IR to prevent image saturation while maintaining optimum scene illumination.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall have a configuration Ethernet port for easy installation.

The High Definition H.264 IP Bullet Camera Series (including 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR) shall meet or exceed the following design and performance specifications.

Video Analytics Operation

Objects in Area The event is triggered when the selected object type moves into the region of interest. If the number of objects is exceeded, a new event is not triggered until the number of objects falls below the defined value.

Object Loitering The event is triggered when the selected object type stays within the region of interest for an extended amount of time. The event is reset when the object leaves the region of interest.

Objects Crossing Beam The event is triggered when the specified Number of Objects: have crossed the directional beam that has is configured over the camera's field of view. The beam can be unidirectional or bidirectional. If the number of objects is exceeded, a new event is not triggered until the event times out.

Object Appears or Enters Area The event is triggered by each object that enters the region of interest. This event can be used to count objects. **Object Not Present in Area** The event is triggered when no objects are present in the region of interest.

Objects Enter Area The event is triggered when the specified Number of Objects: have entered the region of interest. **Objects Leave Area** The event is triggered when the specified Number of Objects: have left the region of interest.

Object Stops in Area The event is triggered when an object in a region of interest stops moving for the specified Threshold Time: **Direction Violated** The event is triggered when an object moves in the prohibited direction of travel.

Tamper Detection The event is triggered when the scene unexpectedly changes.

HIGH DEFINITION H.264 IP Bullet CAMERA SPECIFICATIONS (Model # 3.0C-H3A-BO1-IR and 3.0C-H3A-BO2-IR)

A. Image Sensor:	WDR 1/3" progressive scan CMOS
B. Active Pixels:	1920 (H) x 1080 (V)
C. Imaging Area:	4.2 mm (H) x 2.4 mm (V) 0.165" (H) x 0.094" (V)
D. Illuminator Technology:	High power IR LEDs
E. Maximum IR Illumination Distance at 0 lux:	BO1 – 30 m (100 ft.) BO2 – 60 m (200 ft.)
F. Wavelength:	850 nm
G. Minimum Illumination:	BO1 – 0.2 lux (F1.2) in colour mode BO2 – 0.4 lux (F1.6) in colour mode 0 lux in monochrome mode with IR Illumination
H. Dynamic Range:	100 dB
I. Lens:	BO1 – 3-9 mm, F1.2, P-Iris, remote focus and zoom BO2 – 9-22 mm, F1.6, P-Iris, remote focus and zoom
J. Angle of View:	BO1 – 26° - 79° BO2 – 11° - 26°
K. Image Compression Method:	H.264 (MPEG-4 Part 10/AVC), Motion JPEG
L. Image Rate:	30 (all resolutions)
M. Streaming:	Multi-stream H.264 and motion JPEG
N. Motion Detection:	Selectable sensitivity and threshold
O. Electronic Shutter Control:	Automatic, Manual (1/6 to 1/8000 sec)
P. Iris Control:	Automatic, Manual
Q. Day/Night Control:	Automatic, Manual
R. Flicker Control:	50 Hz, 60 Hz
S. White Balance:	Automatic, Manual
T. Privacy Zone:	Up to 4 zones
U. Audio Input/Output:	Line input/output, I/O mini-jack (3.5 mm)
V. Audio Compression Method:	G.711 PCM 8kHz

W. External I/O Terminals: Alarm In, Alarm Out

Electrical Specifications

A. Power Consumption: 22 W with external power
12.95 W with IEEE 802.3af Class 3 PoE

B. Power Source: 12 V DC, +/-10%, 22 W min
24 V AC, +/-10%, 28 VA min
PoE: IEEE 802.3af Class 3 compliant

Network Specifications

A. Network: 100BASE-TX

B. Cabling: CAT5

C. Connector: RJ-45

D. API: ONVIF compliant (www.onvif.org)

E. Security: Password protection, HTTPS encryption, digest authentication, WS authentication, user access log.

F. Protocols: IPv4, HTTP, HTTPS, SOAP, DNS, NTP, RTSP, RTCP, RTP, TCP, UDP, IGMP, ICMP, DHCP, Zeroconf, ARP

G. Streaming Protocols: RTP/UDP, RTP/UDP multicast, RTP/RTSP/TCP, RTP/RTSP/HTTP/TCP, RTP/RTSP/HTTPS/TCP, HTTP

Physical & Environmental Specifications

A. Dimensions: 241.7 mm x 94.9 mm x 70 mm
9.5" x 3.7" x 2.8"

B. Weight: 1.15 kg (2.5 lbs)

C. Body: Aluminum

D. Housing: Surface mount, tamper resistant

E. Finish: Powder coat, cool gray 2

F. Adjustment Range: ±175° pan, 0-90° tilt, ±175° azimuth

G. Operating Temp: -40°C to +50°C (-40°F to 122°F)

H. Storage Temp: -10°C to +70°C (14°F to 158°F)

I. Humidity: 20 - 80%, relative humidity (non-condensing)

Certifications and Regulations

A. Certifications:

- UL 60950
- CSA60950
- CB Scheme
- CE
- ROHS
- WEEE
- UVV
- C-Tick

Environmental:

- IK10 Impact Rating
- Meets IP66 Weather Rating

Electromagnetic Emissions:

- FCC Part 15 Subpart B Class B
- IC ICES-003 Class B
- EN 55022 Class B

Electromagnetic Immunity:

- EN 55024 Class B
- EN 61000-4-2
- EN 61000-4-3
- EN 61000-4-4
- EN 61000-4-5
- EN 61000-4-6
- EN 61000-4-11

28.7.7 ANPR Camera Specification

The camera complete with appropriate software shall be fully integrated within the Avigilon platform to capture all license plates enter/leaving the site in all conditions, 24hours a day. It shall allow the user to import and monitor watch lists, create instant email alerts and on-screen alarms and perform post-incident plate searches.

PRODUCT	High Definition, License Plate Recognition Camera Series 1L-HD-LP-50 Single Lane, High Definition, License Plate Recognition Camera
Division 28	Electronic Safety and Security
Level 1	28 20 00 Electronic Surveillance
Level 2	28 23 00 Video Surveillance
Level 3	28 23 29 Video Surveillance Remote Devices and Sensors

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall support 100BASE-TX and PoE 802.3af network interfaces for streaming video and control data over standards compliant networks.

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall operate in the Avigilon Control Center (ACC) environment with support for automatic detection of cameras, encoders and NVRs in the same broadcast domain.

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall support user configuration of network parameters including: Static IP address; Subnet Mask; Gateway; and Control Port for control communications.

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall support user configuration of camera parameters including: Camera Name; Location and Logical ID.

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall support user configuration of an unlimited number of independent motion detection zones within the camera field of view.

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall support user configuration of compression quality and image rate per individual camera.

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall have input/output terminals for connecting alarm inputs and alarm outputs.

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall support UDP transport.

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall detect license plates on vehicles travelling up to 60 mph or 100 kph when installed in the overhead position at the recommended mounting height.

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall detect license plates in all lighting conditions, including a minimum illumination of 0 lux.

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall support the detection of license plates within one vehicle road lane or approximately 10 ft. (3 m).

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall be remotely upgradeable over an IP network for feature enhancements and investment protection.

The High Definition, License Plate Recognition Camera Series (including 1L-HD-LP-50) shall meet or exceed the following design and performance specifications.

HIGH DEFINITION license Plate Recognition CAMERA SPECIFICATIONS (Model # 1L-HD-LP-50)

A. Image Sensor:	1/2" progressive scan CMOS
B. Resolution:	1280 (H) x 720 (V)
C. Illuminator Technology:	High-power SMT LED
D. Wavelength:	850 nm
E. Dynamic Range:	61 dB
F. Lens:	25 mm, f/4
G. Image Compression Method:	JPEG2000
H. Image Rate:	30
I. Recommended Target Distance:	50 ft. (15 m)
J. Recommended Overhead Mounting Height:	13-17 ft. (4.0-5.2 m)
K. Maximum Overhead Mounting Height:	25 ft. (7.5 m)
L. Maximum Roadside Mounting Height:	17 ft. (5.2 m)
M. Maximum Roadside Offset:	17 ft. (5.2 m)
N. Motion Detection	Selectable sensitivity and threshold
O. Electronic Shutter Control:	Automatic, Manual (2 to 1/30,000 sec)

P. Iris Control:	Automatic, Manual
Q. Focus Control:	Automatic, Manual
R. Flicker Control:	50 Hz, 60 Hz
S. White Balance:	Automatic, Manual
T. Backlight Compensation:	Automatic
U. External I/O Terminals:	Alarm In, Alarm Out; terminal strip
V. Serial Communications:	RS-485; terminal strip

Electrical Specifications

Camera:

A. Power Source:	PoE: IEEE 802.3af Class 3 compliant 24 VAC, 12 VDC
B. Power Consumption:	6 W maximum
C. Power Connector:	2-pin terminal block

Illuminator:

A. Power Source:	24 VAC, 24 VDC
B. Power Consumption:	72 W
C. Power Connector:	3-wire terminal block, 12-20 AWG

Network Specifications

A. Network:	100Base-TX
B. Cabling Type:	CAT5
C. Connector:	RJ-45
D. Security:	SSL
E. Protocols:	UDP, TCP, SOAP, DHCP, Zeroconf

Physical & Environmental Specifications

A. Operating Temp:	-10°C to +45°C (14°F to 113°F)
B. Storage Temperature:	-10°C to +70°C (14°F to 158°F)
C. Humidity:	20 - 80%, relative humidity (non-condensing)

Camera:

A. Dimensions:	85 mm x 67 mm x 53 mm 3.3" x 2.6" x 2.1"
B. Weight:	0.53 kg (1.2 lbs)
C. Mount:	1/4" UNC-20 (top & bottom)

Enclosure:

A. Dimensions:	284 mm x 279 mm x 221 mm 11.0" x 11.2" x 8.7"
B. Weight:	4.0 kg (8.8 lbs)
C. Mount:	4 x M5 holes at 40 mm x 62 mm (1.57" x 2.44")

Illuminator Power Supply:

A. Dimensions:	160 mm x 160 mm x 81 mm 6.3" x 6.3" x 3.2"
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B. Weight:	1.85 kg (4.1 lbs)
C. Mount:	4 x M4 holes at 145 mm x 123 mm (5.71" x 4.85")

Certifications and Regulations

- A. FCC, Class A
- B. CE, Class A
- C. UL/cUL Listed
- D. IP66

28.8 DEDICATED SERVER NVR CABINETS

The CCTV sub specialist shall include in his tender for housing the network and CCTV digital recording equipment to be located within main security ICT room. The cabinet shall include the following as a minimum:

- Size: 800mm wide x 1000mm deep wall cabinets
- Glazed front door with security locking system
- Steel ventilated, wire mesh rear door with security locking system
- Lockable side panels
- Ventilated top cover
- Vertical cable management
- Vertical cable tray
- 19" panel mounts fitted front and rear
- Cross member supports
- 1 x 4-way low-noise fan tray
- 2 x 12-way 13-AMP power distribution unit

28.9 UPS

The sub-specialists shall provide UPS's (Uninterruptible Power System) protect the security installations in the event of a power failure. UPS's shall be contained within the CCTV cabinet. Details of UPS as follows:

- 800VA / 480-watts capacity
- 220/230/240VAC voltage
- 81-145VAC / 162-290VAC voltage range
- 60/50Hz (auto sensing) frequency range
- +/- 10% AC voltage regulation (battery mode)
- Transfer time: 2-6ms, 10ms max.
- Waveform (battery mode): simulated sine wave
- With short-circuit and overload protection
- 12V / 9AH x 1 battery
- 23-minutes autonomy (based on 1 No. PC load at 99W)
- Recharge time: 4-hours recovery to 90% capacity
- With green, yellow and red flashing indicators for AC mode, battery mode and fault respectively

- With overload, discharge and overcharge protection
- Alarms for battery-mode, low-battery, overload, battery replacement and fault.
- Dimensions 330(d) x 100(w) x 140(h)mm.
- < 40dB noise level
- Management: USB port supports windows 2008, Linux and MAC.

28.10 MONITORS

Monitors shall be provided within ICT room and again remotely at reception desk. They shall incorporate the following features as a minimum requirement:-

- 40" LED colour monitor Full HD 200MHz ready
- 3 video terminals (composite, S-Video & Y/Cb/Cr component video)
- RGB for PC input
- Screen resolution 1280 x 1024.
- 4No. HDMI inputs
- Energy & space saving feature.
- Wall mounting bracket

The user shall have full control over the system from any of the monitor locations.

28.11 CCTV PROPOSAL SUBMITTALS FOR CLIENT REVIEW

It is a mandatory requirement for the electrical reserved specialist and their proposed CCTV specialist produce full CCTV design layout drawings, detailed wiring schematics, high level schematics and itemised equipment schedules for presentation and review by the client. Thereafter, the proposed CCTV specialist shall set up a live working demonstration off site of the proposed equipment prior to the client and engineer giving a decision on any product. All costs associated with this element shall be borne by the electrical reserved specialist and CCTV specialist.

28.12 LABELLING

All accessories shall be labelled with cable tag labels to indicate network point termination or supply source. Allow for all cameras etc. to be labelled with device numbers/port code, example: **C#102/1A12** – Camera # 102 / Cabinet #1, Patch panel "A", Port # 12.

28.13 SURVEILLANCE SIGNS

Surveillance signs shall be erected both internally & externally. Each sign shall carry a symbol of a CCTV camera and contain the following wording 'This system is controlled and operated by 'Mercy Secondary School.' Exact locations shall be agreed on site with the client.

28.13.1 Wiring

Generally signal cables shall be CAT6a, however all CCTV wiring shall be in accordance with the specialist installer's requirements and wire ways shall be suitable for the cables to be installed. CCTV cables shall be installed in dedicated wire basket containment as part of the structured cabling installation. Cameras shall be wired to appropriate cabinets ensuring that no run of CAT6a exceeds 90-metres. Any runs greater than 90m shall be in fibre.

28.13.2 Commissioning & Hand-over

Commissioning shall include testing the following aspects of the CCTV system:-

- That all wiring is correctly terminated
- That supply voltage to all appropriate parts of the system is correct
- That the type of camera and lens fitted at each position is correct
- That the operation of the auto irises & direct drive lens under varying light levels is satisfactory
- That the Network recorders connects to the purchasers IT network via it's IP address.

At handover the electrical reserved specialist & security sub specialist shall:

- Ensure all system documentation is correct.
- Train designated users in the operation and adjustable features of the system.
- Provide a system logbook to the client and explain how to record/report events.
- Demonstrate all aspects of the operation of the system and compliance with the agreed requirements.
- Ensure that correct documentation is passed to the users to enable the system to be operated.
- Ensure that the users are aware of the procedure for summoning assistance in the event of a system malfunction.
- Request the customer to sign an acceptance document and to enter any confidential information required by the system.

Upon completion of the CCTV installation a system record shall be agreed with and authorised by the Client/User and a copy provided to Client/User. The following information shall be included.

- The name, address and telephone number of the protected site.
- The location of each control unit and the type and the location of each camera and its
- Associated hardware an indication of the camera views defining the protected areas and the identification of any specific areas which cannot be consistently protected by the system. NOTE camera views can be provided in the form of drawing, printout or video recording.
- The type and location of the power supplies
- Details of those cameras that the client has the facility to manoeuvre or isolate.
- Manufacturers' documentation relating to equipment and its operational settings and controls.

- Full instructions for the correct use of the system including details of routine testing procedures and any necessary maintenance requirements.

After commissioning of the system, final alignment and adjustment of the cameras in the presence of the client & engineer shall be carried out. The contractor shall also allow for 3 No. full operational demonstration/training half-days with the client and/or his representatives, the first taking place approximately 4 weeks after the first demonstration and the second and third to occur during the defects liability period at times agreeable with the client.

28.14 MAINTENANCE

The contractor shall include for monitoring the installation and pay all costs for the first 12 months of operation, which shall include 24 hour (4 hour call out period maximum) response to system faults and free parts and labour warranty for the duration of this maintenance contract.

Additionally, regular servicing and maintaining of the installation shall be carried out during the maintenance period. During this period the contractor in conjunction with the specialist installer shall submit to the engineer copies of all maintenance records and issue full report including details of tests carried out and any faults found with the system and corrective action taken.

A system logbook shall be provided and presented to the client at handover stage to facilitate maintenance records.

28.15 SPECIALIST SUPPLIER

The specialist supplier shall be a PSA licensed approved installer

Pauric Rushe

CTI Business Solutions

Manager / CCTV-Network Engineer

0851299717

pauric@cti.ie

28.16 BASELINE PRODUCT/EQUIPMENT MANUFACTURE

- Avigilon

29 68 SECURITY PROTECTION INTRUDER ALARM

29.1 GENERAL

The electrical reserved specialist shall allow for employing a PSA licensed intruder alarm specialist for the supply, terminations, testing and commissioning of the intruder alarm installation.

The electrical reserved specialist shall supply and install galvanised conduits to the various locations as details on the drawings. A 20mm conduit shall serve no more than 3 No. points. Intruder alarm cable fixing by means of staple gun is not acceptable.

The system installation and equipment must all comply with EN50131-1: 2004, Grade 3.

Panic attack pushbuttons shall be provided in the admin office, principals offices and Junior admin office, as detailed on the contract drawings.

29.2 WIRING OF THE INTRUDER ALARM

Internally the system shall be wired using 8c 0.7mm² PVC/PVC cable in radial circuits. Activation & deactivation of the entire system shall be by key fobs and keypad. External wiring shall be carried out in multi-pair Poly/Poly gel filled cable.

The installation shall be shall be a closed circuit system to comply with EN50131-1: 2004, and the installer shall hold a current installers licence in conjunction with the PSA. (Licence number to be provided at time of tender submittal) The detectors shall be as indicated on the contract drawings. Each external detector shall be wired on a radial circuit to allow protected areas to be zoned on an individual basis. Equipment shall be manufactured by Honeywell or equal & approved. Keypads with incorporated proximity readers shall be used to control intruder alarm system.

The reserved electrical specialist shall liaise with the specialist installer prior to submission of his tender to ensure that all wiring, containment and power supplies have been allowed for in the overall tender figure. It is the responsibility of the contractor to verify all requirements prior to submitting his tender. No claims shall be entertained post tender.

29.3 EQUIPMENT SPECIFICATION

29.3.1 Control & Indicating Equipment (CIE)

- Control Panel (integrated PSTN Communicator)
- Located as detailed on the security installation drawings
- Integral 2.5A (1.25A @ grade 3) Power Supply & Communicator
- 16 Zones - Expandable up to 144 zones
- 8 outputs expandable up to 68 outputs
- Support for minimum 10 keyproxs
- 500+500 event log
- 250 Users

- 8 Groups
- 128 Links
- 2Galaxy Peripherals Support
- PC Applications for Remote Support
- Suitable for use in installations compliant to PD6662:2004 (EN50131-1:2004) security grade 3, Environmental Class II and EN50131-1:1997 security grade 3, Environmental Class II.
- Boxed 2.75A EN50131-1: 2004 security grade 3 intelligent Power Supply
- Located as detailed on the security installation drawings.
- This Galaxy Power RIO to include the following features:
- Reports AC Battery & Fuse status to the Galaxy control panels as well as tamper information over the Galaxy RS485 interface.
- A Galaxy RIO integrated in the unit providing 8 programmable inputs and 4 outputs.
- Suitable for use in installations compliant to PD6662: 2004 (prEN50131-1: 2004) security grade 3, Environmental Class II and EN50131-1: 1997 security grade 3, Environmental Class II.

29.3.2 Keyprox with Volume Control

- Located in new admin office.
- Tactile backlit rubber buttons
- Full System Control
- 32 alphanumeric backlit display
- Tamper protection
- Can be directly mounted to the panel up to distances of 1000m
- Set/unset with PIN
- ASK format, card 'self-learn' capability.
- Dual action functionality, simple set/unset operation removes the need for PIN entry.
- Set up for Areas/Groups to be agreed, prior to programming, with consulting engineers.
- To be supplied with 10 portable ACE for the use of setting and/or unsetting the IAS.
- EN50131-1 security grade 3, Environmental Class II

29.3.3 Internal Sounder, 120dB

This warning device shall be mounted inside the premises as an internal warning, and to assist correct setting and unsetting of the alarm system. The unit can be set up to a 120 decibel sounder, and is multi-toned.

- Located as detailed on the security installation drawings.
- Sounder level can be set for progressive mode
- Alert signal and status reporting (Set/Unset, delay...)
- Power supply : 4 batteries LIO3V
- Battery life : 2 years
- Tamper : opening and wall mounted
- Diameter: 165mm

29.3.4 External Sounder

This warning device shall be mounted on the external elevation of the protected premises. It shall incorporate a 15-minute cut-off timer in the event of alarm activation raised from the IAS.

Located as detailed on the security installation drawings.

- Sound output of 116dB
- High impact polycarbonate moulding
- 2 Watt Xenon Strobe Tube, alternating assurance LEDs
- NiCad back-up battery included
- Dual piezo sounders
- Multi-colour options
- Front and rear tamper
- Sweeper sounder sound
- EN50131 security grade 3 Environmental Class IV

29.3.5 Magnetic Reed Contact

Magnetic reed contact sensors are used to detect the opening and closing of doors. The contacts are to be tampered or sealed in accordance with PD6662: 2004, prEN50131: 2004 security grade 3, Environmental Class II.

Located as detailed on the security installation drawings.

EN50131 security grade 3 Environmental Class II

29.3.6 Wireless Panic Attack Systems

A wireless panic attack system for yard supervision consisting a belt clip with a transmitter worn by Supervisors in the play yard shall be provided. These shall link via a receiver into the main building intruder alarm system. 3 No. wireless panic attack transmitters shall be provided, fully enabled.

29.3.7 Anti-Masking Dual Technology Detector

Dual Technology Detector monitors an area with a range of up to 15m x 18m, utilizing passive infrared and microwave technologies. In order for the unit to activate, both the infrared and microwave fields must simultaneously recognize an intruder, minimizing false alarms. Masking details shall be agreed prior to setup.

Located as detailed on the security installation drawings.

This Dual Technology Detector comes with the following features:

Advanced Dual Core Signal Processing supports a multitude of advanced functions, including concurrent diagnostics, digital fluorescent light interference filter, digital adaptive microwave threshold adaptive baselines, and Bi-directional Temperature Compensation. Separate trouble relay.

K-Band technology, frequency: 24, 125Ghz

Power requirements: 2,5~16V DC, 25mA @ 12VDC

Tamper switch

Operating temperature – 10 degrees to 55 degrees C.

Dimensions: 119x71x42mm (h x w x d)

EN50131 – 1 security grade 3, Environmental Class II

29.4 METHOD OF SIGNALLING (EXTERNAL MONITORING)

The intruder alarm system shall be connected up to a PSA approved external monitoring company for remote monitoring of the installation. The system shall have GSM dual path signalling monitoring service, which shall monitor the system 24-hours a day, 7 days a week, by the monitoring company. This phone line monitoring service operates 24 hours a day, verifying that the phone line is operational and has not been cut by intruders.

In addition, if the phone line goes down, the GSM will automatically switch alarm communications to the mobile phone network, allowing the alarm system to operate as per normal even though the regular phone line is inoperative. In this way, the phone line is disrupted due to intruder attack or other reasons (e.g. accidents etc.) the system will still be fully functional.

The intruder alarm specialist shall allow for liaising with the monitoring company for the provision and initial cost for setting up external monitoring including the first 12 months coverage. This shall be included by the alarms specialist costs at tender stage. The contractor shall be responsible for providing all telephone cabling as necessary within the building between Eircom's incoming position and intruder alarm panel.

29.5 MAINTENANCE

The specialist installer shall include in their tender for the cost of comprehensive maintenance of the systems for a period of 12 months from the date of commissioning. This cost shall include for 24-hour engineering maintenance cover. Preventative maintenance and corrective maintenance will be provided and will consist of 2 site visits to be carried out on a 6 monthly basis. Copies of all maintenance carried out shall be forward to the engineer for his records.

29.6 TESTING AND COMMISSIONING

The complete system shall be tested and commissioned by the specialist Installer in conjunction with the equipment manufacturer's representatives in accordance with PSA: 2004. Two copies of the commissioning certificates shall be provided.

29.7 LINK TO EXTERNAL BUILDING LIGHTING

As a requirement by the Department of Education the intruder alarm system must be connected to the external security lighting installation. For this project in the event of an alarm signalling, the external building and car park lighting shall go into 'hand' mode and turn all external lights 'On'. This shall integrate with the Philips Dynalite lighting controls system to facilitate this arrangement.

29.8 LINK TO FIRE ALARM SYSTEM

For security purposes the fire alarm system must be connected to the intruder alarm system, which will automatically connect to a 24-hour central station.

The communicator to the ARC (by intruder alarm specialist) will be capable of distinguishing whether the alarm is fire or intruder. The contractor shall include for this connection. The fire alarm and intruder alarm specialist shall indicate wiring details.

29.9 SPECIALIST SUPPLIER

The specialist supplier shall be a PSA licensed approved installer.

Pauric Rushe

CTI Business Solutions

Manager / CCTV-Network Engineer

0851299717

pauric@cti.ie

30 68 DOOR BELL INSTALLATION

30.1 GENERAL

In addition to the access control installation, the electrical reserved specialist shall allow for the supply and installation of a door bell and chime at the front entrance of the building. This shall be used for out of hours use when the reception is not manned. The bell chimes shall be located in two locations of the ground floor corridor, location to be agreed on site. All power supplies and transformers associated with this installation shall be located in the switch room.

- 1 no. Bell Push Friedland D834W.
- 2 no. Bell Chime Friedland D117
- 2 no. Bell Transformer Friedland D765 suitable for DIN rail mounting.
- Bell chimes shall be wired using bell circuit cabling from the TX.

31 69 LIGHTNING PROTECTION SYSTEM (LPS)

31.1 GENERAL

A Level IV lightning protection system shall be installed in accordance with BS EN62305. The system should be installed in accordance with BS EN62305 parts 1-4 inclusive.

The system shall consist of a series of 25x3mm aluminium lightning conductor tapes bonded to the aluminium rooftop, which will act as the air termination network, and terminated at earth pits at various ground level locations.

Down conductors shall be bonded to the air termination network and drop externally down the outside of the building at 10m intervals around the outside perimeter. The down conductors shall be fixed to the external facade of the building at 1m centres using standard D/C clips. A bi-metallic clamp shall be fitted to each down conductor. The down conductor shall then terminate at ground level in a set of earths rods, driven into the ground and housed in an inspection chamber complete with test point.

To minimise the visual appearance of the down conductors, the conductors shall be PVC coloured to match the roof finishes and parent masonry work and be located where possible at downspouts and building returns etc. The contractors shall allow for a non-standard RAL colour finish on the conductor tape as tender stage. Each down conductor shall then terminate at ground level in a set of earths rods, driven into the ground approximately 2.8metres deep and housed in an inspection chamber complete with test point. Cross bonding between the electrical earth and the lightning conductor earth to be established.

All necessary roof bonding clamps designed not to puncture or damage the roof in any way shall be included by the specialist installer. On completion the various systems are to be identified and described fully in Owner's Manual and left certified to BS EN62305.

Due to visual location and aesthetics of this building, a pulsar lightning rod proposal shall not be acceptable under any circumstance.

31.2 SPECIALIST INSTALLERS

- Reg Farrell Ltd
- J&J Mowbray Ltd
- Rainey & Company Ltd

Or equal & approved by engineer.

32 GENERIC EQUIPMENT SPECIFICATION

32.1 GENERAL

All equipment supplied and installed shall conform to EN 29000 and BS 5750 in regards to manufacturing processes and quality. All accessories shall be complete with 35mm deep galvanised surface back boxes. The following items have been described with relevant European standards, where applicable to indicate the performance and quality of their product. British Standards shall apply in cases where such European standards do not exist. Where electrical equipment has not been detailed previously in this specification or on the drawings the following minimum standards will apply as outlined hereafter.

32.2 13 AMP SWITCHED SOCKET OUTLETS

All socket outlets shall be double-pole switched and with 3-pin child resistant shutter system. Socket outlets shall be switched with outward bound rockers and in compliance with BS 1363 with suitable back boxes.

32.3 13 AMP UNSWITCHED SOCKET OUTLETS

Socket outlets shall be in compliance with BS 1363 with suitable back boxes. All sockets shall have a 3-pin child resistant shutter system.

32.4 13 AMP FUSED CONNECTION UNITS

Spur Units or Fused Connection Units shall be provided with suitable rated fuse. The fused connection unit shall be provided with a flex outlet and neon indicator as necessary depending on its purpose and the equipment served. They shall comply with BS 5733, and be fused on the supply line. Dimensions shall be 82mm x 82mm x 44mm with the flex outlet up to 10mm outside diameter.

32.5 20 AMP DOUBLE POLE SWITCHES

These shall be provided with a neon indicator and flex outlet as necessary depending on item of equipment to be served. They shall comply with BS 3676 and be complete with earth terminals. Dimensions shall be 86 mm x 86 mm max.

32.6 TELEPHONE OUTLETS

These shall be suitable for surface mounting with telephone plug in socket connector RJ45 type.

32.7 RELAYS

Relays shall be suitably rated and comply with all IEC and BS regulations including BS 9150, BS 9151 and IEC 255.

32.8 HAND OFF/AUTO SWITCHES

These shall be 3 position switches of the grid rocker type suitable for mounting in gridswitch arrangement. They shall be suitably engraved hand off and auto and shall be single pole operated to BS 3676. 1.37. The gridswitch shall be engraved and complete with indicator neon.

33 BUILDING MANAGEMENT SYSTEM (BMS)

33.1 GENERAL

The following information provides the electrical reserved specialist an understanding of the controls strategy and narratives for this project. The supply of the BEMS panel shall be by others, however the electrical reserved specialist shall be responsible for all wiring associated with the controls installations including all infrastructure and cabling. The electrical reserved specialist shall note that all Semple & McKillop, (SMK), BMS drawings and schematics are for design intent only. It is the responsibility for the electrical reserved specialist to co-ordinate with the mechanical counterparts for the issue of BMS working drawings together with schematics and locations of all final mechanical plant including valves, actuators, sensors etc. in order to avoid wiring to incorrect locations or using incorrect cabling. No claim for deploying SMK design intent drawings as construction issue shall be entertained.

34 EARTHING

34.1 EARTHING SYSTEMS

The electrical reserved specialist shall contact the supply authority to determine the earthing system employed in the existing buildings and that which shall be applicable in the new building as defined in the NSAI I.S. 10101: 2020 Regulations, NSAI I.S. 10101: 2020. The installation earthing conductor shall be connected to the Protective Conductor of the incoming services. This shall be confirmed and verified by the electrical reserved specialist who shall contact the local electrical supply authority.

34.2 MAIN EARTHING TERMINALS OR BARS

The installations shall be provided with main earthing terminals or bars as part of the main L.V. Switchboards, to which the earthing conductors, the circuit protective conductors and the main bonding conductors shall be connected. The earthing terminals shall take the form of approved connector blocks, complete with insulating shrouds to BS 5733: 1979 and NSAI I.S. 10101: 2020: and of suitable capacity for the number and size of cables to be connected.

Readily accessible provision shall be made for disconnection of the main earthing terminals from the means of earthing and or disconnecting the main equipotential bonding conductors.

34.3 MAIN EQUIPOTENTIAL BONDING CONDUCTORS

Main equipotential bonding conductors shall be installed to connect the main earthing terminals or bars with: -

- All main services pipework including water, gas and oil as applicable.
- Other service pipes and ducting as indicated on the drawings.
- Risers of space heating and ventilation systems.
- Exposed metallic parts of the building structure.
- Lightning protection system (LPS)
- Other services in accordance with NSAI I.S. 10101: 2020:

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.

The conductors shall be comprised of 450/750-volt grade, single core, stranded plain copper conductors, green/yellow LSF insulated cables to BS 6004/1975 Table 1a and sized as per attached drawings.

Mechanical protection shall be provided throughout the length of each main equipotential bonding conductor. Connection of the conductors to conductive parts scheduled above shall be by means of an approved clamping device, and a label as defined in the I.E.E. Regulations (514-13) and NSAI I.S. 10101: 2020: shall be permanently fixed to each connection.

34.4 CIRCUIT PROTECTIVE CONDUCTORS

Circuit protective conductors shall interconnect the main earthing terminals or bars with all exposed conductive parts of all items of equipment forming the electrical systems installations. Individual circuit protective conductors shall only be used.

LSF sleeving coloured green/yellow at all terminations shall suitably identify circuit protective conductors, which take the form of an uninsulated core of a multi-cored cable.

34.5 SUPPLEMENTARY BONDING

Within the zone formed by the main equipotential bonding, local supplementary bonding connections shall be made to metal parts to maintain the equipotential zone.

For the purposes of tendering, it is assumed that all joints in pipework and ductwork services are permanent, reliable, metal-to-metal joints of negligible impedance and that no additional supplementary bonding will be required.

This contract shall include for the testing of all such joints and the informing of the Engineers of all cases where the impedance is not negligible.

35 PRE-COMMISSIONING AND COMMISSIONING

35.1 GENERAL

The electrical reserved specialist contractor shall be responsible for the pre-commissioning and commissioning of all systems as detailed hereinafter and shall include in his tender figure for all costs which may be incurred due to compliance with the requirements of this section. A detailed commissioning programme with buy in of all sub-sub specialists shall be produced and issued to the engineer at maximum 3months before scheduled PC of the project.

The terms pre-commission and commission are defined as follows: -

35.2 PRE-COMMISSION

Pre-commission shall mean the testing, checking and adjustment of each individual component within a system to ensure that its operation is satisfactory, its mechanical and electrical connection are correct and in accordance with the manufacturer and/or suppliers instructions and/or wiring diagrams and installation manuals and to ensure that it is functional and in working order.

35.3 COMMISSIONING

Commission shall mean the testing and operation of each system to ensure that it is operating as designed and that the function under control is being maintained within design limits and also that the response of the system to changes in the variables being monitored by the system is satisfactory.

Pre-commissioning, therefore, shall apply to each individual controller, indicator etc.

35.4 IMPLEMENTATION

The contractor shall ensure that all information necessary to comply with the above requirements is made available by the relevant suppliers.

The contractor shall include for all site visits necessary by the suppliers or their agents to ensure compliance with the above.

The engineer shall be at liberty to attend all pre-commissioning checks and commissioning checks, as he deems necessary.

The final commissioning of the plant and all systems therein shall be carried out in the presence of the engineer, the client and any such representatives, which the client may deem necessary.

Should the systems fail to commission for any reason the process must be repeated at a later date after all faults have been rectified by the sub- contractor.

The contractor may at his discretion employ the services of the supplier or his representative to carry out commissioning of any or all of the systems. A commissioning certificate must be supplied for each system tested.

Systems that are commissioned in the absence of the Engineer shall not be accepted and the commissioning will require to be repeated in the Engineers presence.

35.5 INSTRUCTION AND INFORMATION

The contractor shall instruct the client or his appointed representative in the operation of all systems supplied and commissioned with him. A building owner's manual shall be compiled by the electrical reserved specialist and shall include the following:

- Operating instructions for all systems.
- Operating and maintenance instructions for all items of equipment supplied under the electrical contract.
- Installation and wiring diagrams.
- All guarantees.
- All commissioning certificates etc.
- 'As Installed' Drawings.

36 OPERATIONAL & MAINTAINENCE DIGITAL PROJECT SAFETY FILE

36.1 COMPILATION OF MANUAL:

The electrical reserved specialist shall be responsible for the supply of a digital O&M project safety file and all its specified elements and requirements are to be collated and managed by a specialist O&M Co-Ordinator. In addition, 1 hard copy of the safety file shall be handed over in a format detailed below. The O&M Co-Ordinator should be appointed early in the project to ensure the file is compiled as the project progresses. This will allow time for reviewing documentation / formats / templates early and ensure prompt delivery of the documentation to the client following completion of the project.

Prior to appointment, the proposed specialist co-ordinator should be able to demonstrate the following to the client and consulting engineer:

- Track record on recent similar projects.
- Proposed method of collating documentation from relevant parties
- Tracking methods and documentation to be used throughout the project

The role of the Specialise O&M Co-Ordinator should include the items listed below.

- Site attendance as necessary to agree client specific layout O&M File. Allowance should also be made for site based update meetings with the main contractor as required.
- Receive and analyse existing safety file information
- Collate and manage all design and O&M documentation from design team, sub-contractors and suppliers.
- Ensure received documentation is accurate, relevant and site specific.
- Integrate new elements of the work with the existing documentation to ensure a complete and accurate handover file if made available to the client following project completion.
- Present for approval of design team
- Final handover to client including staff training

The file is to be a web-based application formatted to facilitate tracking, viewing, printing, access, editing, searching and updating of the file.

36.2 PRESENTATION & FORMAT:

The O&M Manual will be presented as a *web based* application capable of being hosted either online (available 24hrs a day, 365 days of the year) or on the client's internal IT network with no loss of functionality. Documentation will be held primarily in PDF format with all drawings also included as CAD/Revit files for future use. The system shall capable of dealing with all other popular file types.

The system shall be capable of holding operation and maintenance documentation for a number of individual sites for the same client. The file can be expanded to cater for existing projects and possible future expansion. The system shall be accessible through a front screen featuring each of the projects which can have links to the individual safety files of each individual project.

Access to the O&M Manual shall be restricted via password / username combinations. Individual usernames can be assigned to each user which can, in turn grant different levels of access. A variety of access levels should be available from 'read only' to full user access for editing and uploading. The system shall not be restricted to a limited number of users.

A clear audit trail shall be recorded for every document uploaded to the O&M Manual. Time and date stamps shall be applied to all documents when they are uploaded.

A comprehensive search engine shall be included to ensure easy and quick navigation to any document. Searching shall be possible using key words, phrases and shall be possible to restrict the search to specific areas of the O&M Manual if required.

36.3 SAFETY, HEALTH & WELFARE AT WORK (CONSTRUCTION) REGULATIONS:

Under the above (Regulation 8), the client has a duty to keep the safety file available for inspection by any person carrying out any future works on the building. To this end, the digital O&M manual ensures the client is compliant with this regulation and offers a flexible and easy to use tool for keeping project information available, accurate and up to date.

This application facilitates the future uploading and editing of additional documentation by the client to any area of the file to ensure the file can be kept current and up to date by the user.

36.4 QUALITY OF DOCUMENTATION:

It shall be noted that all documentation submitted as part of the O&M Manual needs to be project specific. General sales brochures shall not be included – the relevant pages shall be extracted and the models of plant and equipment used clearly identified. Documentation shall be focused on giving the end user clear information on how to operate and maintain his building.

All documentation shall be included in PDF format to facilitate uploading to the builder's digital O&M Manual. Scanned documents shall be avoided except in the case of test certificates. Where scanned documents must be included, then a minimum setting of 400dpi in full colour shall be used. Drawings shall be submitted in both PDF & CAD. CAD drawings shall be presented in .dwg format and be fully bound to all external references.

The O&M Manual shall be based on and comply with the following:

- Safety, Health and Welfare at Work (Construction) Regulations 2013
- BS 4884 – Technical Manuals – Parts 1, 2 & 3
- BSRIA Guide 2/2004 – Computer Based Operation & Maintenance Manuals
- BSRIA Guide 1/2007 – Handover, O&M Manuals & Project Feedback

- Project Specific Requirements
- Industry Best Practice

36.5 HARD COPY MANUAL FORMAT

1 copy of the digital O&M safety file shall be handed over to the client/engineer at proposed PC date of the project. Although the degree of detail will vary, all O&M manuals for building services installations need to contain certain types of information. It is advisable that the building services O&M manuals are compiled to a similar template for the clients benefit.

The contractors sub-specialist should refer to BG1/2007 standard for '*Handover, O&M Manuals, and Project Feedback*' when compiling these manuals. O&M's should be compiled to a minimum level of Class C as outlined in these standards and should follow the template included below.

Section	Description
01	Contents, Structure, Layout & Emergency Information This section is a guide to the contents, structure and layout of the manual. It enables the reader to comprehend the scope and purpose of the document and helps to identify where specific information can be obtained. An important feature of any manual is the emergency information. This information should be located at the end of the document for ease of reference, and should include name, address, telephone and fax number, and e-mail addresses of the appropriate contracts in the event of fire, theft or burglary, and gas, electricity or water failures, and leaks. It should also list firms or staff to contact in the event of the failure or breakdown of plant, such as lifts, boilers or pumps. Where applicable, the location of fire-fighting equipment, hydrants and rising mains should be described. Special attention should also be given to hazards particular to the building. Depending on client policy, a note of security installations may also be included.
02	Overall Purpose This section should provide a general overview of the original design intent (available in outline from the design brief and in detail from the specification). It should include a summary for each engineering system installed, giving:

	● The parameters and conditions within which it has been designed to operate a system ● The type of each service (gas, electricity and water) required to operate a system ● The intended method of control. The section should be kept as brief as possible.
03	Description This section should provide a detailed description of each engineering system installed. It should include: ● The system type (such as a cold water supply) ● System location and what it serves ● What the system depends upon in order to function ● Design data, basic design parameters, basic assumptions made during design ● Reasons for selecting particular plant ● Expected service life (where available) ● Planned operational efficiency. ● Location
04	Equipment Schedule This section shall be a fully detailed asset register. Type, model number and serial number of all component items within the system should be listed, together with the names of their respective manufacturers or suppliers. To be presented in tabular format.

36.6 REFERENCE SUB-SPECIALIST

Engineering Documentation Ltd. (+353 719141564 / info@engdoc.ie), or an equal and approved format.

37 PROJECT HANDOVER OBLIGATIONS & CLIENT DEMONSTRATIONS

37.1 GENERAL

Upon completion of the installations & demonstrations, the contractor shall issue a completion certificate on their company headed paper in accordance with template illustrated below. This is to verify that the various electrical systems have been demonstrated to the end users and that the O&M manuals have been issued to the building representative. This shall be signed by all parties on the certificate.

37.2 HANDOVER CERTIFICATES

As part of the handover requirements for this project, the contractor shall be responsible for organizing and carrying out all the duties listed below and obtaining the necessary sign offs by the building representative, engineer and various subcontractors. This certificate is a mandatory requirement and shall be filled out on the contractors headed paper

Handover & Completion Record Sheet	
Project Name:	
Roll No:	
Address:	
Project:	
Item:	Signatures & Date
Mechanical services comprising heating water services, ventilation, soils & wastes and fire protection services tested and operating satisfactory.	
Electrical Services comprising of electrical supply, electrical centre, main distribution, power distribution, lighting services, earthing, communication services, transport services & protective services tested & operating satisfactory.	
The contractor has liaised with the engineer and/or building representative and confirmed that the intruder alarm installation has been zoned to take account of the building authorities' requirements for out of hours use of the building.	
The contractor has liaised with the engineer and/or building representative and confirmed that the building authorities' requirements for operational times on the heating installation, external lighting and all time clock controlled systems have been incorporated into the M&E services controls.	
A schedule of all heating zones and all time clocks within the building detailing their purpose, location and individual operational time settings has been provided in its own section in the operating & maintenance manuals.	
The lighting controls commissioning certificate incorporating Parts: A & B has been provided by the contractor and included in the operating & maintenance manuals handed over to the building representative.	
The cold & hot water services have been designed and installed in accordance with prevailing national & international standards with a specific focus on the prevention of legionella in the water systems.	
Information with regard to the prevention of legionella through regular maintenance of the hot & cold water systems was explained to the building representative at the handover talks and has been included in both the O&M manual and the safety file issued to the building representative by the main contractor.	
A DVD recording of formal handover talks, training and demonstration of the M&E services has been provided by the contractor and is included in the O&M manual.	

The building representative i.e. caretaker has been taken through a visual check scenario of the electrical installation in the building.	
A check list for visual inspections of the electrical installation has been handed over to the building authority and a copy has also been included in the O&M manuals.	
A soft copy & online access copy of the O&M manuals has been provided by the contractor and is included in the O&M manuals.	
O&M manuals have been checked for compliance and handed over to the building representative and have been fully explained.	
Two training and demonstration meeting were held in the presence of the engineers, contractor, their M&E sub-contractor, the building representative and were fully briefed on all elements of the M&E services provided. Date Of Meeting No.1 Date Of Meeting No.2	
Laminated wall chart has been provided explaining common operating/maintenance procedures.	
As Installed drawings detailing the layout of the M&E services and have been verified by the engineer and have been handed over to the building representative in hard copy and soft copy format.	
Confirmation of the above elements:	
We the undersigned confirm that all of the above elements have been concluded.	
Building Services Consulting Engineers (Company Name):	
Semple & McKillop Ltd	
Names: (Printed)	Signed:
(i)	
(ii)	
Electrical reserved specialist (Company Name):	
Name: (Printed)	Signed:
Building Representative:	
Name: (Printed)	Signed:

37.3 CLIENT DEMONSTRATIONS

All client demonstrations shall be recorded on digital camcorder and the electrical reserved specialist shall be responsible for the recording of demonstrations of plant operation and compiling a DVD for handover to the employer along with the completed maintenance manuals and 'As Installed' documentation.

The electrical reserved specialist shall also arrange for pre-client demonstrations to take place in the presence of the consulting engineer. Only after successful demonstrations to the consulting engineer shall a date be organised with the client for full client demonstrations.

Additional client demonstration days shall be held approximately 1 week, 2 weeks & 4 weeks after the 1st demonstration day for the purpose of refreshing the client after they have operated the systems for a period. All sub-specialists must be in attendance on each day as requested by the engineer and/or client. No additional monies shall be granted for this works.

38 LABELLING REQUIREMENTS

The contractor shall be responsible for carrying out specific labelling requirements for each space as required in the latest TGD's. A3 size laminated sheets incorporating simple instructions for the operation of the listed elements (if present) in each room shall be located adjacent to the door of each space. Each sheet shall be forward to the engineer for approval prior to installing on site;

38.1 LIGHTING CONTROLS:

Clear instructions on what lighting controls are provided and how they operate

38.2 BLINDS:

Include the following 'Raise blinds when not required in order to reduce lighting energy used'

38.3 LOCAL HEATING CONTROLS

Clear instructions on what local heating controls are provided and the operating of these in the space.

38.4 MECHANICAL EXTRACT VENTILATION (SPECIALIST ROOMS)

Clear instructions on how the system works and how to operate it along with the importance of natural ventilation. A reminder for those who use the system to open a window before switching on the ventilation system

39 SCHEDULE OF LUMINAIRES

39.1 NOTES

The contractor is strongly advised to read the following notes on light fittings as well as the notes following this schedule:

- Where names of manufacturers and types of equipment are stated, these are for the purposes of making clear the nature and quality of equipment that is required. Where no reason is given for the exclusive use of such equipment, the Contractor is at liberty to offer goods of equal quality, appearance, workmanship and design from any other manufacturers, provided that such alternatives are wholly compliant with the specification and schedules.
- Adjustable fixing brackets shall be used/supplied to fit all Surface Mounted Fluorescent Luminaire in order to clear ceiling tile.
- Where specific manufacturers are listed, these are provided purely to offer an indication of manufacturers that offer the products listed.
- Alternatives will be accepted if the alternatives comply with the technical requirements listed below and are of the same general appearance as the fittings shown within the photographic images included.
- The Contractor shall ensure that the light fittings offered have no more than a Maximum artificial lighting power consumption level of 2.5watt/m² per 100lux. It shall be the responsibility of the contractor to check and verify that equipment proposed fully meets the specification.
- Any items installed that do not meet the specification shall be removed and replaced at no cost to the contract.

39.2 LUMINAIRES PROPOSALS

The contractor shall submit to the Employer's Representative for approval the following information and luminaire details in order to demonstrate fully that the proposed luminaire meets the performance objectives and design parameters outlined within this specification, accompanying drawings and schedule of luminaires and lamps documented below:

- Samples of equivalent luminaires (and to be fully operational, lamped and wired)
- Full technical luminaire specifications, including:
 - a) Calculations for sample areas of the installation including details of the assumed maintenance factors, interior surface reflectance's and lamp type and details and lumen outputs.
 - b) Minimum Classroom Requirements are: Average Classroom 300-Lux, Classroom working plan as per architectural drawings, Uniformity Level of 0.8 (+/- 10%).
 - c) Luminaire photometric performance including Light Output Ratios and Polar curves.
 - d) Technical specification including materials and construction information.

- e) Lamp types Luminaire weights and required mounting details for operation and installation (including remote gear or battery pack information where applicable).
 - f) Luminaire dimensions including recess space requirements (including remote gear or battery pack information where applicable), are co-ordinated and suitable for all architectural details and ceiling designs.
 - g) Written confirmation that all luminaires come with a manufacturer's 5 year warranty for the supply & replacement of any component, part or fitting including all labour costs associated with the replacement of parts.
 - h) UGR ratings.
- Demonstration of full co-ordination and compatibility with architect's installation details, available supporting and/or fixing elements, recess spaces and ceiling designers shall remain the responsibility of the contractor
 - Proof of availability of spare parts in the Republic of Ireland.
 - Photographic illustration - to demonstrate the proposed luminaires aesthetic coherence with the architecture and other luminaires.
 - Proof of meeting all relevant standards and CE Marking, manufacturers Declaration of Conformity, proof of the manufacturer's CENELEC Agreement Licence / ENEC Certification.

39.3 SCHEDULE OF LUMINAIRES

Refer to Part 4 Equipment Schedules element of specification Documents.