

***EMERGENCY WORKS SCHEME 2026
ELECTRICAL UPGRADE SYSTEM***

**ELECTRICAL UPGRADE AT MOUNTMELICK FET
MONUTMELICK CO LAOIS FOR LOETB**

***Works Requirement document – Volume A.2.4.
Specification of Performance, Standards and Materials***

For

Electrical Services Installation Works

Project Ref: 0840

Date: July 2026

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REV	ISSUE	DATE	DOCUMENT	AUTHOR	APPROVED
	Tender Issue	23/07/2026	0840 – Electrical Specification	MP	JG

SECTION 1: PRELIMINARIES AND GENERAL CLAUSES:

01. Description Of Site:

The site is the existing, Mountmellick FET, Mountmellick, Co Laois, which is easily accessible from the road. The site boundaries are defined on the accompanying drawings, and this Contractor shall confine his operations to the area indicated.

This Contractor shall be deemed to have made a thorough examination of the site and all features thereof, the existing premises, together with all internal and external services, adjoining premises and property or other things affecting the proposed works, to ascertain precisely the nature and extent of same and the condition under which the works will have to be executed, as no claim will be allowed on the grounds of want of knowledge in this respect.

This specification entails the supply, erection, installation, connection, testing and setting to work of Electrical Services associated with the finishing in every respect of the following works:

- Decommission, disconnection and removal off site of all existing electrical services within the areas of works as shown on the accompanying drawings
- Diversion of utility services - ESB
- Provision and Installation of all distribution boards and sub-mains cabling
- Provision and Installation of cable containment
- Provision and Installation of wiring for power, lighting,
- Provision and Installation of ITC equipment, as indicated.
- Provision and Installation of lighting fittings
- Provision and Installation of Lighting, power for the site services, i.e. site lighting/EVC (existing retained)
- PA/Class Chane System,

NOTE – the following systems are being retained with minor works as scheduled on drawings allowed for. The services in question are:

- Projectors/Screens
- Site Lighting
- Intruder Alarm/CCTV
- Door access system

It shall be noted that not all elements of the specification have been transferred to the drawings. It is therefore important that the specification is read in conjunction with the drawings. Where a discrepancy is found between the drawings and specifications the most onerous should be taken.

Any apparent contradictions between tender documentation should be queried with the Employer's representative during the tender process. In the case where a contradiction is not highlighted it will be at the discretion of the Employer's Representative to decide which document takes precedence. In the case of all standards outlined in this and other contract documentation, it is to be taken that the latest version or superseding standard is the relevant standard. (The precedence of information as defined within the Contract will still stand on all other matters

02. Description Of Works:

The works covered by this specification comprises of the Electrical Services Installation in connection with the electrical upgrade works within the Educational Centre and the recently constructed workshop as detailed hereunder.

These works are to be carried out by a suitably qualified and registered Electrical Contractor as a direct contract with the LOETB.

The contractor shall include all labour, materials, import charges and transport which may be required for and in the construction of works detailed in the Specification and as shown on drawings, and shall provide at this own expense for all necessary power, plant, tackle, machinery, tools, apparatus, instruments, scaffolding, ladders, hoists, fencing and other equipment for the workmen and for the erection, testing, demonstration and commissioning of the complete plant in the manner described, together with the carriage thereof to the spot where they are required to be used and their subsequent removal.

This specification will set out in general terms the design drawings and data to be used by the Contractor in order to submit a tender bid for the electrical services installation and the works associated with the installation. The procurement, delivery, supply, handling, erection, installation and commissioning of the services as there under described as may be seen or inferred from the enclosed drawings and documents from the Consulting Engineer.

The Contractor shall satisfy himself that the installation is in accordance with all codes and standards. All works described shall comply with:

- The Safety, Health and Welfare Act, 1989.
- Requirements of the Health and Safety Authority / SI 138.
- Factories Act / Statutory Instruments.
- Client Safety Protocol.
- Client Specifications.
- Chartered Institute of Building Services Engineers.
- The Tender Drawings.
- The Contract Preliminaries.
- All relevant Irish, British and European Standards and Codes of Practice.
- EN12464 - The Lighting of Workplaces
- National Rules for Electrical Installations, IS 10101:2020
- IS 820-2019 Nondomestic Gas installation.

The Contractor shall at his own expense, keep his area of the site, always, free from debris, obstructions or surplus materials arising because of the works described in this specification and

on completion of the works shall leave the site in a clean and tidy condition to the satisfaction of the Employer's Representative at the end of each working day.

All goods, products and materials shall be in accordance with the latest revision of Irish and EU Standards. All installations shall be in accordance with latest NSAI and Department of the Environment Building Regulations and Technical Guidance Documents.

The Contract for services and scope of work for the Contractor includes for the supply, delivery, positioning, erection, connection, testing, commissioning, and setting to work, of all plant and materials necessary to complete all remedial works to the satisfaction of the Employer's Representative and in accordance with the various drawings, schedules conditions and contractual documents and the requirements of this specification.

Materials and Products

Materials shall be selected, and all building elements designed to ensure that the building and all components are durable and low maintenance and do not present a hazard to the health and

safety of the users. In accordance with Part D of the Building Regulations all works shall be carried out with proper materials and in a workmanlike manner. "Proper materials" means materials which are fit for the use for which they are intended and for the conditions in which they are to be used, and includes materials which:

- Bear a CE Marking in accordance with the provisions of the Construction Products Regulation.
- Comply with an appropriate harmonised standard or European Technical Assessment in accordance with the provisions of the Construction Products Regulation.

Or

- Comply with an appropriate Irish Standard or Irish Agreement Certificate or with an alternative national technical specification of any State which is a contracting party to the Agreement on the European Economic Area, which provides in use an equivalent level of safety and suitability.

The Engineer shall have the power to order during the progress of the works the removal from site of any material, which in his opinion is not in accordance with this contract, the substitution of proper materials, and the removal and proper re-execution of any work, which in respect of materials and workmanship is not in accordance with the contract. This condition is not withstanding any previous tests or interim payments. The Engineer will periodically inspect the progress of the installation as it proceeds. If the Contractor requires any special inspection, he shall be obliged to advise the Engineer with two weeks' notice prior to the inspection required.

The electrical contractor will provide submittals sheets for all elements of the electrical installation. The initial submittal package will include all items in a single submittal for ease of assessment. Submittals shall have the relevant technical information presented in a proper datasheet with the specific product highlighted. Evidence of CE Marking, warranties and triple E register compliance will be provided where applicable. Following approval of submittals by the M&E consultant all visible elements of the installation will be provided on a samples board on

site for the M&E consultant to review. Following this review of samples final design team approval is issued.

Please note that ‘The Contractor’ in this specification refers to the Electrical Contractor.

03. Site Conditions:

The submission of a tender will be deemed to imply that a site visit has been made to ascertain the nature and extent of the works involved, accessibility, local conditions, the supply of, and conditions affecting labour and the execution of the Contract generally.

On submission of a tender the Contractor shall be deemed to have acquainted themselves fully with all the necessary details of the building construction and occupancy.

Claims for extra payment on the grounds that the nature and extent of the work was not understood will not be granted.

This Contractor is strongly advised to visit the site and ascertain the facilities of access thereto, the supply of labour and materials the district will afford and general convenience of working. He shall be taken to have made himself acquainted with the nature of the works; the site and all existing buildings and all other things insofar as they may have any connection with or effect the works.

Contractors must refer to the Construction Industry Federation standardised approach to commencing construction projects in Ireland which incorporates the COVID-19 public health requirements, and ENSURE that all measures required in order to comply with these guidelines are included for. This document is available at www.cif.ie and a copy of same is included with the tender documentation issued for the works.

All the above matters must be taken into account when tendering and no charge for any extra labour or materials will be allowed in consequence of this Contractors failure to do this. The Contractor must notify the project Engineer immediately should site conditions alter significantly from those as stated in the tender documents.

04. Covid 19

The contractor shall allow in his tender for working on site in line with the CIFs Standard Operating Procedure (SOP) and, for any additional time and cost incurred to accommodate the implications of C19 restrictions. Ensure all directly and indirectly employed staff have undergone the CIF’s COVID-19 safety induction programme and have a digital card and follow the instructions of the main contractors C-19 compliance officer.

05. Tender Drawings/Surveys

The submission of a tender will be deemed to imply that a site visit has been made to ascertain the nature and extent of the works involved, accessibility, local conditions, the supply of, and conditions affecting labour and the execution of the Contract generally.

On submission of a tender the Contractor shall be deemed to have acquainted themselves fully with all the necessary details of the building construction and occupancy.

Claims for extra payment on the grounds that the nature and extent of the work was not understood will not be granted.

The design drawings issued within the tender package must be read in conjunction with all relevant project specifications. If the contractor has any queries regarding design drawings issued prior to tendering they shall notify this office immediately. It shall be otherwise deemed that the contractor has understood and priced for all works as designed.

06. Tender Returns:

The Electrical Contractor shall be deemed, before tendering, to have made a thorough examination of the Drawings, Specifications, Conditions of Contract, the Site and other things affecting the proposed works to ascertain precisely the nature and extent of same and the conditions under which the proposed works will have to be executed. The Tenderer must complete the tender return / pricing pages accompanying this specification document, in full, where each elemental item is to be priced for separately.

07. Pricing:

Un-priced items - Any item left un-priced shall be deemed to be included for in the tender and the cost of the item shall be deemed to be spread across and included in the rates generally.

Currency - All prices and rates shall be deemed to be denominated in Euros (€). All P.C. and Provisional Sums herein are in Euros.

08. Payment:

The Contractor must submit Progress Statements for each Claim and Interim Certificate Amounts may be at the Engineer's Discretion.

09. Ascertainment of Prices for Variations:

Any oral instructions, directions or explanations given by the Engineer upon the Works to Electrical Contractor shall if involving a variation be confirmed in writing by the Electrical Contractor to the Engineer within five working days.

The rates in the Priced Bill of Quantities referred to in the clause above applied to the Works shall determine the value of work carried out as a variation when such work is of a character similar to that to which the aforesaid rates apply and is carried out under similar conditions. The aforesaid rates shall also determine the value of any work omitted.

10. Bill Of Quantities:

The contractor shall, within seven days of being requested to, submit to the Engineers a detailed schedule, of rates covering every item fixed, as specified, upon which the sub-contractors estimate has been based. The number of items and quantities shall be given up to the totals as indicated in the Tender Summary. The Bill of Quantities shall remain with the Engineers until the works are completed and shall form the basis for agreement of variations by measurement. However, the Contract is a lump sum contract and is not subject to re-measurement.

11. Works Programme:

The Electrical Contractor shall include within his tender, details of his intended timing and order for the construction of the Electrical Services.

12. Installation and setting out of works

The Contractor shall set out the whole of the works and be responsible for the correctness of the positions, levels and dimensions of the several works. All openings, plinths, bases and holes to be cut in the structure shall be positioned and marked by the Contractor.

The tender drawings are diagrammatic only and the Contractor shall allow for a practical installation allowing for the setting around obstructions and other minor modifications which may or may not be apparent from the services drawings.

The exact courses and positions of all pipes, ducts, flues, cabling, conduit, trunking etc. and other items of equipment shall be duly laid out and marked on the job by the Contractor and approved before execution as the best possible course and position, having regard to all considerations including temperature and the proximity to other services plant.

The Contractor shall make good any incorrectly set out works and shall be liable for costs of making good any work incorrectly carried out. The Contractor shall furnish all materials, labour and instruments necessary to enable the setting out to be checked.

13. Guarantees and Warranties

All manufacturers guarantees and warranties on plant, equipment, etc., shall be valid up to the end of the Defects Liability Period.

14. Defects Liability Period:

All manufacturers guarantees and warranties on plant, equipment, etc., shall be valid up to the end of the Defects Liability Period. Refer to the Conditions of Tendering in the Contract Document.

15. Triple E Register

The Triple E Products Register is a benchmark register of best-in-class energy efficient products. The European Union (Energy Efficient Public Procurement) Regulations 2011, SI 151 of 2011, state “a public body shall only procure equipment or vehicles which are (a) listed on the Register or (b) satisfy the published SEAI energy efficiency criteria for the equipment or vehicle concerned, and the public body shall specify this requirement in any documentation describing its procurement requirements”. The contractor shall ensure that all products or electrical equipment installed are listed on the Sustainable Energy Authority Ireland’s (SEAI) Triple E lists of energy efficient equipment or are compatible with the criteria of the Triple E evaluation scheme.

16. Builders Work:

The Electrical Contractor shall be responsible for the correct marking out and providing all builder's works information/drawings to fulfil his obligations with regard to Builder's Attendances. Where services pass through partitions (floors, walls, ceilings) the Electrical Contractor shall maintain the fire rating if applicable within the services.

The Electrical Contractor shall refer to the drawings to identify all Fire Walls within the building. The Contractor shall be responsible for making good of all builder's work opes around services and ensuring that the making good does not damage the services installed.

17. Coordination Works:

The Electrical Contractor shall allow for liaising with all other existing trades in relation to coordination.

The Electrical Contractor shall mark out opes and holes on all wall surfaces as required to the satisfaction of Services Engineer, in sufficient time to allow the completion his works to programme.

18. Supervision:

The Contractor shall make available throughout the duration of the works a Project Supervisor or Site Foreman with appropriate qualifications and or experience to attend site meetings and receive instructions as are necessary for the execution of the contract, and to carry out superintendence of the works on site. The Project Supervisor /Site Foreman shall keep accurate records and details of all aspects of the works as necessary.

19. Labour:

The Electrical Contractor shall ensure that all employees are registered for PAYE / PRSI and that all employees have successfully completed a SafePass course. Only fully qualified and competent tradesmen, together with their necessary labourers, or helpers, shall be employed by the Contractor on the works, which shall be carried out and completed in the best substantial manner.

20. Site Establishment:

It is the responsibility of this to provide adequate temporary water, power and lighting supply for the duration of the Construction period.

21. Protection of Existing Services:

When stripping out the redundant services the Contractor shall ensure that no unnecessary damage is caused to either the equipment and/or the building fabric which is to be retained. The Electrical Contractor shall make good, at his own expense any damage caused whatsoever to existing services to the complete satisfaction of and in accordance with the instructions of the Engineer/Statutory Authority concerned, and shall keep the Client indemnified at all times from claims in connection with the damage.

22. Electricity Supply:

The electricity supply to this project will be 380/230 Volts, 50 cycles, and all electrical plant and equipment must be suitable for this supply.

23. Wiring Details:

The General rules for wiring of supplies of Electrical Energy, as laid down by the Electro Technical Council of Ireland, National Rules for Electrical Installations, 5th Edition IS 10101:2020, together with the regulation laid down by the E.S.B., shall be strictly adhered to, as shall the requirements of the 18th Edition of the I.E.E. Rules and Regulations.

24. Trade Names

Any reference to Trade names shall be for the purpose of describing the Specification standard of the article or material to be used and it does not imply that the specified trade name solely must be used.

25. Inspection Prior to Concealment

Where work requiring inspection or testing is subsequently to be concealed, due notice shall be given to the Engineer to accommodate necessary inspection and witnessing of testing where required before concealment. Failure to give due notice, of at least 48 hours, shall necessitate the Contractor uncovering the work and reinstating at their own expense.

The Engineer reserves the right to forego its inspection; however this will in no way relieve the Contractor's responsibility to comply with the specification and drawings. All work that is not installed to the required standard or does not demonstrate adequate co-ordination with the building and other services must be removed and re-installed in full compliance with the tender documentation and relevant standards at the Contractor's cost and without any associated increase in the project program

26. Tests/Commissioning On Completion:

The contractor shall test all installations on completion in accordance with standard test procedures, that is, relevant I.S. / B.S. / E.S. and Codes of Practice. The Contractor shall notify the Engineer in writing when the electrical services installation or parts thereof are ready for testing and commissioning, allowing sufficient time period for programming the testing, commissioning and handover of the systems.

The contractor shall issue a seven day notice period to the Engineer prior to tests being carried out to allow for the Project Engineer to witness, if he so wishes.

The Contractor shall prove that all test results are in accordance with the performance based specification issued, and furnish the project Engineer with the report / certificate issued by the specialist commissioning company. All test / commissioning certificates are to be included in the project O&M manual.

27. Making Good Damage:

The Contractor shall inspect all equipment and materials on arrival on site for defects or any failure to meet the specification and shall replace any defective equipment or materials as necessary. The Contractor shall take all necessary precautions to ensure that there is no damage or defacements caused by their employees or representatives to the furniture, fittings or other equipment within the buildings or to the premises themselves or to adjoining premises, and shall make good at their own expense any damage caused to the premises or its contents during the works, to the entire satisfaction of the Employer's Representative.

28. Instruction:

This Contractor shall liaise with the Engineer in providing for instructing the Employer in the operation of the electrical services installations on completion of the installation works. He shall provide two sets of record drawings, for the installed systems and full operating and maintenance manuals.

29. Drawings:

Copies of drawings of the building are issued with each Specification. Dimensions and other information shown on the drawings forming part of the Contract are believed to be correct, but no responsibility for same is accepted. This Contractor should note that, prior to finally positioning and outlets or fittings, these must be agreed with the Engineer. The Contractor shall be responsible for the setting out of the work and he shall rectify any errors he may make, either in setting out the work or during its progress. The Contractor shall not deviate in the execution of the work from the Specification or Drawings herein referred to, except upon written order signed by the Employers Representative authorising such deviation.

The Electrical Contractor shall keep on site a full set of the Construction Drawings, on which he shall record and note the actual layout of all the Electrical services installations as installed, including routes.

The Electrical Contractor shall include for the preparation of final marked-up drawings, at practical completion stage.

30. Maintenance:

The works shall be maintained by the Contractor in perfect condition for 12 months after the issue of the Engineers certificate of practical completion and any work or material exhibiting defects during that period shall be made good by the Contractor at his own expense.

31. Tax Clearance Certificate & C.I.F. Pension/Sick Pay Scheme:

It will be a condition for the award of the Contract that the firm being considered must be able to produce, within seven days of being requested to do so, a Tax Clearance Certificate from the Collector General of Taxes, Sarsfield House, Limerick and provide evidence of Membership of the Construction Industry Federation (C.I.F.) Pension/Sick Pay Scheme.

32. Insurances:

The Contractor shall comply with the requirements of Clause 10 of the “Short Public Works Contract” relating to Insurance and Compensation. He shall effect adequate insurance in his own name and also in the name of the Employer to cover all the risks or claims specified in the aforesaid “Short Public Works Contract” and shall hold the Employer indemnified against all such claims and risk in anyway arising out of the works included in the Contract.

The minimum sum for public liability insurance shall be €6,500,000.00 (six million, five hundred thousand euro) for any single claim, including employer’s liability of €13,000,000.00 (thirteen million euro) and including all risks as stated in the attached “Tender and Schedule”.

CONTRACT SAFETY AND HEALTH PROCEDURES:

Introduction

The Contractor shall note the Preliminary Safety and Health Plan prepared by the Project Supervisor for Design Stage, information included within this report and include all costs relating to compliance with that set out within the various Sections of the Preliminary Safety and Health Plan.

The Contractor shall include for complying with the Safety, Health and Welfare at Work Acts and Regulations current at the date of tender.

The Contractor shall include for providing all necessary information as requested by the Project Supervisor for the Construction Stage to enable the preparation and completion of the Safety File.

The Contractor shall include for "As Built" drawings for inclusion in the Safety File.

The Contractor shall hand over all documentation in connection with the Safety File and full information must be handed over for sign off, to the PSDP prior to Practical Completion Certificate been issued

Procure and maintain insurance cover and provide indemnity in respect of any claim incurred by reason of the performance of functions and duties of the project supervisor for the Construction Stage of the Project. Assist in preparing and completing the Safety File.

Regulations

The Contractor shall comply and adhere to the general principles of prevention as stated in the following:

- Safety, Health and Welfare Act 2005 - Present;
- Safety, Health and Welfare at Work (General Application) Regulations 2007;
- Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013);
- Memorandum on Council Directive 92/57/EEC; and
- Construction Industry Research and Information Association: "Control of Risk: A Guide to the Systematic Management of Risk from Construction", Report FR/CP/32, 1995.
- Safety, Health and Welfare Act (Chemical Agents) Regulations (2015)

B1. BASIC LEGAL REQUIREMENTS:

Contractors must comply with the Safety, Health and Welfare at Work (Construction) Regulations 2013 to 2021 and any other statutory provisions and common lay duties. Steps must be taken to ensure the provision of adequate and suitable plant and equipment.

Only those Contractors and Employees having appropriate training and experience should be allowed work, on the premises. The Contractor shall appoint a Project Supervisor as required by the Site Health and Safety Regulations.

B2. SAFETY COMMUNICATION:

The Contractor is required to ensure that all the Employees, Sub-Contractors and all their Employees, whilst on the Company premises are informed of the Health and Safety Rules and Procedures.

B3. PERIOD OF WORK:

The Contractor must notify the Project Co-ordinator in an appropriate way before commencing and on completion of their task. Prior application must be made for any work to be undertaken outside of normal office hours.

If work is to be phased, the method of phasing the work is to be prepared, agreed and distributed to all parties.

B4. VEHICLES:

Vehicles used by Contractors or their Employees are allowed on the Companies premises for delivery, parking or collection subject to local instructions. All drivers are requested to exercise maximum care when on Company premises and particularly when Employees or Members of the Public are entering or leaving.

Drivers of large vehicles operating in confined circumstances must ensure there is a person in attendance to assist with reversing etc.

B5. DELIVERY AND DEPOSIT OF MATERIALS AND GOODS:

No materials, goods or equipment shall be stored in Plant Rooms or placed so as to obstruct general work areas, gangways or fire exit routes.

All rubbish especially dangerous or flammable materials must be removed from the premises daily.

B6. CONTRACTORS WORK AREA:

The Contractor must keep locked, the doors to flat roofs with unprotected edges, plant rooms and electrical apparatus, unless in attendance. Where possible, the Contractor's work should be clearly defined and physically separated from all parts of the premises. The area may be marked by a temporary partition or tape backed up with warning signs.

The segregated area will become the responsibility of the Contractor. Visitors to Contractor's work must be accompanied by Contractors representative. Under no circumstances should portable or temporary methods of heating be introduced to the Contractors Area, without prior written authorisation.

B7. RAISED SURFACES, HOLES AND PROJECTIONS:

Raised surfaces, holes, trailing leads or surface and projecting equipment must not be left at any time without taking the necessary safety precautions. All opening must be securely fenced or

covered over and marked with warning notices. Loose materials of whatever kind must not be left about or allowed to obstruct the roadway, gangways or working area.

B8. FIRE EQUIPMENT:

The removal or obstruction of Fire Extinguishing Equipment from its original location is prohibited. A Contractor is responsible for providing and maintaining any specialised fire extinguishers and equipment for the work in progress.

B9. EVACUATION OF BUILDING:

The contractor must read Fire Instructions displayed on the premises and comply in the event of an emergency evacuation. He/she is not to eliminate or diminish exists during alterations.

B10. EXISTING SERVICES:

It is the Contractors responsibility to ascertain the existence and whereabouts of electrical cables, drains, air, gas, and water mains. The Contractor must familiarise himself/herself and how to operate the main and/or local isolation points for services before starting work and in anticipation of an emergency.

B11. PLANT, TOOLS, AND EQUIPMENT:

All plant, tools and equipment brought onto the Company's premises should be of safe design and in a safe condition. Particular attention must be given to checking the electrical and mechanical integrity of any hired equipment. Earth leakage circuit breakers should be fitted on all 220-volt cables. Equipment operating at 110 volts is preferable.

B12. SAFEGUARDING OF MACHINERY:

All machines such as circular saw tables and pipe threaders must be guarded in accordance with statutory requirements.

B13. SAFETY STATEMENT:

Contractors are required to have safety statements available for inspection by the Clients H.S. and W. offices. They are also required to prepare method statements when undertaking tasks requiring special skills or technology.

B14. PORTABLE ACCESS EQUIPMENT:

Where ladders, step-ladders and trestles are necessary, they must be used in a safe manner for work to be done. Ladders should be securely tied at the top or held by a person at the bottom unless they incorporate suitable safety devices. The equipment should be of suitable construction and free from defect. Equipment and materials must be carefully moved and not thrown or dropped from a height.

B15. WARNING OF DANGER:

Care must be taken, at all times to protect the Client's employees and members of the public from danger and to protect property and work in progress from damage.

Any circumstances which give rise to such danger or damage must be reported immediately.

B16. PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING:

All Contractors employees must be issued with, and make full use of, all such protective equipment or clothing, as required by statute or any regulations made thereunder. They must also meet any locally agreed requirements for protecting the employee, e.g., for the use of safety helmets and protective footwear.

B17. ACCIDENTS:

In addition to the statutory obligations for Contractors to report dangerous occurrences and accidents to the appropriate authority, all accidents must be reported to the safety co-ordinator of the Clients.

B18. HOT WORK:

In the event of the Contractor carrying out any of the following works he must carry the appropriate insurance and also comply with all the procedures and safety precautions set out in this insurance:

- ☐ All activities involving flame.
- ☐ Hot air or arc welding and cutting equipment.
- ☐ Braising and soldering equipment and blow lamps.
- ☐ Bitumen boilers and other equipment producing heat or having naked flame

B19. SAFETY, HEALTH, WELFARE & ENVIRONMENTAL ISSUES

This Contractor shall comply fully with all statutory safety, health and welfare regulations regarding work people, including those employed by Sub-Contractors employed on the site and particularly the Safety, Health and Welfare at Work (Construction) Regulations 2013 to 2021 and provide all relevant details to the Main Contractor to carry out the function of Safety Planning Supervisor for the construction phase of the works.

This Contractor shall comply in all respects with the Factories and Safety in Industry Acts and any other Acts and with any Statutory Instruments or Regulations issued thereunder.

This Contractor is required to provide a safety method statement clearly indicating the proposed sequence of his works and the precautions he will be taking at each stage in the works to protect his employees, and those of the main contractor, other sub-contractors, visitors and the Employer's personnel and any plant and equipment, etc. Full details of any chemicals or substances proposed to be used in the project construction process should also be detailed fully and the Employer's prior written approval received for its use.

This Contractor shall include for complying with the Safety, Health and Welfare at Work Acts and Regulations current at the date of tender.

The Main Contractor shall be appointed by the Client under a collateral agreement to the main contract as Project Supervisor for the Construction Stage in respect of the project pursuant to the Safety, Health and Welfare at Work (Construction) Regulations 2013 to 2021. This Contractor shall include all costs for the provision of the necessary services and details to the Main Contractor to perform his duties as Project Supervisor for the Construction Stage pursuant to Regulations 6 and 7 of the Regulations.

This Contractor shall include for providing all necessary information as requested by the Project Supervisor for the Construction Stage to enable the preparation and completion of the Safety File including record drawings, specifications, maintenance and operating manuals and commissioning certificates. The record drawings and Maintenance Manuals shall be as required under previous clauses of this document.

COMPLIANCE

We can confirm that our design considers all the requirements as out lined in the current health and safety regulations and we have taken every practical step ensuring that the installations we design can be safely installed, used and maintained

SECTION 2: PARTICULAR SPECIFICATION:

ELEMENT 60 : SITE SERVICES:

60.1 Extent of Work In This Section

This section includes for the building façade lighting as indicated on the drawings and as specified hereafter.

The reconnection of existing lamp standards on the site to the new distribution shall be allowed for – allow for re-lamping existing fittings with LED to match existing.

The works also entail the de-commissioning, disconnection and removal of existing facade lighting system complete.

60.2 System of Wiring

Wiring to the wall mounted external lighting circuits shall be carried out in 3 x 2.5 mm sq., PVC/LSF/cu., insulated cables in galvanised steel trunking and conduits, as shown on the accompanying drawings.

Circuitry shall be as shown on the drawings. The contractor shall include for final connection to all fittings. Switching and control of the circuits shall be as noted and as detailed on the drawings.

60.3 Lighting Fittings

Light fittings shall be supplied and erected in the positions shown on the drawings and shall be in accordance with the materials specifications, the applicable standards and the performance required and as scheduled which is at the back of this specification.

The contractor shall include for taking delivery, handling, storing, erecting and connecting all light fittings and shall also include for profits and overheads.

ELEMENT (61) : ELECTRICITY CENTRE MAIN AND SUB- DISTRIBUTION SYSTEM

61.1 Extent Of Work In This Section

This section covers the new metering and main board to replace the existing switchgear in the Centre, as shown and as detailed on the accompanying drawings.

The existing main and sub distribution switchgear in the Centre is to be decommissioned, disconnected and removed, off site. All existing sub circuits connected to this main switchgear shall be likewise disconnected and removed, as part of the works.

The Contractor shall note that the Creche facility on the site is to be reconnected to the new switchgear complete with check meter. Testing of all submains shall be allowed for.

61.2 Distribution System

Distribution sub-main cables between the new main board and the sub distribution switchboards shall be PVC/SWA/PVC/L.S.F cu., insulated cables on cable tray throughout. The size of distribution cables shall be as indicated on the drawings.

- Boards shall be constructed from heavy gauge sheet steel with a minimum thickness of 1.2mm,
- The board shall be constructed from a bolted steel frame construction with a minimum frame thickness of 2mm,
- Main Distribution Board to conform to Form 4a Type 3 – sub distribution board Form 2a
- Board construction must comply with EN 60439-1 type tested system,
- Each incoming and outgoing circuit shall be enclosed in a separate compartment fitted with a hinged door,
- All doors to have 8mm triangular locks,
- All compartment doors associated with the essential fire services shall be red,
- All busbars and busbar assemblies shall comply with EN 60439 (TTA),
- All busbars shall be constructed from rectangular section, hard drawn copper,
- Busbar supports shall be constructed from suitable shock proof insulating material,
- Busbar peak withstand current shall be a minimum of 105 kA,
- Busbar rated short time withstand current shall be a minimum of 50 kA at 3 seconds with a busbar temperature rise of 30°K,
- All circuit breakers and power feeders shall be of the fault make and fault break pattern,
- Multi-function energy meters shall be supplied as outlined on the drawings. These shall be complete with metering module giving 2 programmable pulses per meter (kWhr and kVARhr) with a pulse of 100 milliseconds,
- All multi-functional meters to be connected to the BMS outstation,
- The main board and sub-boards are to be fitted with surge protection as per the table below,
- external, visible, permanent nameplates shall be provided on all switchgear identifying all instruments, switches, meters, circuit breakers, switch fuses, indicator lights etc. Labels shall be engraved metal or trafolite,
- Distribution Board labels to be mechanically fixed,

- The contractor shall also allow for all co-ordination and attendances in connection of the ESB mains and metering cable – capital charges, levies, to be allowed for by this contractor,

	Switchgear
Format	Wall mounted
Form	Form 2b Type 2
Fault Level	20kA
Spare capacity	25%
Surge Protection	Type 1 on main switchgear/Type 2 on sub distribution boards

Table 1: Distribution Board Details

61.3 New Sub-Distribution Boards

The panels shall be manufactured in strict compliance with the Code of Practice For the Design, Selection and Erection of Low Voltage Switchgear Assembly, as published by the ETCI and the attached general specification for low voltage switchgear.

In addition, the requirement of the IEC document, IEC 439, the main board shall be Form 4 Construction, assembled with production rating of IP 54, externally and IP20, internally. MCB's shall be to BS 3871, DE 0641, Class K for motive power, Class L for lighting services. ELCB's shall be to B.S. 4293 , 30 MA. Fuses shall be to B.S. 88.

The Sub-distribution boards at the location indicated on the drawings shall consist of surface mounted miniature circuit boards of approved manufacture. It shall be fitted with an isolating switch on the incoming supply and outgoing ways shall be protected by miniature circuit breakers, as indicated in the Schematic Drawings of Sub-Distribution Board.

61.4 Distribution Trunking

The Contractor shall include the low and extra low voltage trunking for the distribution cables and control cables to sizes and runs as indicated on the drawings. The steel cable trunking shall be fixed to walls, ceiling or structural steelworks as indicated on the drawings.

It shall be provided complete with all bends, tees, crossovers, couplers, offsets and earth links and shall be as manufactured by Uni-Trunk or equal and approved.

Where cable trunking passes through floors and where it enters separate fire compartments it shall be provided with approved fire barriers.

Vertical mounted cable trunking shall be provided with cable pin racks to support cables at 2000 mm centres. All fixing holes and holes for conduit entry shall be drilled prior to commencement of wiring so as to avoid damage to cables.

New main containment system is to be installed within the centre. The system will comprise of metal trays, trunking, supports and fixings. The cable containment will comprise of a fire alarm tray, light and power trunking, LV tray and IT/ELV tray. The location and routes for all cable containment systems as discussed herein shall be confirmed by the Contractor and co-ordinated with all other trades and construction disciplines. All containment is to be installed in the ceiling void along all corridors.

Containment is to be provided as per Table 2 below. Sizing to be in accordance with IS10101 Annex 52J.

Containment to be installed level and in straight lines and is to be supported at regular intervals and at changes in direction and height. There are to be no sharp edges which could damage cables and equipotential bonding is to be provided. The Contractor shall include for all vertical runs as required and for all necessary supports and brackets.

Trays and trunkings shall be fixed to the roof slab or fixed horizontally to the wall using a Unistrut trapeze bracket arrangement. Supports shall be in accordance with manufacturer's recommendations and in any event shall not be greater than 1200mm apart. The Contractor shall provide cable tray flyovers where mains and telecommunications cables cross over.

Cable type	Primary	Typical size	Secondary
Sub-mains cabling	Cable ladder	Refer to drawings	N/A
Final circuits	Steel single compartment trunking	Refer to drawings	Steel conduit Dado trunking
Fire alarm cabling	Cable tray	Refer to drawings	Steel conduit
ELV alarms etc	Cable tray	Can share ICT tray provided it is bundled to one side	Steel conduit

Table 2: Containment Types

61.5 Cable Tray /Cabling

The Contractor shall supply and install cable tray as required and as shown on the drawing for the distribution cables. Cable trays shall be W.I.B.E., or equal and sizes shall be as shown on the drawings.

Sub-mains cabling is to be SWA thermosetting cable, to Euroclass Class CCA – s1b, d1, a1. Separate CPCs are to be used. These sub-mains cables will be distributed on galvanised steel cable tray (medium duty to I.S. EN 61537) primarily routed in the corridor ceiling void. Major Cable sizes are provided on the electrical schematic drawing with cable tray sizes provided on layout drawings.

The armour of the cable should be bonded at both ends to the distribution equipment by means of a nut and bolt through a tab linked to the earth bar.

ELEMENT (62) : POWER DISTRIBUTION SERVICES

62.1 Extent Of Works In This Section

This section shall include for the complete sockets, power and general services installation as shown and as detailed on the accompanying drawings.

This element also includes for testing of the small power outlets in the existing new trades workshop building and include for issuing a Periodic Inspection Report.

This Contractor shall also allow for carrying out a Periodic Inspection Report on the Creche facility.

62.2 System Of Wiring

Sockets shall be wired on the ring main system using 4 mm² PVC/l.s.f/cu cable, protected by 20A RCD units, with a maximum of 6 outlets per circuit. The wiring shall be carried out in PVC/LSF/Cu singles cables in concealed galvanised steel trunking and recessed conduits.

62.3 Socket Outlets And Plugs

Socket outlets shall be the flush type (Part M Compliant) in metal boxes, with surface type being used. They shall be 13 Amp flat pin type and shall comply with BS 3676.1989 and BS EN 60669-1.2000 or BS 3676. Part 1 of 1989, and amendments up to May 1978, shall be the switched type, single or twin, as shown on the drawings, and shall have a matt chrome finish. The contractor shall note the requirement for unswitched socket outlets to the computer stations. The Contractor is to ensure that Socket/Switches are Part M Compliant, and ensure the following;

- The switch / socket cover itself needs to contrast visually with the wall background and switches.
- There is a colour contrast to be implemented for the on circuit switch to the wall socket and light switches.
- On a double socket the circuit switches cannot be adjacent.

Sockets generally shall be mounted about 0.3 metres above floor and in the case of worktops placed against walls, the sockets shall be located about 200 mm above the worktop. A small number of outlets shall be at 1.5 metres above floor in the locations as indicated on the drawings.

All socket outlets/face plates both on dado trunking and stand-alone sockets to be Part M compliant socket outlets/face plates.

Dado trunking installation:

This Contractor shall include for the supply and installation of the 3-compartment dado trunking as indicated on the drawings. Dado trunking shall in all locations be extended vertically, wall mounted to ceiling level.

Dado trunking shall be mounted approximately 150mm above bench level. The final mounting heights and locations must be approved with the Engineers on site prior to installation.

Local Isolator installation:

The Contractor shall include for the supply and installation of the local single and three phase isolators as shown on the drawings. Isolator sizes shall be as shown on the drawings. This Contractor shall include for final connection.

62.4 Connection Units

The Contractor shall include for the supply and installation of fused connection units for the following equipment located as indicated on the drawing.

- (a) Intruder Alarm Panel
- (b) Data equipment.
- (c) Fire Alarm panel

62.5 Mechanical Plant / Controls Wiring

The contractor shall include for all the electrical work associated with the wiring of the mechanical services installation. Location of plant and equipment requiring electrical supplies are as shown on the drawings.

Equipment to be wired by the electrical contractor to include burners, pumps, fans, speed controllers, and other equipment shown on the drawings. The contractor shall wire all the above equipment to diagrams provided by the mechanical contractor.

These connections include but are not limited to:

- Motor Control Centre (MCC); Door interlocked mains isolator and fuses,
- Fuses, overloads, contactors and separate isolation switches. Shunt pumps are to be wired to run with burners,
- Circulation Pumps; Fuses, contactor, overloads, time setting from hand/off/auto switch, remote outside frost detector (common to all pumps) overriding time setting and heat dissipation thermostat and remote room stat,
- Pressurisation Unit; Fuses and isolation switches (packaged unit),
- Auto Fill unit,
- Weather Compensation,
- BMS Controller Unit,
- Remote Heating Panel in Manager's Office,
- Extract Fans: each fan has a link to the BMS for fault monitoring and indication,
- Boiler System

62.6 Power Wiring - Miscellaneous

The contractor shall provide and install a new power supply to the fire alarm panels and P.A. system, security system panel, access-controlled doors, as indicated on the accompanying drawings.

62.7 Whiteboard Provisions

The provision of whiteboard and projectors and the associated specialist audio visual wiring does not form part of this contract. Dado trunking is provided both above and below whiteboard height, linked with a vertical run of dado. The AV equipment provider will be expected to make use of this dado to install the specific type of wiring required for the whiteboard/projector system he is installing. Sockets will be provided at low and high level in the dado for powering AV equipment.

The location shall be as per the drawings and by reference to the standard Department room layouts. As the actual data projector is not part of the contract the contractor shall provide the following services and terminations to facilitate the provision of data projectors.

- A network point.
- Additional socket outlets.
- All the wiring associated with these shall be accommodated in wall mounted three compartment dado rail trunking.

Refer to the drawings for typical layouts for the network points, associated socket outlets etc are outlined in Dado trunking should be located nearer the window side of centre rather than the door side to facilitate easy student access. The horizontal section at the lower end of the wall mounted vertical dado rail trunking shall be a minimum of 500mm above finished floor level as detailed.

62.8 Vampire load design strategy

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. The BMS will allow for a 15-minute delay after the intruder alarm is set before the vampire load strategy is activated.

The shutdown relays shall be linked to the BMS to retain close control. 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.

The main board 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 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) so as to eliminate any ambiguity. Essential services shall be indicated on the power layouts, elevations and teaching wall detailed drawings.

All essential services shall be demonstrated to both the design team and 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 s (for example a relay sticking) then the centre can manually bypass the relay. This is a vital feature to ensure the centre has the confidence to know that they can easily bypass the system if it does cause a fault.

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

The contractor shall provide an alarm link to the BMS by including some passive vampire strategies such as:

- Heating is forced off (but still allowed on early the next morning) this is done by ending the current time schedule
- Hot water heating and all pumps forced off (except if under frost control)
- Motorised valve power cut
- Circulation lighting power cut

Note that a BMS alarm (and traffic light red) is triggered if water, heat or power use is larger than pre-sets when the alarm is set, and the BMS should be programmed to commence "outof- hours" monitoring upon receipt of an arming signal from the Intruder Alarm System.

62.9 Disconnecting and removal of existing obsolete services

The contractor shall allow for the disconnection and removal of all exiting general services outlets including cabling systems within the existing centre as shown and as

detailed on the accompanying drawings.

This contractor must visit the centre to familiarise himself with the full extent of these works.

62.10 Co2 Monitoring

All teaching spaces shall be fitted with a CO₂ monitoring system in each teaching space that shall include a LED display. Each classroom shall be fitted with its own standalone wall mounted Carbon Dioxide sensor / alarm. The single wall mounted self-contained unit shall consist of a CO₂ sensor enclosure and a large LED display and all associated electronics. The units shall be maintenance free, have internal automatic self-diagnostics and incorporate a high quality, gold-plated, non-dispersive infrared (NDIR) waveguide sensor for measuring the ambient carbon dioxide concentration. The minimum illuminated area of 8.5cm² is required with the following indicator ranges.

The parameters and sensor settings should be as follows:



As the CO₂ monitor is 230V, a switched fused spur is required to isolate them. I.S. 10101:2020 Installations state that all 230V equipment must have a means of isolation. The unit shall be screwed to the teaching wall facing the body of the classroom. The display colour will be capable of changing from Green to Amber to orange and Red to indicate CO₂ levels, thus providing easy visual indication as well as specific readings. The LED colour indicator should be capable of being easily identifiable from the rear of the classroom. It should be either self-powering from the ambient light in the classroom using an integrated PV panel or be connected to the mains distribution system. It does not need to be connected to the BMS system. The system will enable the teaching space users to be aware when the desired levels are breached so that the necessary intervention via opening windows for ventilation can take place to maintain the comfort levels and air quality.

A laminated A4 size label (screwed at the four corners to the wall) incorporating clear and simple advice and instructions on how the teaching space can be operated efficiently regarding heating, lighting and ventilation during hours shall be located in a suitable location near the door of each teaching space. It is paramount that all staff are provided with full user training and demonstration of these systems as part of the handover requirements.

The audible alarm shall also activate at 1500 ppm with the red traffic light to warn the teacher to open windows. The audio alarm shall automatically turn off when the reading reduces to <1500 ppm and shall also be provided with a mute button which will operate for 30 minutes.

The units shall be 24V AC / DC +/- 20%, 50Hz and be provided with one no. 0-10V DC analogue output. The self-diagnostics shall indicate an error message on the LED screen should any error be present and also activate the yellow LED in flashing mode. The units shall have a measurement accuracy of +/- 2% of the reading, have a response time of less than 10 seconds and a warmup time of less than a minute and be suitable for an operating temperature of 0°C to 50°C. The complete installation shall be in accordance with EMC 2004/108/EC, 92/31/EEG including amendments, EN 61000-4-2 level 2, EN 61000-4-3 level 2, EN 61000-4-4 level 4, EN 61000-4-6, EN 61000-4-8 level 4, EN 55022 class B.

62.11 Earthing and Bonding

Earthing is to be provided to the parameters of the NSAI National Rules for Electrical Installations in order to mitigate the danger caused by:

- All types of electrical faults,
- Atmospheric discharges,
- Accumulation of static charges.

Earthing connections will be provided in a manner that is neat, visible, and aesthetically acceptable. Care should be taken however to ensure that the earthing is not presented as a target to student interference by appropriate locating of such earthing.

All connections shall be labelled as per IS10101 requirements with metallic tags. Where bonding conductors are not visible due to other fixtures e.g., where they are behind IPS panels, they shall be inspected before the panel is closed and an adhesive label confirming that they have been inspected is to be affixed in an unobtrusive location in close proximity e.g., under the sink.

The earthing and bonding installation shall be installed such that there is no probability of galvanic corrosion occurring due to dissimilar metals being in contact. Bonding leads shall be kept as short as possible.

Main bonding conductors shall have an equivalent cross-sectional area of at least half that of the largest protective conductor in the installation but shall not be less than 10mm² copper but need not exceed 70mm²

ELEMENT (63) : LIGHTING SERVICES

63.1 Extent Of Works In This Section

This section shall include for the complete general and emergency lighting, as indicated on the drawings and as specified hereafter within the Centre, as detailed – refer to drawing no 0840-EL105 for defined scope of works – this element.

General Lighting

The lighting installation is to be efficient, provide for a high-quality learning environment, and be easily maintainable and aesthetically pleasing. All lighting shall be surface mounted LED lighting where plasterboard ceilings are provided; the LED lighting may be surface or recessed where suspended grid ceilings are provided.

The LED provision will reduce the primary power requirements and in turn the amount of renewable energy required. The lighting design and controls shall be as per TGD 030 and TGD 031 respectively, and following amendments. The LED lighting shall meet the following performance specification:

Light Source	LED
Colour Rendering Index	>80
Colour Temperature	4000k
Minimum Luminaire Efficacy	125 lm/W
Median Useful Life (IEC 62717) Ta 25°C (50,000 hrs)	L80 B50
Minimum Driver Lifetime (Max ambient temp 35°C)	50,000hrs
MacAdam Step	3
UGR	<19

Lighting must have certified luminous efficacy of 125 luminaire lumens/circuit watt as opposed to lamp lumens/circuit watt. It is a requirement that all light fittings procured on public sector projects are listed on SEAI's Triple E register, or comply with the Triple E criteria. Luminaires that are not listed or do not comply will be rejected. The Contractor shall include for luminaires and switching within the tank room with a neon indicator on the ceiling below to indicate if luminaires are turned on. The Contractor shall coordinate with the Lift Services Specialist with regards to the installation of the luminaires within the lift shaft. Where Lighting Control Modules are used, care will be taken to ensure all cables are neatly organised and secured to the structure within the ceiling void.

An automatic lighting control system shall be provided in all areas. In areas where daylight levels are sufficient, as indicated on the drawings, dimmable electronic control gear shall be provided.

The lighting system shall comprise of:

- Dimmable Control Daylight/absence/movement Sensors
- Auto/Off switches
- Momentary switches

Photoelectric dimming in habitable rooms. Sensors must have a maximum parasitic/standby power of 0.1W/m².

A light level of 300 lux shall be provided in general classrooms at the working plane, 400 lux in the Physical Education Hall (measured 1.0m above the playing court) and 120 lux in toilets, circulation, and entrance areas at 700mm above the finished floor level. The Disabled WCs should have a minimum light level of 200 lux at 700mm above finished floor level. Lighting in specialist rooms shall be 500 lux, 300 lux in computer rooms at the working plane.

Space	Lux Level	UGR	Uniformity	Ra
General Classrooms	300 lux @ work plane	19	0.6	80
PE Hall	400 lux @ 1.0m above the playing court	19	0.6	80
Circulation areas	120 lux @ 700mm AFFL	25	0.4	80
Toilets	120 lux @ 700mm AFFL	25	0.6	80
Disabled toilets	200 lux @ 700mm AFFL	25	0.6	80
Computer room	300 lux @ work plane	19	0.6	80
Specialist rooms	500 lux @ work plane	19	0.6	80

63.2 System Of Wiring

Wiring to the circuits shall be carried out using 2.5 mm²/P.V.C/L.S.F/Cu singles P.V.C./l.s.f/cu insulated cables in galvanised steel conduit and or trunking. Circuitry shall be as shown on the accompanying drawings.

Generally, the conduit/wiring shall be run on the surface at high level and shall terminate at each lighting point in a C.I. multiple loop-in box. All bushes connecting conduit to trunking shall be securely tightened prior to the commencement of wiring.

Flanged couplings shall be used for connecting conduit to trunking.

The wiring to recessed lighting fittings shall terminate in a local 6 amp outlet, with final connection in heat resistant flexible cable (maximum length 1500 mm). The 6 amp outlet shall be of M.K. manufacture and shall be surface mounted in cast iron Besa boxes.

Wiring to surface mounted fittings shall be directly into the terminal blocks provided in the fittings. Heat resistant glass fibre sleeves shall be fitted to all wiring inside fittings.

Note: PVC/PVC, flexible cable shall not be used for final connections to recessed fittings. The contractor shall note that the lighting control strategy within classrooms / teaching areas as shown and as detailed on the accompanying drawings.

63.3 Lighting Switching

Lighting switches shall be provided and ganged as indicated on the drawings. They shall be 20 amp inductive rating grid switch type, either 1 way, 2 way, key operated, intermediate for internal use, on push type with auto-time release and shall be mounted on surface conduit boxes. They shall have porcelain bases with plastic rockers and flush mounted matt chrome cover plates.

Where wiring of more than one phase enters a switch box, vertical barriers shall be provided between phases and 'red' warning plates engraved "Danger 380 Volts" shall be provided below the cover plate and fixed to the switch.

The Engineers approval shall be obtained to all ganging arrangements before ordering and fixing to ensure that these are in accordance with the Clients and Architects requirements. Switchgrids shall be fitted with earth terminals and bonded to the switch boxes by suitable earth conductors. Switches shall be recessed mounted at 1100 mm above finished floor level unless otherwise indicated.

Lighting switches for toilets used for the control of extract fans shall be the double pole type as detailed. Switches in small window less stores which are located outside the door shall have an 'on' indicator light.

All lighting installations operating in conjunction with automatic dimming to "Off" lighting controls and absence detection must have manual "On/Off/ dimming" switching arrangements via push type retractable light switches.

63.4 Lighting Fittings

Lighting fittings shall be supplied and erected in the positions shown on the drawing and shall be in accordance with the materials specification, the applicable standards and the performance required as scheduled which is bound-in at the end of this specification.

The Contractor shall include for taking delivery, handling, storing, erecting and connecting all lighting fittings, and shall also include for profit and overheads.

The Contractor shall provide in his tender for the erection and trial of a reaable number of fittings specified, not exceeding 5% of the total, for inspection by the Employer and the Architect, and no claim shall afterwards be entertained for the labour involved in the erection of such fittings for trial before selections have been made.

63.5 Lamps

The contractor shall include for the installation of all filaments and fluorescent tubes, the cost of supply and delivery being included in the sum for the fittings.

Client Handover and demonstration:

After the final commissioning the system shall be demonstrated to the centre. This demonstration shall take place on a separate day from any other Lighting commissioning.

After demonstration a certificate of demonstration shall be signed by the Centre Manager and this document will form part of the hand over documents. The contractor is responsible for providing the building user / owner with all handover documentation.

The contractor shall include in his Tender for the initial 12 months service contract to commence from the date of practical completion.

The service contract shall be fully comprehensive and to include a minimum of 4 (No.) service visits at 3 monthly intervals.

The hand over documents must include the following:

- Certificate of demonstration to Contractor,
- Certificate of demonstration to Employer's Representative,
- Certificate of demonstration to Client,
- Operation manuals,
- Commission Confirmations.

63.6 Disconnection and removal of existing obsolete services

The contractor shall allow for decommissioning, disconnection and removal of existing general and emergency lighting systems within the entire centre, completed.

This contractor must visit the Centre to familiarise himself with the full extent of these works.

This contractor shall note the works in the recently constructed wet trades workshop on site to be retained.

63.7 External Lighting

External Lighting

Existing site lighting lamp standards are to be retained and connected to the new distribution system, as shown and as detailed on the accompanying drawings. Re-lamping of fittings shall be allowed for. Contractor to survey the site to identify the number of fittings.

63.8 Lighting Controls

All lighting circuits to be wired in 2,5mm² LSHF singles unless otherwise stated and protected by 10A MCBs. The operation of lighting in each space shall be contained within the space.

All lighting installations operating in conjunction with automatic dimming to OFF lighting controls and absence detection must have manual ON/OFF switching arrangements via push type light switches.

All switching of lights in classrooms shall be so arranged that natural daylight may be maximised and individual rows serving areas benefiting from daylight can be separately controlled.

Lighting controls in classrooms shall be based on manual ON /OFF switching, absence detection and daylight sensing, so that lights will then dim/ turn off by switch depending on the signals from the automatic controls.

In corridors where some areas may benefit from rooflights/ external glazing and others not, the lighting shall be zoned to take account of the various daylight influences.

All corridor lights are to be linked to a key switch located in the main entry lobby, Contractor to allow for all associated contactors in distribution boards.

Light switches shall be of metalclad finish and lighting circuits shall generally be run in galvanised steel conduit, surface or concealed, depending upon building construction. Light switches to stores etc. shall be push type with auto time delayed release.

Lighting in student toilet areas shall be controlled via presence detection in conjunction with ventilation as necessary.

All facades of the building where access is possible shall be lit and shall be controlled by separate timeclocks and hand-off-auto switches in the distribution boards.

Manual and automatic lighting control shall be DALI. Dimming shall be DALI dimming control providing an automated “maintained illuminance” level when used in conjunction with a dimming sensor or photocell. A minimum of 1mm² 2-core cable is to be used for the interlinking cabling.

- Daylight levels of sensors are to be set by means of a calibrated rotary control. Sensors which require switching levels to be set according to actual daylight levels are not acceptable. If sensors can be remotely set they should also have the facility to be set at the device.

63.9 Emergency Lighting

Wiring shall be carried out using 2.5 mm² singles P.V.C./l.s.f/cu insulated cables in galvanised steel conduit or trunking to each self contained emergency light or exit sign.

Exit lights of the self contained sustained type shall be complete with 3 watt LED filaments and a capacity of 3 hours duration and shall have a mains monitoring light.

Existing emergency lighting circuit can be used / extended to additional devices as shown.

Final connection to the fittings shall be as described for the general lighting installation. Where exit signs are suspended, the Contractor shall allow for providing the necessary conduit suspensions. The Contractor shall include for supply and delivery of the emergency light fittings including any profit and for handling, storage, erecting and connecting.

63.10 Testing and Commissioning of Emergency Lighting

Wiring to emergency lighting units, shall be taken separately from the respective sub-distribution boards (new circuits). At each board, as required, an interface unit shall be inserted

into the wiring to the emergency lights. The contractor shall include for the testing and commissioning of the entire system by the system suppliers and for attendance on the suppliers during commissioning.

On the satisfactory completion of the testing and commissioning the contractor shall submit the inspection and test certificate in accordance with I.S. 3217: 2023).

A completed 4-Part Commissioning Certificate of the Emergency Lighting Installation as required under I.S. 3217: 2023 for Emergency Lighting Installations shall be provided by the Contractor and handed over to the Employers Representative on substantial completion of the project as follows:

Part 1 (Design)

Geaney Engineering Consultants will prepare, complete and sign Part 1 of the Commissioning Certificate (on the company's headed paper) as the Designers on the project, and will issue the certificate for inclusion in the Safety File.

Part 2 (Installation).

The Contractor is required to prepare, complete and sign Part 2 of the Commissioning Certificate (on the company's headed paper) as the Installers on the project, and issue the certificate for inclusion in the Safety File.

Part 3 (Commissioning)

The Contractor shall arrange to have the Emergency Lighting Installation commissioned by a suitable qualified person in accordance with the ETCI Building Emergency Safety System (BESS) requirements, or approved alternative scheme, who is required to prepare, complete and sign Part 3 of the Commissioning Certificate (on the company's headed paper) as the Commissioning Engineers on the project, and issue the certificate for inclusion in the Safety File.

Part 4 (Handover).

The Contractor are also required to prepare, complete and arrange for the Clients Signature of Part 4 of the Handover Certificate (on the company's headed paper) as the Contractor on the project confirming that the Client has been fully instructed on their responsibility regarding the ongoing maintenance of the system, and have issued a service contract agreement to the Client.

63.11 Servicing Of Emergency Lighting

The contractor **must** allow for the **first year** of servicing of the Emergency Lighting System, the following must be included for;

- Quarterly tests in accordance with a systematic schedule.
- All Lamps checked and verified to ascertain any blown lamps.

- All LEDs in charging circuit will be checked and verified for illumination.
- During the tests, each emergency light is illuminated from it's battery source for 30 minutes for the quarterly test
- Each emergency light is illuminated from it's battery source for 3 hours on the annual test to be carried out at prior to the yearly service agreement ending.
- Check that all defects recorded in the log book have been rectified.
- The log book is checked and filled out as appropriate and a certificate of testing is issued on completion

LIGHTING CONTROLS			
Lighting Mode	Turning On	Turning Off	Dimming
TEACHING SPACES			
Off	By switch only	Lights Off	Lights Off
Auto	By Switch	Lights turn off after minimum of 10 minutes with no movement detection from sensor or when adequate daylight is available. Lights can also be turned off using switches.	Combined lighting levels (Daylight and Artificial) to constantly maintain minimum lux level outlined in specification. Each parallel row from the window will dim at a different rate to maintain a constant lux level across the room work-plane. Lighting will not dim below 10%.
CORRIDORS			
Off	By HOA key switch only	Lights Off	Lights Off
Auto	Presence Detection	Lights switch off after minimum of 5 minutes with no movement detection or by HOA key switch	Some areas may benefit from rooflights/ external glazing and others not, the lighting shall be zoned to take account of the various daylight influences. Combined lighting levels (Daylight and Artificial) to constantly maintain minimum lux level outlined in specification
On	Constantly On	Light on	None

ELEMENT (64) : COMMUNICATIONS SERVICES

64.1 Extent Of Works In This Section

This element includes for the re-cabelling of the ITC systems as shown and as detailed on the accompanying drawings.

The existing system is to be decommissioned, disconnected and removed.

The Contractor shall note the requirement for additional ITC points in the Centre, as detailed on the accompanying drawings.

64.2 Systems Of Cabling

All elements of the structured cabling system shall be compliant to the relevant component specification of ISO 11801-1/ISEN 50173-1 for Cat6a U/UTP. All testing shall be carried with a Level III tester to EN 50173 PL2 (for a 2 connector Permanent Link) or PL 3 (for a 3 connector Permanent Link). Testing for POE should also be provided as part of the standards.

All telecommunications cables, copper & fibre shall be compliant to the EU Construction Product Regulation (CPR) supported by a current Declaration of Performance. The cables shall meet, as a minimum, Cca s1a d1 a1 when tested to EN 13501-6. The Cat6a U/UTP Cca copper cable shall have a maximum Outside Diameter of 8.0mm so as to maximise space within the containment system.

Offered solution should be sourced from a single manufacturer, with a complete Design and Manufactured System covered by a single 25 year Warranty Scheme encapsulating both Copper and Fibre. Distributor Brands will not be considered.

Copper Connectivity must be third party tested to be compliant with all ISO/EN/TIA Component standards as well IEC 60512-99-002, test un mating under load.

- o IEEE 802.3at (Type 1) PoE up to 15.4 watts
- o IEEE 802.3at (Type 2) PoE+ up to 30 watts
- o IEEE Draft 802.3bt (Type 3) PoE+ up to 60 watts
- o IEEE Draft 802.3bt (Type 4) PoE+ up to 100 watts
- o Cisco Universal Power Over Ethernet (UPOE) up to 60 watts
- o Power over HDBaseTTM (POH) up to 100 watts

Accredited to a recognised Environmental Improvement Scheme (Carbon Neutral) and ISO 14001 – Certificate. Test results will only be accepted with a manufacturer 25-year warranty for all Copper and Fibre optic products and labour for Cat6a U/UTP. The project engineer will only accept handover of a project based on the manufacturer's warranty and certification otherwise the project will be deemed to be incomplete.

64.3 Systems Of Wiring

Wiring generally shall be carried out in Cat 6a cable *OM4 (50/125) Laser Optimised* on cable tray and the cable shall terminate in standard R.J 45 outlet sockets, mounted 450 mm

above floor for a desk mounted instrument and 1200 mm above floor for a wall mounted instrument.

Caballing to outlets off the cable tray containment shall be in galvanised steel conduit and metal outlet boxes throughout.

64.4 Public Address/Class Call System

A new PA system will be provided as part of the contract by a contractor-employed specialist who will carry out final connections and commissioning with wall-mounted one-way speakers in all teaching spaces, one-way speakers in all circulation areas and external speakers as indicated on the drawings. All wiring will originate from the central console to be located in the manager's office.

This includes the supply, installation, testing and commissioning of the public address / class call change system within the Centre.

- (a) New output Switch Panel fitted with 50 No., switches plus automatic master switch c/w Tone Generator for class call system.
- (b) Randal 841 Class Change Timer.
- (c) Amplifier with two microphone inputs and provision for auxiliary input from external source. Provide for rack to house amplifier, etc.
- (d) Desktop Paging Microphone.
- (e) outdoor horn speakers c/w separate volume control at console
- (f) loudspeakers – refer to drawings for numbers,
- (g) Reproduction facility for recording and broadcasting.

The console shall be located in the Manager's Office and all the wiring shall radiate outwards from that point. Speaker points in classrooms shall generally be located over the door. This contractor shall invite submissions from specialist installers for the supply, installation, testing and commissioning of the public address/class call system equipment and associated wiring.

PA System Requirements	
Cabling	
Classrooms	4 Core Cat V Screened Cable CCA – s1b, d1, a1 class.
Corridors	2 x 1.5mm Core Cat V Screened Cable CCA – s1b, d1, a1 class.
Termination Box	KRONE termination box within 2 metres of console in accessible location for maintenance and commissioning
Speakers	
Classroom /Corridor Mounting Heights	1600mm AFL
External Speakers Mounting Height	2500mm – 3600mm AGL
Control Console	
Amplifier Inputs	▪ Talk Out ▪ Talk Back ▪ GP Microphone ▪ External Chime Board ▪ Program Inputs/Remote Mics ▪ Program Inputs/Remote Mics
Microphone	The microphone shall be a dynamic type 12” gooseneck microphone and shall be integrated on the top of the main console. This microphone shall be operated by a push to talk switch located on the main switch panel. This microphone shall be mounted via an XLR type socket for ease of maintenance.
Switch Panel with following zones	▪ Each teaching space as a separate zone ▪ All Corridors as one zone ▪ All external speakers as one zone To incc “Push to Talk” and “All Call” switches

24 Hour Master Clock	To provide control for class change, start of day and end of day chimes. Dual Channel with each channel providing: ▪ 56 Program times ▪ 1sec to 30min pulse ▪ Classroom speakers 3 Watts each ▪ Corridor Speakers 3 Watts each ▪ External speakers 15 Watts each ▪ Auto daylight saving ▪ Permanent On /Off override switch ▪ USB Program key ▪ Permanent current time and date display ▪ Program for day or group of days ▪ Holiday mode ▪ Backlit display ▪ Keypad lock facility
Chime Board	Minimum of 3No. chimes. One for announcement, one for class change and one for end of day. Exact sounds to be agreed with client representative.
Reproductions facility	Facility to provide 0dB output for recording facilities Facility for a universal input for reproduction of material

Client Handover and demonstration

After the final commissioning by the specialist supplier the system shall be demonstrated to the Centre. This demonstration shall take place on a separate day from any other PA commissioning. After demonstration a certificate of demonstration shall be signed by the Centre Manager and this document will form part of the hand over documents.

The hand over documents must include the following:

- Certificate of demonstration to Contractor,
- Certificate of demonstration to Employer's Representative,
- Certificate of demonstration to Client,
- Instruction sheet with pictures,
- Switch allocation drawing sheet with a column left for the Centre to label the room numbers with names,
- Operation manuals,
- Commission Certificate.

64.5 Door Access Control System

The electrical contractor shall allow for works to the existing door access control systems as per the accompanying drawings. Each unit to be fully networked system controlled via PC located in the administration office.

Testing, Commissioning & Record Drawings – additional outlet installation

Test set up and test equipment specification as per TSB 67 October 1995 or most recent standards, where applicable. Test results shall be supplied to the consultant and client prior to acceptance of the installation. Results shall be supplied as a word file, in printed and electronic format.

Optical attenuation on all fibre optic links shall comply with current edition or most recent standards, where applicable of ISO 11801.

As a minimum, the following results shall be provided per fibre optic cabling link, Connection Map, Length, Attenuation.

Horizontal cabling links shall be tested to TIA/EIA 568A Basic Link.

As a minimum, the following results shall be provided in a link performance certificate per horizontal cabling link:

- Connection Map, Length (or propagation delay),
- DC loop resistance/Pair; Capacitance per pair,
- Attenuation per pair (0-100MHZ); ACR per pair,
- Near End Cross Talk (NEXT) per each pair combination (0-100MHZ).

On completion, the supplier shall provide full test results in a bound paper form and on a CD. On completion, the supplier shall provide as constructed drawings in AutoCAD format as detailed above.

Distribution Facility

Power supply to each cabinet shall be via a separate industrial type plug and socket outlet to IS/EN 60309 from a dedicated MCB so as to eliminate the risk of nuisance tripping. This shall be terminated in a switched spur, with a trailer lead directly connected and mounted in the cabinet.

Electrical power socket outlets shall be provided. The number of power socket outlets can be calculated by dividing the number of network points by twenty four. At least two additional power socket outlets shall be provided for expansion.

Surge protection shall be provided at the input to the LV board.

General Requirements

All cableways (cable trays, trunking, conduit, wall boxes and dado trunking, where appropriate), shall be completely installed by the Electrical Contractor prior to the beginning of the structures cabling installation.

In general, cable trays shall be specified as wide and flat, rather than deep. In no case shall cables be laid more than six deep into a cableway.

No cableway shall be filled more than 60% after the initial installation. Maximum loading for a cableway after upgrades and additions is 75%. Gutter bolts shall be secured with the head inside and the nut outside.

For fibre optic cable, basket and tray are acceptable: it is not normally possible to guarantee the bend radius required for fibre in trunking. Conduit shall not be used for fibre optic cable, except for completely straight runs.

Carrier systems shall be bonded using flat-earth straps in accordance with current standards.

Where cable trays are used or vertical runs are required, cables shall be clipped to trays using loosely attached cable ties. Where cable ties are used to secure the structure cables, they shall be tied in bundles. Bundles shall be no greater than ten cables per bundle. Under no circumstances shall cables be tied tightly.

The shortest possible routes shall be used; drops and rises shall be minimised. Power may not be run in the same compartment as structured cabling, under any circumstances. Lift or elevator shafts may not be used as routes for wiring.

Where crossovers exist, some cross-sectional area of cableways may be lost. All calculations of required cable tray dimension refer to the minimum dimension of the tray, including crossovers.

Where trunking or conduit passes through fire compartment walls, floors or ceilings, holes must be sealed with sealing compound giving appropriate rating of fire stability, to BS476 Part F.

Steel Trunking

Steel trunking may be used for structured cabling in floor and ceiling voids and in ducts, or for direct mounting of outlets, in areas where additional durability is required (e.g. plant spaces and service areas).

Cable Tray

Galvanised cable tray is the most commonly used cableway for main runs. Ensure tray is well supported. As cables shall be run no more than six deep, cable trays shall be specified as wide and flat no more than 50 mm deep.

Baskets

Baskets may be used for fibre optic cables, RF and audio-visual cables, but are not recommended for structured cabling (the mesh only makes contact with the cabling at points, potentially causing a pressure point on the cable).

Compartment Trunking

In all cases where dado trunking is being provided, care shall be taken to ensure that adequate clearance exists around the trunking for safe and easy insertion of power socket outlets and data sockets. Co-ordination between furniture and electrical installer may be required.

To allow for flexibility three-compartment trunking shall be used in all areas.

The bottom of the trunking shall be 150mm above desk height. Both, power socket outlets and data sockets and fixing used on this trunking shall be of the range recommended for the trunking. For under-bench area, or areas where aesthetic qualities are not critical, box trunking may be used.

Where power and up to fifteen data cables are to be run, 100x50mm trunking may be used (assumes no socket box deeper 35mm).

Where power and up to thirty data cables are to be run 100x100mm trunking with a cable divider may be used (assumes no socket box deeper than 35mm), power and data cables must be kept separate by the divider; alternatively three compartment trunking may be used with two of the compartments used for data.

Where greater than thirty cables will run, separate trunking must be provided for power and data.

The Electrical Contractor as part of the infrastructure contract will provide RJ45 data sockets and patch panels for connection at local switches.

Steel Conduit

Steel conduit shall be used to drop to individual points and for AV usage. The exact depth of wall boxes must be agreed with the structured cabling installer prior to installation. This may be critical for the mechanical properties of some modular outlet systems.

With UTP cable on straight runs, it is possible to pass four UTP cables through 20 mm conduit and up to six UTP cables through 25mm conduit. Cables shall be pulled in one operation; if cables are not pulled together, new cables being pulled through a conduit may damage existing cables. Care shall be taken to remove all burrs and sharp edges; glands, grommets, etc., shall be used at ends of conduit to ensure no damage to cables.

Any conduit run shall have no more than two bends between inspection boxes and the bends shall not exceed the bend radius of the cable.

Conduit drops and runs shall be co-ordinated with locations of chalkboards, whiteboards, pin boards, etc.

ELEMENT (65) : PROTECTIVE SERVICES

65.1 Extent Of Works In This Section

This section includes for the complete strip out of the existing Fire Detection and Alarm System installations except the recently constructed Wet Trades Workshop which shall be modified to accept a dedicated loop zone from the new system to be installed in the Centre.

The new system shall be open protocol.

The contractor is to make due allowances for maintaining the existing system of Fire Detection and Alarm within the centre until the new system is commissioned.

The contractor **must** allow for the first year maintenance / service contract, as this is to be priced separately in the tender summary.

All redundant equipment and detectors and wiring shall be stripped out and disposed of to a licenced WEEE recycling facility. Contractor shall note that there may be existing Ionisation smoke detectors with radio-active cells which must be segregated for WEEE disposal and shall not be disposed of in general refuse or mixed waste streams.

Existing Access Control to be interfaced with the new system as detailed on the accompanying drawings.

65.2 Fire Alarm Installation:

The fire alarm system (L2/L3 coverage) shall be carried out as indicated on the drawings and as specified hereafter. The new fire alarm system shall be carried out in full accordance with I.S. 3218:2024. All equipment central to the operation of the analogue addressable Fire Alarm system shall be designed and manufactured by the company installing and commissioning the system. A dedicated fused spur outlet shall be provided from the main distribution panel to connect to the fire alarm panel supply unit, in 2.5mm² L.S.F. PVC singles in galvanised steel trunking and conduit.

The Fire Alarm Panel shall have a dedicated power supply taken directly from the main switchgear panel and shall be controlled by an isolating protecting device which shall be reserved solely for the fire alarm system, coloured red and labelled "FIRE ALARM: DO NOT SWITCH OFF" and which shall be secure from unauthorised operation.

The power supply shall be wired in 4mm² LSF cable run in metal conduit, to a fused spur outlets (unswitched) with neon indicator light. The power to corridor hold open electro magnets, access control maglocks and the gas slam shut valve shall be taken from local General Services Distribution Boards which shall be fitted with additional RCBOs and wired to spur outlets serving the Power Supply Units.

These units shall be hardwired through Fire Alarm interface relays so that in the case of a fire alarm condition all corridor compartment doors will close automatically, escape doors will open and the slam shut valve will close. The interface relays shall be located in the electrical closets for ease of access.

The complete Fire Alarm system, including interfaces shall be wired in 2x1.5mm² Prysmian FP Plus enhanced fire resisting cable of PH 120 classification tested in accordance with I.S. EN 50200 and BS 8434-2 or equal and pre-approved.

Cables shall be generally run in segregated surface mounted suitably sized containment throughout in full compliance with requirements of the current IS3218 standard (I.S. 3218:2024) and the cable manufacturer's instructions.

Fire alarm system containment shall be dedicated for Fire Alarm System cabling and shall not be shared with any other service. Fire alarm cable shall in all cases be glanded into back boxes /conduit end boxes in accordance with I.S. 3218:2024. All cables shall be installed in such a manner that they are physically continuous throughout the length of each circuit other than where connection is made at the terminations of a system component or at a designated riser junction box. No other cable connections are to be used.

All cable installation shall be carried out in strict accordance with the manufacturer's recommendations and the requirements of I.S. 3218:2024 section 6.14.

Fire alarm system cabling final drops to devices shall be contained within surface run galvanised steel conduit in all areas. Manual call points shall be re-settable key operated surface mounted type, with cable drops enclosed within galvanised steel conduit. Manual

The Contractor shall provide galvanised steel trunking headers as required for cable entry to control panels.

SINGLE KNOCK OPERATION

The System shall be programmed with 'single knock' operation whereby actuation of an automatic/manual point within the building shall automatic activate the Fire Alarm panel. The controls panels shall incorporate a facility for separate (Phased) alarms, whereby the sounders shall operate an evacuation signal in the actuated zone and warning signal only in other zones.

The system shall continuously scan all loops and report a fault or fire condition in two seconds maximum. The system shall be cabled, connected and commissioned with interconnections to the following, as required:

Door hold Open Installation:

New Door Hold Open devices shall be fitted to cross corridor fire doors, for future, as indicated on the drawings. The door hold open electromagnets shall be interfaced to the Fire Alarm System to automatically release on fire alarm.

Activation of the fire alarm system shall cause:

- Fire Alarm Sounders to operate in the building with fire alarm
- Activation of digi-dialler.
- Fire Alarm to be raised in remote monitoring centre.
- Release of all access controlled doors
- Release of all fire door hold open devices
- Shut down of boiler control panel
- Shut down of air extract system

The Fire Alarm shall be inter-linked to the Door Hold-Open Installation. Upon receipt of an alarm signal Door Hold-Open Systems shall fail safe into fire positions.

The electrical specialist shall include for the Fire Alarm manufacturer's representative to make all necessary site inspections during installation and testing of the system and for the manufacturer to make full inspection and test and issue a commissioning certificate prior to final acceptance by the engineer.

Before commencing wiring, the contractor shall obtain from the supplier, a diagram relating to this particular installation and shall submit this to the consulting engineer for approval. The contractor shall include for the supply and fixing of screw-fixed ivory labels with black 6mm. lettering engraved 'Fire Alarm System' on adaptable boxes used for this installation.

The systems shall be commissioned by the suppliers and the specialist shall include for this in his tender as well as for attendance on the supplier during commissioning. When the systems have been commissioned separate certificates shall be issued. The systems shall not be deemed completed until acceptable certificates are handed to the consulting engineer. The commissioning certificates shall be in accordance with I.S. 3218:2024

The contractor shall include for the supply and erecting of heat-sealed plans with wooden picture frame of the building (reduced scale) with all zones clearly marked and coloured. The drawings shall be mounted adjacent to the Fire Alarm panel(s). The contractor shall also supply and hand-over to the client, a log book for use on an on-going basis, in accordance with I.S. 3218:2024.

The new system works shall not be deemed complete until a satisfactory commissioning certificate has been submitted to the engineer. Certificate shall be in exact accordance with I.S. 3218:2024. The fire alarm equipment shall be to the approval of the consulting engineer.

65.3 Control & Indicating Equipment Configuration:

The control and indicating equipment shall conform to the following Requirements:

- Addressable two-state detectors. Analogue addressable detectors.
- Addressable input and output devices shall be connected to addressable loops capable of accepting up to 99 devices.

- Have a minimum capacity for operating 1 fully loaded addressable loop. This shall be extendible up to a maximum capacity of 10 addressable loops.
- Provision shall be made for each addressable loop to be sub-divided into a maximum of 5 geographical zones. The section of wiring corresponding to each zone circuit shall be protected from faults in other sections by line isolator modules.
- It shall be possible to allocate all 99 addressable devices on the loop to a single zone.
- Shall have provision to drive and monitor up to 10 repeater panels providing a repeat of the indications on the Control and Indicating Equipment display and up to a further 3 repeater panels also incorporating the full set of system manual user controls.
- Shall come complete with an 80 character line printer, locally via a parallel port.
- Shall be capable of interfacing directly to an electronic radio paging system.
- It shall be possible to connect a VDU monitor to the Control and Indicating Equipment to display the information that would otherwise appear on the Control Panel Printer.
- Housings shall be capable of being surface or semi-recessed mounted and shall come complete with cable entries, fixings, knock-outs and covers. The housings shall afford a minimum ingress protection to IP43.

65.4 Control & Indicating Equipment Basic System Functions:

The control and indicating equipment shall be capable of the following basic system functions:

- Monitor the status of all devices on the addressable loops for fire, short-circuit fault, open-circuit fault, fault tolerance, incorrect addressing, unauthorised device removal or exchange, pre-alarm condition and contaminated detector condition.
- Monitor the status of all internal connection and interfaces, including charger, battery and remote signalling functions.

Provide the following discrete visual indications: Power on green led indicator.

<i>Fire Alarm</i>	dual red led indicator.
<i>Fault</i>	yellow led indicator.
<i>Disabled/isolated</i>	yellow led indicator.
<i>Fire zones</i>	red led indicator per zone.

Incorporate an integral 80 character LCD alphanumeric display. In order that an easy identification of different information is provided, the LCD display shall typically be arranged as follows:

- Row 1: Event type.
- Row 2: Zone message.
- Row 3: Addressable point message.
- Row 4: Circuit identifier/point number/zone number and number of events in the system.

Provide a set of push button controls to enable an authorised operator to perform the following:

- Evacuate (actuates all alarm sounders in the system). Silence (stops all currently actuated alarm sounders).
- Reset (returns the Control and Indicating Equipment to quiescent condition).
- Contain mandatory individual plugable cassettes for: Loop Control.
- Alarm Output Control. Common Monitoring Control.
- Data Processing Control and Optional Control Cassettes for : Service Control Card.
- Programmable Output Control. Computer Inter-Face Control.
- Meet the requirements of BS3116; Part 4.

65.5 Alarm Monitoring Functions:

The control and indicating equipment shall incorporate the following Alarm Monitoring Functions:

- Interrogate each addressable device at least once every 2 seconds.
- The overall response time, for each type of analogue addressable detector, including that for the sensor, the signal transmission system and the fire decision algorithm, meets the requirement of IS 3218.
- The response time of the Control and Indicating Equipment to two-state addressable detectors and conventional detectors shall not exceed 10 seconds. The ability to annunciate a pre-alarm condition designed to give the earliest possible warning of a potential fire condition without raising the full alarm condition.
- The ability to automatically adjust the alarm and pre-alarm threshold levels to compensate for changes in detector sensitivity due to contamination over a period of time.
- The ability to provide automatic warning that a detector has reached a level of contamination which requires that it be replaced or serviced.

65.6 Alarm output functions:

The control and indicating equipment shall have the following Alarm Output Functions:

- Be capable of providing a two-stage alarm sounder facility that can be programmed, either on a zonal basis or common system basis, to meet the requirements of the fire authority. Three possible sound output signals shall be available as follows:
- Alert pulsed tone (1 second on, 1 second off). Evacuate continuous tone.
- User definable tone for specialised events, for example bomb alert.

65.7 Supervision and Fault Reporting:

The control and indicating equipment shall have the following Supervision and Fault Monitoring Functions:

- Monitor all critical system components and interconnections (internal and external). In the event of a failure occurring which prevents correct operation of the alarm
- alarm functions, a fault indicator will light and a message shall be given on the alphanumeric display within 100 seconds of occurrence.

- Provide text messages to indicate the precise location of where a fault has occurred in the system.
- The extract shall remain operational during a fire event.

65.8 Automatic Fire Detectors – new devices

All detectors shall be approved and listed by the Loss Prevention Council Board (LPCB).

The automatic fire detectors shall be fixed to the installation by mean of plug-in addressable detector bases. The base shall incorporate the optional feature of being able to lock the detectors in place once plugged in.

The addressable base must incorporate all the circuitry required for communicating detector status to the Control and Indicating Equipment, including the address setting switch.

The electrical sub specialist shall produce standard accessories for installing smoke detectors in air ducts. This equipment shall be designed to accommodate the manufacturer's standard smoke detectors and bases, both conventional and addressable.

OPTICAL SMOKE DETECTORS

The Optical Smoke Detectors shall meet the requirements of BS5445: Pt.7: 1984

The optical smoke detectors shall have a sensitivity sufficient to be classified as 'A' in BS5445: Pt.9: 1984 test fires TF2 and TF3.

HEAT DETECTORS

The Heat Detectors shall meet the requirements of either BS5445: Pt.5 (EN54: Pt.5) for detectors suitable for normal environment or BS5445: Pt.8 (EN54: Pt.8) for detectors designed for high ambient temperatures

ADDRESSABLE MANUAL CALL POINTS / BREAK GLASS UNITS

The Addressable Manual Call Points / Break Glass Units shall meet the requirements of BS5839: Pt.2.

The Addressable Manual Call Points / Break Glass Units shall provide an integral red led to indicate activation. Break-glass Call points shall be individually addressed.

FIRE ALARM SOUNDERS/STROBE UNITS

Fire Alarm Sounders shall be of the detector integrated or surface mounting type, with solid state, two-tone 24V DC c/w integral 75cd strobe light unit.

65.9 Fire Alarm Cabling – new devices

Fire alarm cabling shall be carried out in 1.5sq.mm. PH120 *enhanced* Cable with red LSF oversheath. As per Irish Standard – I.S. 3218:2024. Check to ensure that all ancillary warning devices operate as specified. Check interconnection with Fire Alarm Control Panel to ensure correct operation. Where fire alarm cabling is carried externally it shall be external grade enhanced PH120.

The contractor shall note that the new system of fire alarm cabling shall be carried on separate cable tray containment throughout.

65.10 Door Access Control System

Contractor is to allow for interfacing existing system of access control, in accordance with the accompanying drawings. Access Control to be linked to the fire alarm system to release upon activation of the fire alarm system and to the main access control system so all classrooms can be locked down after class change.

65.11 Commissioning & Testing of fire alarm

Introduce Smoke into the Detector Assembly to provide a basic functional test. Introduce smoke to the furthest Sampling Point in each Sampling Pipe. Transport time is not to exceed the local regulations. Activate the appropriate Fire Alarm zones and advise all concerned that the system is fully operational. Fill out the log book and commissioning report accordingly. A completed 6-Part Commissioning Certificate of the Fire Detection and Alarm Installation as required under I.S. 3218:2024 shall be provided by the Contractor and handed over to the Employers Representative on substantial completion of the project as follows:

Part 1 (Design)

Geaney Engineering Consultants will prepare, complete and sign Part 1 of the Commissioning Certificate (on the company's headed paper) as the Designers on the project, and will issue the certificate for inclusion in the Safety File.

Part 2 (Installation).

The Contractor is required to prepare, complete and sign Part 2 of the Commissioning Certificate (on the company's headed paper) as the Installers on the project, and issue the certificate for inclusion in the Safety File.

Part 3 (Commissioning).

The Contractor shall arrange to have the Installation commissioned by a suitable qualified person in accordance with the ETCI Building Emergency Safety System (BESS) requirements, or approved alternative scheme, who is required to prepare, complete and sign Part 3 of the Commissioning Certificate (on headed paper) as the Commissioning Engineers on the project, and issue the certificate for inclusion in the Safety File.

Part 4 (Handover)

The Contractor are also required to prepare, complete and arrange for the Clients Signature of Part 4 of the Handover Certificate (on the company's headed paper) as the Contractor on the project confirming that the Client has been fully instructed on their responsibility regarding the ongoing maintenance of the system, and have issued a service contract agreement to the Client.

Part 5 (Verification)

Geaney Engineering Consultants will prepare, complete and sign Part 5 of the Certificate of Verification (on the company's headed paper) as the Designers on the project, and will issue the certificate for inclusion in the Safety File on receipt of the remaining completed certificates.

Part 6 (Certificate of Servicing /Testing)

The Specialist Fire Alarm Suppliers are required to prepare, complete and sign Part 6 of the Certificate of Servicing /Testing (on the company's headed paper) as the Commissioning Engineers after they carry out their 3 month and 6 month inspection and testing of the fire alarm system, and issue the certificates for inclusion in the Safety File

ELEMENT (69) : EARTHING

69.1 Extent Of Works In This Section

This section shall cover the provision of the earth electrode for the installation, the connection between the electrode and the main earthing terminal in the building and the connection of the following to the main earthing terminal:

- (a) Neutralising conductor from the E.S.B. Neutral.
- (b) Protective earth conductors for the installation.
- (c) Main equipotential bonding conductor.

The earthing system generally shall comply with the following sections of the 'National Rules for Electrical Installations' as issued by ETCI:

(5th Edition National Rules for Electrical Installations, IS 10101:2020)

Section 413: Protection against electrical shock in case of a fault
(Protection against indirect contact)

Chapter 54: Earth arrangements and protection conductors.

The system of lighting protection, as specified hereunder, shall be allowed for.

69.2 Earth Electrode

The earth electrode shall consist of an earth rod of copper clad steel or galvanised iron of minimum dimensions 16 mm dia. by 1.2 m long driven vertically into the ground or of bare copper conductor or galvanised iron rod of minimum 16 mm dia. and 4.5 m long buried 500 mm in the ground, complying with ETCI Regulation 542.2.

The point of connection to the earth electrode shall be marked with a 50 mm thick concrete cover stamped 'Earth Electrode' as detailed in Clause 79 of Document 'BE'.

69.3 Main Earthing Terminal

The main earthing terminal shall consist of a bare copper bar of a minimum cross sections area equal to the largest protective earth conductor. The bar shall be incorporated in the main Distribution Board and shall be fitted with adequate terminals which shall ensure that not more than two conductors shall be under the one terminal.

69.4 Earthing Conductor

The earthing conductor shall connect the earth electrode to the main earthing terminal for the installation. The earthing conductor shall be an insulated copper conductor having a cross sectional area in accordance with the following table:

Cross Section Area of phase conductors	Cross Sectional Area of earthing conductor
Smaller or equal to 16 mm ²	10 mm ²
16 mm ² to 35 mm ²	16 mm ²
Larger than 35 mm ²	25 mm ²

69.5 Neutralising Conductor

The neutralising conductor between the main earthing terminal and the E.S.B. neutral shall be an insulated copper conductor. The conductor shall have the same cross-sectional area as that of the earthing conductor between the main earthing terminal and the earth electrode and may be a conductor of a multicore cable or a separate earth conductor insulated for system voltage.

69.6 Protective Conductors

Protective conductors shall be provided between the main earthing terminal and each sub-distribution board. This shall have a minimum cross sectional area as set out in Table 54F of the ETCI Rules as follows:

Cross Section Area of conductor mm ²	Cross Sectional Area of corresponding protection conductors mm ²
Smaller or equal to 16 mm ²	Same area as conductor
16 mm ² to 35 mm ²	16 mm ²
Larger than 35 mm ²	Half conductor size

Protective conductors shall be insulated in green-yellow coloured PVC as specified.

It may form one core of a multi-core cable or else be a separate cable run alongside the supply cable.

69.7 Equipotential Bonding

Equipotential bonding shall be carried out in accordance with Clause 547 of the ETCI National Rules for Electrical Installations.

Incoming metallic services and the extension of these services in metal pipes within the building shall be connected to the main earthing terminal at the main switchboard by means of an insulated stranded copper conductor of 10 mm² minimum cross sectional area.

Metallic services and equipment in the toilet areas shall all be bonded together by means of insulated standard copper conductor of 2.5 mm² minimum cross sectional area and such local bonding conductor shall be connected to a protective conductor which in turn shall be connected to the main earthing terminal at the main switchboard.

69.8 Testing

The earthing system shall be tested using an appropriate earth testing kit and the results shall be logged and a copy forwarded to the Engineers for their records.

The engineers shall be advised in advance of the test being carried out so as to give them an opportunity to witness the test.

ELEMENT (70): INTRUDER ALARM & CCTV INSTALLATION

70.1 Intruder Alarm

The existing Intruder Alarm system will be retained.

This contractor shall note the works required in tidying up existing cabling systems and installing on new containment as shown and as specified on the accompanying drawings.

70.3 C.C.T.V. Installation

The existing CCTV system will be retained.

This contractor shall note the works required in tidying up existing cabling systems and installing on new containment as shown and as specified on the accompanying drawings.

ELEMENT (6-) : BUILDERS WORKS

Extent Of Works In This Section

BUILDERS WORKS

The contractor shall be responsible for all elements of Builders Works as required to complete the upgrade works as described. The following sections describe the main elements. Contractor to allow for all ancillary elements of Builders Works as required to complete the works as intended whether described herein or not.

Photographic Condition Survey

Prior to commencing the works the contractor shall carry out a photographic condition survey to record any pre-existing damage to existing facilities and issue to the Employers Representative. Any damage caused to existing facilities during the upgrade works shall be made good/replaced as new at the contractor's expense to the satisfaction of the Employers Representative.

Protection Of Equipment & Finishes

The contractor shall allow for protection of the training centre equipment, furniture and finishes. In particular the existing computer equipment / Interactive White Boards etc shall be adequately protected from ingress of dust during the upgrade works. As a minimum all computer equipment Interactive White Boards shall be enclosed in 1000 gauge black polythene sheeting sealed to the wall/ceiling with duck tape to avoid the ingress of dust. Wall / ceiling finishes shall be made good on removal of the tape.

The contractor shall allow for moving / removing and reinstating existing furniture and wall fixtures as necessary to complete the upgrade works. Due care shall be exercised and centre's furniture and floor finishes shall be protected as necessary to prevent damage including covering in polythene sheeting as necessary. Under no circumstances is the furniture to be used as standing platforms for access to the works.

Strip Out Demolitions

The contractor shall include for isolation disconnection strip out and disposal of all redundant existing fire alarm system including equipment, devices, wiring and containment systems etc. to a licenced WEEE waste recycling facility, including cleaning out and removal of all resulting debris taking care to minimise damage to existing finishes. Contractor to allow for making good and redecoration to match existing finishes where existing services have been removed.

Coring of Opes

Where necessary opes shall be carefully cored to minimum size necessary to allow passage of new services cables. Routes shall be carefully chosen to avoid unnecessary damage to the finishes. In general service routes shall be agreed in consultation with the Services Engineers/Client prior to commencement of any works. The contractor shall take care to minimise damage to the existing finishes in completing the necessary upgrade builder's works.

Contractor shall allow for carefully coring of all opes through external masonry walls, as required to install new services.

Allow for making good and weathering following installation of services. Contractor shall allow for carefully coring of all opes through internal masonry walls, as required to install new services.

Allow for making good following installation of services and for fire stopping fire compartment wall as necessary using a certified fire stopping specialist company.
Certification of all fire stopping works including fully indexed drawings and numbered photographic records shall be provided as part of the Hand Over Safety File.

No damage to existing wall and floor finishes will be tolerated; any damage caused by the contractor will be rectified to Employers Representative satisfaction at contractor cost.

Painting To 'Match In'

Contractor to allow for cleaning and preparation, a sealer and two coats of matt emulsion paint finish to all repairs and new surfaces installed under this contract. (Dulux Matt or equal - colours to match existing to engineer/client approval)

Contractor to allow for under coat and two finishing coats of oil based gloss paint finish to all new surface run containment trunking and conduits etc installed under the contract to match existing room paint finishes. (Dulux Gloss or equal - colours to match existing to client approval)

Site Temporaries / Access / Hot Works etc

The contractor shall provide adequate temporary lighting where required, whilst the work is being completed. Connection to the existing power supply shall be allowed by the employer

Working from heights, the electrical contractor is responsible to provide correct provisions for contractors to work from height under the Health and Safety Welfare Regulations 2006-2013.
The contractor shall provide a hot works permit, fire blanket and fire extinguisher where hot works are being carried out and should be observed for at least two hours after works are complete, to reduce risk of fire.

The contractor is responsible for hiring of skips from a reputable waste removal company for the removal and disposal of waste and redundant materials generated by the installation works.

Contract Cleaning

Contractor to allow for a thorough clean down of the entire buildings where upgrade works have been completed by a specialist firm of contract cleaners on completion of the contract. A builder clean shall not be acceptable.

Timing of final contract clean to be agreed with the Engineers and shall only be programmed following completion of all upgrade works.

SITE BUILDER WORKS

This includes the site trenching, ducting and reinstating works as shown on the accompanying drawings.

Low Voltage Switchgear - General Specification

- 1.1. This covers the construction of distribution boards, motor controls centres and low voltage switchgear assemblies.
- 1.2. Generally all low voltage switchgear assemblies shall be manufactured in strict compliance with the 'Code of Practice for the Design, Selection and Erection of Low Voltage Switchgear Assemblies', as published by the Electro-Technical Council of Ireland. In addition, the requirements of I.E.C. document, I.E.C. 439, shall be fully complied with. Assemblies may be custom built assemblies or factory built assemblies, as appropriate.
- 1.3. Main distribution board assemblies shall generally be 'Form 4' fully compartmented, unless specifically stated elsewhere. Sub-distribution boards shall be 'Form 3' construction while motor centres shall be of 'Class 1' construction. A protection rating of I.P. 54 shall be provided externally, while an internal rating of I.P. 20 shall be applicable.
- 1.4. Switchboards, motor control centres, and distribution boards shall be of cubicle type construction. The enclosure framework shall be of minimum 2.50 mm sheet steel, while door panels, etc., shall be 1.50 mm thickness.

Insulated assemblies where specified, shall be constructed of high impact-resistant glass fibre reinforced polyester.

All assemblies shall be of symmetrical construction, extendible and incorporating a minimum of 25% free space for future use.

- 1.5. Air Circuit breakers/moulded case circuit breakers shall be manufactured to comply with the requirements of the current edition of VDE 0660, BS 4752, and IEC 157 part 1, and amendments thereto.

Air circuit breakers/moulded case circuit breakers when used as a main incomer, shall be capable of withstanding a prospective short circuit current of 40 KA and shall be tested to Category P2, IEC 157-1.

- 1.6. Miniature circuit breaker: shall comply with the requirements of BS 3871 and VDE 0641. MCBS serving motive power requirements shall be of 'Class K' construction. MCBS serving lighting and general services requirements shall be of 'Class L' construction, while MCBS serving low voltage lighting circuits shall be of 'Class D' construction.
- 1.7. Earth Leakage Circuit Breakers: shall be manufactured to comply with the requirements of BS 4293 and amendments thereto, of 2 KA short circuit current rating, current operated and set to trip at 30 mA, unless stated otherwise elsewhere.
- 1.8. Fuses: shall be manufactured to comply with the requirements of BS 88, VDE 0635, VDE 0636, and all applicable amendments. Fuses shall be DZ type (up to 35A rating) and/or 'NH' type (ratings above 35A) as appropriate.

- 1.9 Isolators: shall be manufactured to comply with the requirements of IEC 408 and amendments thereto, shall be of the rotary air break type and shall be lockable in the off position. The prospective short circuit current rating of each isolator shall be adequate for the respective duty.
- 1.10 Motors starters: shall be manufactured to comply with the requirements of IEC 292-1 and amendments thereto. Starters shall be provided with adjustable thermal and magnetic protection. It shall be the responsibility of the manufacturer to set the overload facility and to supply to the contractor/client, a record of all such settings.
- 1.11 Contactors: shall be manufactured to comply with the requirements of IEC 158-1, shall be AC3 Category and shall be provided with a minimum of 2 no. spare normally open contacts with 2 no. spare normally closed contacts.
- 1.12 Busbars: shall comply with the requirements of IEC 439 and BS 159 and amendments thereto. Bars shall be manufactured from H.D.H.C. copper of rectangular section and shall be moulded in a separate compartment within the switchboard.

Neutral busbars shall be of the same dimensions as the above busbars, while the earth busbar shall be a minimum of 50% of the neutral/phase busbar cross sectional area.

Busbars shall be sized to carry safely, the installed load and shall be capable of accommodating a 25% increase in the installed load without the necessity of increasing the busbar size. Centre fed busbars shall be capable of accommodating a minimum of 75% of the installed load on each half.

Flexible connections to the busbars shall be of acceptable for connections up to 63A rating. Connections of greater rating than 63A shall be carried out in adequately insulated and supported copper busbar of rectangular cross section.

- 1.13 Pilot lamps push buttons and control switch: shall comply with the requirements of IEC 337 and IEC 144 and shall have a protection rating of IP 65. A maximum voltage of 220V shall be admissible in respect of control/indicating circuits, however, where possible an operating voltage of either 110 V or 24 V should be adopted.
- 1.14 Instruments/instrument transformer: shall comply with the relevant sections of IEC 473, IEC 185 and VDE 0414.
- 1.15 Wiring: all wiring within the switchgear enclosure shall consist of PVC insulated copper conductor run within PVC trunking. The spacing factor within the trunking should be such as not to exceed 30% of the cross section of the trunking. Labels of a patented manufacture shall be provided at each end of each cable.
- 1.16 Labelling: The function of all items inside and outside the switchgear enclosure shall be suitably identifiable throughout the provision of 'screw-on' type engraved labels, manufactured from 'Traffoylet' sheet or similar and prior approved.

All circuits within the enclosures shall be given a reference number. This reference number shall be repeated on a heat sealed chart within each compartment. The chart shall state the function and rating of each service.

- 1.17 Terminals: A separate terminal section shall be provided within each switchgear enclosure. The location of this enclosure, i.e. top/bottom or side, shall be decided by the Engineer prior to fabrication.

Terminals shall be manufactured to comply with the requirements of BS 3042. Each terminal shall be sized to accept the incoming cables. Terminals of a 'push-in' type shall not be acceptable.

- 1.18 Earthing: An earthing bar sized as described previously shall run the full length of the enclosure. All metal work, including panels doors shall be bonded to this bar. Cables terminated on moving parts such as doors, shall be of a flexible type and shall be run in PVC spiral wrap or similar and prior approved protection system.

- 1.19 Drawings: Prior to commencement of the manufacture of any switchboard/enclosure, a full set of panel layouts and schematic wiring diagrams shall be made available to the engineer by the manufacturer, for the engineers approval. Only on acceptance of an approved set of drawings, will manufacture of the switchboard/enclosure commence.

- 1.20 Tests: Before despatch to site each switchboard assembly shall be subjected to the following tests. The results of each test shall be recorded and submitted to the engineer, together with an 'as-manufactured' drawing of the board.

- a. Functional and mechanical tests: to test the physical operation of all switches, isolators, control circuits, etc.
- b. Continuity tests: to prove continuity in the wiring system.
- c. Insulation resistance test, as follows:
 1. Phase to Phase.
 2. Phase to Neutral.
 3. Phase to Earth.
 4. Neutral to Earth.
- d. Flash test: 2.50 KV applied for one minute for each of items (1) to (4), listed at (c) above.
- e. Simulation tests: Overload and short circuit protection devices tested for correct operation on randomly selected circuits.

- 1.21. Compliance with the requirements listed at items 1-20 inclusive, shall not exonerate the manufacturer from his responsibility of providing a safe and functional assembly to the user.

SCHEDULE OF LIGHT FITTINGS



HIGH OUTPUT EMERGENCY LUMINAIRES FOR RECESSED MOUNTING WITH SMARTSCAN WIRELESS TECHNOLOGY

IP65 DOWNLIGHTER (BELOW CEILING) IP40 DOWNLIGHTER (ABOVE CEILING)
IP20 CONTROL MODULE CE LED

SPECIFICATION

- Thermally conductive nylon body, polycarbonate bezel finished white (RAL9016)
- Small size - unobtrusive
- Three hour, non-maintained emergency operation
- Simple to install, full status reporting SmartScan wireless communication versions
- Suitable for higher mounting applications
- Aids compliance with BS5266-1:2016 for areas where enhanced illuminance is needed at specific locations
- Reliable LED technology
- Low standby power consumption (1.7W total)
- Superb photometric performance
- Status indicator shows operational condition
- Easily replaceable Nickel Metal Hydride (NiMH) ECO-Power Pack battery

At Platform 1 SmartScan emergency luminaires may self-test at any time. Consequently, caution should be exercised in situations where this may be inconvenient (such as hotel rooms or hospital wards). At Platform 2 specific testing times can be set via the SmartScan website (SmartScan Gateway required).

SmartScan Configurations



Find out more at www.thorlux.com/smartsan

RANGE

LED POWER	AREA DISTRIBUTION CAT. No.	STANDARD DISTRIBUTION CAT. No.	APPROX. kg	TYPE
4W	WFF 19314	WFF 19313	0.6	Non-maintained

Can be supplied with pre-fitted 3m lead for connection into Thorlux Lighting Cable Management:
For connection into recessed Smart 6-pole installations add suffix 'TEE' (see www.thorlux.com/controls)
For connection into recessed SmartScan 3-pole installations add suffix 'TEE3' (see www.thorlux.com/controls)
e.g. WFF 19314TEE See Fig. 1



Fig. 1

SmartScan Wireless Standards Compliance:

Europe: EN 300 220-1 V2.4.1 / EN 301 489-3 V1.6.1
Australasia: ACMA 2014 Radio Communication Standard 2014
Thorlux Patented Wireless Technology - G82575724



* SmartScan versions only

SPARES

DESCRIPTION	CAT. No.	APPROX. kg
4W ECO-Power Pack	PP 19319	0.33

End of life SmartScan batteries can be returned to Thorlux for recycling.

ACCESSORY

DESCRIPTION	CAT. No.
T-bar mounting bracket for Control Module and ECO-Power Pack	SLA 13101

KANBY EVO

NARROW BODY LED CONTROLLER LUMINAIRES



SPECIFICATION

- Steel body finished full polyester non-yellowing satin white (RAL 9016)
- Polycarbonate diffuser: Carefully controlled nanoprism optic version for LG7:2015 (<3000 cd/m² @ 65°) compliance or opal version
- Polycarbonate screw-on end caps with concealed fixings
- Fire-retardant external plastic parts
- Designed to exclude dust, dirt and flies
- Smart versions with intelligent lighting control
- SmartScan wireless technology removes the need for control cabling. Ideal for retro-fit
- Fitted with 4000K LEDs

LED CHARACTERISTICS

CRI	80+
COLOUR TEMPERATURE	4000K
RATED LIFE (HOURS)	67K - L80/B10
PROTECTION	LUX GUARD
DRIVER EFFICIENCY	>85%
REPLACEABLE	YES
POWER FACTOR	>0.9
LL/CW	138.8

For LED characteristics explanation see www.thorlux.com/led-guide

SmartScan Configurations



Find out more at www.thorlux.com/smartsan

RANGE

	NOMINAL SIZE (mm)	LED	OPAL VERSION	LOW GLARE VERSION	APPROX. kg	CIRCUIT
SMART	1200	15W	KE 18943	KE 18951	3.9	D/SS
		26W	KE 18944	KE 18952	3.9	D/SS
	1500	22W	KE 18948	KE 18956	4.2	D/SS
		36W	KE 18949	KE 18957	4.2	D/SS
		43W	KE 18950	KE 18958	4.2	D/SS
STANDARD	1200	15W	KE 18959	KE 18967	3.8	L/A
		26W	KE 18960	KE 18968	3.8	L/A
	1500	22W	KE 18964	KE 18972	4.1	L/A
		36W	KE 18965	KE 18973	4.1	L/A
		43W	KE 18966	KE 18974	4.1	L/A

CIRCUIT TYPE - suffix catalogue number with:

SMART D - Smart / SS - SmartScan

STANDARD L - non-dimming / A - dimming (DALI) e.g. KE 18943SS etc.

EMERGENCY VERSION - prefix catalogue number with:

EKE - Emergency (Not available when selecting the 'SS' suffix)

TKE - AutoTest

WKE - SmartScan (Only available when selecting the 'SS' suffix)

e.g. WKE 18943SS etc.

Add 0.3kg to weights listed

ACCESSORY

DESCRIPTION	CAT. No.	APPROX. kg
Wire suspension kit (3m length)	KE 18195	0.05



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WEB LINKS

www.thorlux.com/controls

2

TYPE G & G-E

Geaney Engineering Consultants, Studio 22, Waterford Business Park, Cork Road, Waterford
Tel: 051879371 Email: info@geaneyengineering.ie

CLARA 360



CIRCULAR LED LUMINAIRES SUITABLE FOR WALL OR CEILING MOUNTING



SPECIFICATION

- Die-cast aluminium body and lid finished full polyester non-yellowing satin white (RAL 9016)
- Silver option (RAL 9006)
- High efficiency satin sparkle effect polycarbonate covers
- Optional 3W LED backlight (RGB or white)
- 100,000 hour life expectancy
- Emergency and AutoTest versions using two integral 1W high power LEDs
- Smart versions with intelligent lighting control
- SmartScan wireless technology removes the need for control cabling. Ideal for retro-fit
- Fitted with 4000K LEDs

LED CHARACTERISTICS

CRI	80+
COLOUR TEMPERATURE	4000K
RATED LIFE (HOURS)	100K - L80/B10
PROTECTION	LUX GUARD
DRIVER EFFICIENCY	>87%
REPLACEABLE	YES
POWER FACTOR	>0.95
LL/CW	132.6

For LED characteristics explanation see www.thorlux.com/led-guide

RANGE

	LED	STANDARD	APPROX. kg	WHITE LED HALO	RGB LED HALO	APPROX. kg	CIRCUIT
SMART	20W	CA 15626	3.2	CA 15637	CA 15631	3.3	D/SS
STANDARD	20W	CA 15625	3.1	CA 15634	CA 15628	3.2	L/A

CIRCUIT TYPE - suffix catalogue number with:

SMART D - Smart / SS - SmartScan

STANDARD L - non-dimming (LED) / A - dimming (DALI) e.g. CA 15626SS etc.

EMERGENCY VERSION - prefix catalogue number with:

ECA - Emergency (Not available when selecting the 'SS' suffix)

TCA - AutoTest (Only available when selecting the 'SS' suffix)

WCA - SmartScan (Only available when selecting the 'SS' suffix)

e.g. WCA 15626SS etc.

Add 0.3kg to weights listed.

FINISH OPTION - suffix catalogue number with: SV3 - Silver RAL 9006 e.g. CA 15626DSV3 etc.

SmartScan Configurations



Find out more at www.thorlux.com/smartsan



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WEB LINKS

www.thorlux.com/controls

Presence Detection Guide

2

TYPE H

Geaney Engineering Consultants, Studio 22, Waterford Business Park, Cork Road, Waterford
Tel: 051879371 Email: info@geaneyengineering.ie

DOT & DOT HALO



CIRCULAR LED LUMINAIRES SUITABLE FOR SURFACE OR SEMI-RECESSED MOUNTING



SPECIFICATION

- Spun aluminium body finished full polyester, non-yellowing white (internal and external)
- Opal or high efficiency satin sparkle effect fire-retardant polycarbonate cover
- Optional light green tinted backlit halo ring (4W RGB or white LEDs)
- Smart versions with intelligent lighting control
- SmartScan wireless technology removes the need for control cabling. Ideal for retro-fit
- Surface or semi-recessed mounting
- Fitted with 4000K LEDs

LED CHARACTERISTICS

CRI	80+
COLOUR TEMPERATURE	4000K
RATED LIFE (HOURS)	100K - L80/B10
PROTECTION	LUX GUARD
DRIVER EFFICIENCY	>80%
REPLACEABLE	YES
POWER FACTOR	>0.95
LL/CW	165.3

For LED characteristics explanation see www.thorlux.com/led-guide

RANGE

	LED	STANDARD VERSION	APPROX. kg	WHITE LED HALO VERSION	RGB LED HALO VERSION	APPROX. kg	CIRCUIT
CONTROLLED	Large version - Satin Sparkle						
	13W	DOT 17654	2.1	DOT 17655	DOT 17656	2.8	D/SS/R
	17W	DOT 16490	2.1	DOT 16491	DOT 16492	2.8	D/SS/R
	Large version - Opal						
	13W	DOT 17657	2.1	DOT 17658	DOT 17659	2.8	D/SS/R
	17W	DOT 16493	2.1	DOT 16494	DOT 16495	2.8	D/SS/R
STANDARD	Small version - Opal						
	14W	DOT 16826	1.5				D/SS
	Large version - Satin Sparkle						
	13W	DOT 17663	2.0	DOT 17664	DOT 17665	2.7	L/A
	17W	DOT 16496	2.0	DOT 16497	DOT 16498	2.7	L/A
	Large version - Opal						
	13W	DOT 17666	2.0	DOT 17667	DOT 17668	2.7	L/A
	17W	DOT 16499	2.0	DOT 16500	DOT 16501	2.7	L/A
	Small version - Opal						
	14W	DOT 16573	1.4				L

CIRCUIT TYPE - suffix catalogue number with:

CONTROLLED D - Smart / SS - SmartScan / R - SmartScan Radar
STANDARD L - non-dimming (LED) / A - dimming (DALI) e.g. DOT 17654D etc.

EMERGENCY VERSION - prefix catalogue number with:

EDT - Emergency (Not available when selecting the 'SS' or 'R' suffix)

TDT - AutoTest

WDT - SmartScan (Not available on 14W when selecting the 'L' suffix)

e.g. WDT 17654D etc.

Add 0.3kg to weights listed.

SmartScan Configurations



Find out more at www.thorlux.com/smartsan

Presence Detection Guide - www.thorlux.com/files/presence-detection.pdf



WEB LINKS

www.thorlux.com/controls

2

TYPE J

Geaney Engineering Consultants, Studio 22, Waterford Business Park, Cork Road, Waterford
 Tel: 051879371 Email: info@geaneyengineering.ie

MICRODOT



SMALL SURFACE MOUNTED CIRCULAR PRISMATIC LED LUMINAIRES



SPECIFICATION

- White body and clear prismatic controller both in polycarbonate
- Fitted with 4000K LEDs

LED CHARACTERISTICS

CRI	80+
COLOUR TEMPERATURE	4000K
RATED LIFE (HOURS)	50K - L70/B10
PROTECTION	-
DRIVER EFFICIENCY	>90%
REPLACEABLE	YES
POWER FACTOR	>0.9
LL/CW	82.1

For LED characteristics explanation see www.thorlux.com/led-guide

RANGE

LED	CAT. No.	APPROX. kg
Mains 13W	MID 16449L	1.4
Emergency 13W	EMD 16449L	1.7
AutoTest 13W	TMD 16449L	1.7

CIRCUIT TYPE - L - non-dimming (LED)

DIMENSIONS



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www.thorlux.com

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TYPE M

Geaney Engineering Consultants, Studio 22, Waterford Business Park, Cork Road, Waterford
Tel: 051879371 Email: info@geaneyengineering.ie

KANBY LED CONTROLLER



LED CONTROLLER LUMINAIRES



SPECIFICATION

- Steel body, gear cover and end caps finished full polyester, non-yellowing white
- Ultra slim profile
- Polycarbonate controller
- Smart versions with intelligent lighting control
- SmartScan wireless technology removes the need for control cabling. Ideal for retro-fit
- Fitted with 4000K LEDs

LED CHARACTERISTICS

CRI	80+
COLOUR TEMPERATURE	4000K
RATED LIFE (HOURS)	90K - L80/B10
PROTECTION	LUX GUARD
DRIVER EFFICIENCY	>85%
REPLACEABLE	YES
POWER FACTOR	>0.9

LL/CW 142.2

For LED characteristics explanation see www.thorlux.com/led-guide

SmartScan Configurations



Find out more at www.thorlux.com/smartsan

Wide body

Narrow body

RANGE

	NOMINAL SIZE (mm)	LED	CAT. No.	APPROX. kg	LENGTH (mm)	FIXINGS	CIRCUIT
SMART	1500	21W	KB 17606 ■	3.3	1560	Suitable for BESA fixing on 600 to 610mm centres	D/SS
		28W	KB 16107 ■	3.3			D/SS
		37W	KB 16108 ■	3.3			D/SS
		49W	KB 16103 ▲	4.1			D/SS
		63W	KB 16104 ▲	4.1			D/SS
STANDARD	1500	21W	KB 17607 ■	3.2	1510	As above	L/A
		28W	KB 16105 ■	3.2			L/A
		37W	KB 16106 ■	3.2			L/A
		49W	KB 16101 ▲	4.0			L/A
		63W	KB 16102 ▲	4.0			L/A

CIRCUIT TYPE - suffix catalogue number with:

SMART D - Smart / SS - SmartScan

STANDARD L - non-dimming (LED) / A - dimming (DALI) e.g. KB 17606SS etc.

EMERGENCY VERSION - prefix catalogue number with:

EKB - Emergency (Not available when selecting the "SS" suffix)

TKB - AutoTest

WKB - SmartScan (Only available when selecting the "SS" suffix) e.g. WKB 17606SS etc.

Add 0.3kg to weights listed

■ Narrow body / ▲ Wide body

PHOTOMETRIC GUIDE



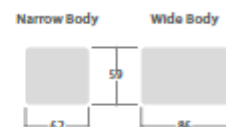
WIDE BODY

Luminaire Lumen Output:
49W = 3570lm
63W = 9465lm

NARROW BODY

Luminaire Lumen Output:
21W = 3555lm
28W = 4590lm
37W = 5860lm

DIMENSIONS



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WEB LINKS

www.thorlux.com/controllers

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TYPE N

Geaney Engineering Consultants, Studio 22, Waterford Business Park, Cork Road, Waterford
Tel: 051879371 Email: info@geaneyengineering.ie

Circular LED recessed downlighters

Recessed luminaires with injection moulded reflector finished white. Open reflector, IP40, Impact rated and IP65 versions available alongside decorative drop glass versions.

Applications: Offices, corridors, reception areas, toilets and retail.

- Toughened/safety drop glass attachments provide a measure of light on the ceiling
- Optional reinforcing board with centre cut aperture
- Supplied with remote gear unit fitted with 2 m supply lead
- SmartScan Radar versions fitted with TEE connector for LCM wiring
- CRI 90 option available to special order
- SmartScan wireless technology removes the need for control cabling. Ideal for retro-fit



Up to IP65 (IP20 above ceiling)

IK10

Up to 121.5 LL/CW

SMARTSCAN

LYREBARD

Lighting management

Lighting control system

Dimming (DALI)
Non-dimming
SmartScan Radar

Emergency system

AutoTest Emergency
Non-emergency
SmartScan Emergency
Standard Emergency

Specification

Mounting	Recessed	IP rating	Up to IP65 (IP20 above ceiling)
Impact rating	IK10	Max presence detection height	4 m

Lighting

Lumen output	925 lm - 2,790 lm	Efficacy	Up to 121.5 LL/CW
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Emergency data

Emergency lumen output	285 lm - 375 lm	Emergency type	Maintained
Emergency duration	3 hours	Battery specification	Nickel Metal Hydride (NiMH)

Power

LED power	8 W - 21 W	Circuit power	10 W - 26 W
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TYPE R & R-E

COBALT



Plain



Hood



Plain & Grill



Hood & Grill

IP66 CIRCULAR LUMINAIRES



SPECIFICATION

- Strong high-pressure die-cast LM2 aluminium body and cover frame. Graphite, full polyester powder finish as standard
- Silver or white finish options
- High efficiency fire-retardant satin polycarbonate diffuser
- Choice of cover styles
- Complies with M.O.D. JSP482 Chapter 8 Document for 'Category C' areas
- Photocell option
- Microwave presence detector option with stand-by light level feature
- SmartScan wireless technology removes the need for control cabling. Ideal for retro-fit
- SmartScan Radar versions with sensor discretely hidden behind the cover
- Fitted with 4000K LEDs

11W/16W LED CHARACTERISTICS

CRI	80+
COLOUR TEMPERATURE	4000K
RATED LIFE (HOURS)	100K - L80/B10
PROTECTION	LUX GUARD
DRIVER EFFICIENCY	>80%
REPLACEABLE	YES
POWER FACTOR	>0.95

LL/CW 106.4

15W HOOD LED CHARACTERISTICS

CRI	80
COLOUR TEMPERATURE	4000K
RATED LIFE (HOURS)	100K - L80/B10
PROTECTION	LUX GUARD
DRIVER EFFICIENCY	>90%
REPLACEABLE	YES
POWER FACTOR	>0.95

LL/CW 56.7

For LED characteristics explanation see www.thorlux.com/led-guide

RANGE

LED	PLAIN	HOOD	CIRCUIT	APPROX. kg	PLAIN & GRILL	HOOD & GRILL	CIRCUIT	APPROX. kg
11W	CT 19516		R/L	3.0	CT 19518		L	3.2
15W		CT 19015	L	3.0		CT 19016	L	3.2
16W	CT 19517		R/L	3.0	CT 19519		L	3.2

COLOUR OPTIONS - add suffix: SV3 - Silver / W9 - White e.g. CT 19516SV3 etc.

CIRCUIT TYPE - suffix catalogue number with:

R - SmartScan Radar / L - non-dimming e.g. CT 19516R etc.
SmartScan Radar add 0.1kg to weights listed.

EMERGENCY VERSION - prefix catalogue number with:

ECT - Emergency (Not available when selecting the 'R' suffix)

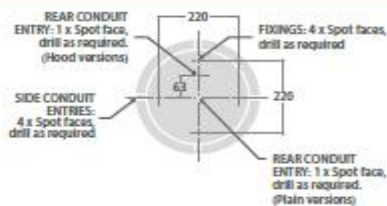
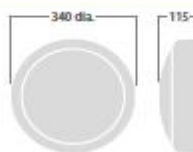
TCT - AutoTest

WCT - SmartScan (11W and 16W versions only)

e.g. ECT 19516L etc.

Add 0.3kg to weights listed

DIMENSIONS



SmartScan Configurations



Find out more at www.thorlux.com/smartsan



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WEB LINKS

www.thorlux.com/microwave

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TYPE S-E & T

Geaney Engineering Consultants, Studio 22, Waterford Business Park, Cork Road, Waterford
Tel: 051879371 Email: info@geaneyengineering.ie



HIGH PERFORMANCE LUMINAIRES
DESIGNED TO MINIMISE LIGHT
POLLUTION AND ENERGY
CONSUMPTION

IP66 IK10++ / IK10 / IK06 CE LED

SPECIFICATION

- Graphite full polyester powder finish. Silver option
- Strong die-cast LM2 aluminium body
- High efficiency prismatic polycarbonate or borosilicate glass front refractor
- Wide distribution (8W) or area distribution (20W, 34W and 42W) options
- Highly specular, multi-faceted injection moulded vacuum metallised reflector on wide distribution versions
- Excellent distribution with less than 2% upward light component
- Optional photocell control
- Smart External versions with intelligent lighting control for use up to 6 metres mounting height
- SmartScan wireless technology removes the need for control cabling. Ideal for retro-fit
- Fitted with 4000K or 5700K LEDs

SmartScan Configurations



Find out more at www.thorlux.com/smartsan



Area distribution

Wide distribution

Realta Design Registration Number 3024955

RANGE

	LED	WIDE DISTRIBUTION	AREA DISTRIBUTION	APPROX. kg
SMART EXTERNAL	IK10 Polycarbonate Cover			
	8W - 4000K	RL 19069SS		3.9
	20W - 4000K		RL 19110SS	4.0
	34W - 4000K		RL 19111SS	4.0
	42W - 4000K		RL 19112SS	4.0
	8W - 5700K	RL 19070SS		3.9
	20W - 5700K		RL 19113SS	4.0
	34W - 5700K		RL 19114SS	4.0
	42W - 5700K		RL 19115SS	4.0
STANDARD	IK10++ Polycarbonate Cover			
	8W - 4000K	RL 19071L		3.8
	20W - 4000K		RL 19116L	3.9
	34W - 4000K		RL 19117L	3.9
	42W - 4000K		RL 19118L	3.9
	8W - 5700K	RL 19072L		3.8
	20W - 5700K		RL 19119L	3.9
	34W - 5700K		RL 19120L	3.9
	42W - 5700K		RL 19121L	3.9
	IK06 Glass Cover			
	8W - 4000K	RL 19073L		4.6
8W - 5700K	RL 19074L		4.6	

CIRCUIT TYPE -

SMART EXTERNAL SS - SmartScan

STANDARD L - non-dimming (LED)

SILVER OPTION - add suffix SV3 e.g. RL 19069SSSV3 etc.

EMERGENCY VERSION - prefix catalogue number with:

ERL - Emergency / TRL - AutoTest (Not available when selecting the 'SS' suffix)

WRL - SmartScan

e.g. WRL 19069SS etc.

Add 0.4kg to weights listed

Photometrics, Accessories, Options and Dimensions pages 3 and 4

TYPE W

THOROPROOF



DIRECT
Pair of stainless steel brackets supplied. Provides clearance for thermal expansion and fixing.



PENDANT
Pair of steel spring loops supplied

ANTI-CORROSIVE POLYCARBONATE LUMINAIRES



SPECIFICATION

- High-impact and corrosion-resistant light grey, injection moulded polycarbonate body
- Frosted prismatic polycarbonate cover
- Body and cover fire-retardant
- Smooth easy-clean lines
- Snug-fit polycarbonate cover clips (stainless steel option)
- Fast installation via external stainless-steel brackets preserves IP rating
- Complies with M.O.D. JSP482 Chapter 8 Document for 'Category C' areas
- Complies with food production standards IFS and HACCP
- SmartScan wireless technology removes the need for control cabling. Ideal for retro-fit
- Fitted with 4000K LEDs

LED CHARACTERISTICS

CRI	80+
COLOUR TEMPERATURE	4000K
RATED LIFE (HOURS)	100K - L70/B10
PROTECTION	-
DRIVER EFFICIENCY	>88%
REPLACEABLE	YES
POWER FACTOR	>0.95
LL/CW	131.5

For LED characteristics explanation see www.thorlux.com/led-guide



Wide body

Narrow body

RANGE

LENGTH (mm)	LED	CAT. No.	CIRCUIT	FIXINGS	APPROX. kg
1570	30W ■ 60W ▲	TP 19773 TP 19774	SS/D/L SS/D/L	1150mm centres	2.6 3.6

FACTORY FITTED THROUGH WIRING - add 'TW' after catalogue number eg. TP 19773LTW

CIRCUIT TYPE - suffix catalogue number with:
SS - SmartScan / D - Smart / L - non-dimming (LED) e.g. TP 19773SS etc.
SmartScan and Smart add 0.1kg to weights listed.

EMERGENCY VERSION - prefix catalogue number with:
ETP - Emergency
TTP - AutoTest
WTP - SmartScan (Only available when selecting the 'SS' suffix)
e.g. WTP 19773SS etc.
Add 0.3kg to weights listed.

■ Narrow body
▲ Wide body

AMBIENT OPERATING TEMPERATURES

LED	STANDARD/SMART		EMERGENCY	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
30W	-20°C	50°C	0°C	25°C
60W	-20°C	40°C	0°C	25°C

For ambient temperatures below the stated minimum contact the Thorlux Technical department

SmartScan Configurations



Find out more at www.thorlux.com/smartsan



Nov. 19

WEB LINKS

www.thorlux.com/controls

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