

SPECIFICATION & PRICING SCHEDULE
FOR
ELECTRICAL SERVICES INSTALLATION
AT
NEW SCIENCE CLASSROOM &
TECHNICAL GRAPHICS AREA
AT HALLA LYDIA,
ST. DOMINIC'S COLLEGE, CABRA,
DUBLIN 7

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TENDER ISSUE

CONTENTS

	Pages
Section 1 INTRODUCTION	04 - 05
1.1 Introduction	
1.2 Definitions	
Section 2 OUTLINE OF SCOPE OF WORKS	06 - 11
2.0 Services (Mainly Electrical)	
2.1 Electrical Supply & Main Distribution (Element 61)	
2.2 Power (Element 62)	
2.3 Lighting (Element 63)	
2.4 Communication (Element 64)	
2.5 Security & Protection (Element 65)	
2.6 Electrical Site Services (Element 60)	
Section 3 CONTRACTUAL MATTERS	12
Section 4 DETAILED SCOPE OF WORK	13 - 32
4.1 Electrical Supply & Main Distribution (Element 61)	
4.2 Power (Element 62)	
4.3 Lighting (Element 63)	
4.4 Communication (Element 64)	
4.5 Security & Protection (Element 65)	
4.6 Electrical Site Services (Element 60)	
Section 5 GENERAL SPECIFICATION	33 - 75
5.1 Materials	
5.2 Plant	
5.3 Storage	
5.4 Setting out	
5.5 Building Protection	
5.6 Cabling Generally	
5.7 Switchgear Assemblies & Enclosures	
5.8 Installation of Cables	
5.9 Cable Trays	
5.10 Conductors in Conduit & Trunking	
5.11 Conduit	
5.11 Installation of PVC Conduit	
5.13 Installation of Steel Trunking	
5.14 Installation of PVC Trunking	
5.15 Installation of Steel Cable Tray & Ladder	
5.16 Installation of PVC Cable Tray	
5.17 Earthing	
5.18 Lighting Installation	

- 5.19 General Service & Lighting Accessories
- 5.20 Motor Starters
- 5.21 Push Button Stations
- 5.22 Mounting Heights
- 5.23 Earthing, Bonding & Lighting Protection
- 5.24 Testing & Certification
- 5.25 Emergency Lighting Installation
- 5.26 Hazardous Area Installations
- 5.27 IT / Data Cables Installations
- 5.28 M.I.C.S. Cables
- 5.29 Brackets & Supports
- 5.30 Mechanical Work
- 5.31 Protection of Installation against Damage
- 5.32 Completion
- 5.33 Operating instructions
- 5.34 ESB Networks
- 5.35 Painting

- 5.36 Labels & identification
- 5.37 Spares & Tools
- 5.38 Schedule & Charts
- 5.39 Operating & Maintenance Manuals

Section 6 SCHEDULE OF DRAWINGS

76

SPECIFICATION FOR THE ELECTRICAL ENGINEERING SERVICES

NEW SCIENCE CLASSROOM & TECHNICAL GRAPHICS AREA AT HALLA LYDIA, ST. DOMINIC'S COLLEGE, CABRA, DUBLIN 7

Date: 19 June 2026

Revision No.: 0

1.1 INTRODUCTION

The project consists of the complete electrical services installation to a new Science Classroom and associated areas & Technical Graphics Room at Halla Lydia, St. Dominic's College, Cabra, Dublin 7.

Electrical services shall consist of main supply and distribution, power & general services, lighting, communication, IT, fire alarm and other services.

The electrical contractor shall be a domestic sub-contractor to the main building contractor.

The following details should be read in conjunction with that of the Equipment Schedules.

While the detailed project requirements are described within the general technical specification and drawings, the descriptive specification provides a description of the services installation and draws attention to particular elements of importance.

In the event that an apparent contradiction exists between any of the services descriptions or drawings, this should be addressed to the Engineer during the tender period for clarification. If an apparent contradiction is not identified during the tender process then it shall be at the discretion of the Engineer to identify which document takes precedence. This in no way overrides the order of precedence of information as defined within the Contract.

1.3 CLIENT & DESIGN TEAM DETAILS

CONSULTING SERVICES ENGINEERS

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SECTION 2 OUTLINE OF SCOPE OF WORK

PROPOSED SCOPE OF WORKS

2.0 ELELCTRICAL SERVICES INSTALLATION

2.1 ELECTRICAL SUPPLY & MAIN DISTRIBUTION (ELEMENT 61)

2.1.1 Central Earthing

- 2.1.1.1** The complete electrical installation will be properly earthed to current regulations. The electrical contractor shall certify the complete installation at handover.

2.1.2 Central and Local Switchgear.

- 2.1.2.1** The Main Distribution board will be located as shown on the proposal drawings.

2.1.3 Power Factor Correction Equipment.

- 2.1.3.1** Power Surge Equipment
Surge protection unit 3 phase 400V Class C will be provided at the main distribution board.

2.1.4 Distribution Cabling

- 2.1.4.1** The main distribution cables will be laid galvanised trays located in the attic space and above false ceilings. All cables to be SWA sized as per the schematic details.

2.1.5 Distribution Boards

- 2.1.5.1** It is proposed that 1 no. main distribution board be installed in the store. The distribution boards will be located as shown on drawing E2 and will be concealed within cabinets.

2.2 POWER (ELEMENT 62)

2.2.1 General Power Outlets

- 2.2.1.1** Twin switched socket outlets are to be provided throughout the school. The socket outlets throughout the school are to be metal clad of MK manufacture or equal to approval by Engineer. All socket outlets to be Part M compliant.
- 2.2.1.2** The General Fused spur outlets are to be provided for. Water heaters, ventilation, heating appliances, fire alarm panel and intruder alarm panel. These are to be suitably rated and switched with a neon indicator and suitably located and are to be MK Metalclad or equal to approval.

2.2.2 Special Purpose Power Outlets (Computers)

- 2.2.2.1** The Workstations as detailed on the proposal drawings shall be provided with power and data points in locations as indicated.

2.2.3 Supplies to Services

- 2.2.3.1** These shall be wired with suitably rated cable which is to be laid in steel conduit in a ring main fashion as shown on the proposal drawings.

2.2.4 Supplies to Equipment

- 2.2.4.1** These shall be wired with suitably rated cable which is to be laid in steel conduit.

2.2.5 Local Earthing and Bonding.

- 2.2.5.1** All local bonding shall be carried out in 2.5sq.mm earthing copper cable conductor and shall include for 3 N° earth rod and an earth lid inspection pit as fuse type RB210 & PT100 respectively and all necessary bonds and clamps.

2.3 LIGHTING (ELELEMTN 63)

2.3.1. Primary Lighting

All lamps and fittings shall be as described in schedule of lighting points and circuits on the proposal drawings and as set out below.

Lighting of appropriate illumination is to be provided and shall be of the correct intensity and colour. All spaces including tank rooms, attic space etc. shall have artificial lighting.

The following outlines the expected Lux levels in each area.

Classrooms, teaching spaces	300lux at 700mm above FFL.
General Areas	300lux at 1500mm above FFL.
Toilet and Storage Areas	120lux at 700mm above FFL.
Entrance and Circulation Areas	120lux at 700mm above FFL.
All other area	120lux at 700mm above FFL.

2.3.1.1. Cabling and conduit

All light fittings are to be wired in 2.5 sq. mm P.V.C. cable in steel conduit from an adjacent lighting circuit

2.3.3. Emergency Lighting

An emergency lighting system shall be provided to the complete complex to cover circulation areas, internal rooms and all final exits.

The system will consist of self-contained non-maintained emergency lights, inverter pack within normal light fittings and exit signs. Central test unit shall also be installed at the main distribution board as per the enquiry drawings to enable the emergency lighting system to be checked out frequently.

2.3.3.1. Cabling and Conduit

All light fittings are to be wired in 2.5 sq. mm P.V.C. cable in steel conduit from an adjacent lighting circuit

2.3.4. Lighting Controls (Switching)

2.3.4.1 To General Classrooms and other teaching areas shall be based on manual on / off switching which will have dimmable capabilities in association with absence detection and daylight sensing.

2.3.4.2 Toilet areas shall be will be switched through IP65 rated passive infra-red detectors.

2.3.4.3 Lighting controls to all stores will be via time delay release switches.

2.3.4.5 External lighting will be controlled via time clock, photocell, manual on / off switching and via activation of the intruder alarm.

2.3.4.6 Supply of 2no. Hand Held Controller Units to be handed to Building Management

2.4 COMMUNICATION (ELEMENT 64)

2.4.1 Audio

2.4.1.4 Telephone System

Existing PABX Unit & Telephone Handsets to be supplied by others. Contractor to wire a link to the new extension to same.

2.4.1.5 Telephone points will be provided and wired back to the existing Data Communications Centre.

All telephone points shall be wired in Cat 6a UTP cabling from RJ45 sockets as located on the enquiry drawings.

2.4.2 Electronic Communication System

The information technology installation will be in compliance with the Information and Communication Technology Infrastructure Guidelines including all Cat 6a UPT cabling, RJ45 computer outlets, associated patch panels and cabinets. Data points shall be located as per the enquiry drawings. They shall be wired individually in Cat 6a UPT cabling to the existing main distribution facility.

2.5 SECURITY AND PROTECTION (ELEMENT 65)

2.5.1 Fire Alarm System

2.5.1.1 An addressable fire alarm system will be provided to the complete complex with type L2 coverage. The fire alarm is to be monitored through the proposed intruder alarm system. Fire alarm panels shall be located as per the enquiry drawings. A wired link is to be provided from the new system to the existing fire alarm system.

2.5.1.2 Provision of manual call points as per the enquiry drawings

2.5.1.3 Provision of smoke detectors as per the enquiry drawings.

2.5.1.4 Provision of heat detectors as per the enquiry drawings.

2.5.1.5 Provision of fire alarm sounders as per the enquiry drawings

2.5.1.6 Provision of external sounder / strobe as per the enquiry drawings.

2.5.2 Other Protection Services

2.5.2.3 Intruder Alarm Services. As per the enquiry drawings.

2.6 ELECTRICAL SITE SERVICES (ELEMENT 60)

2.6.1.1 Incoming Supply

A new supply is to be brought from the existing main distribution board located in the existing school.

2.6.1.2 External Lighting

Allow for the supply and installation of Wall mounted vandal proof external lighting, lighting standards including appropriate switching, necessary cabling and trunking.

Light is to be wired through a time-clock photocell and override switch at main distribution board.

SECTION 3 CONTRACTUAL MATTERS

N/A

SECTION 4 DETAILED SCOPE OF WORK

Note: This specification is prepared using the National Standard Building Elements and Design Cost Control Procedures. All the following references relate to that document and its contents

4.0 SERVICES (MAINLY ELECTRICAL)

The extent of the works consist briefly of:

- (a) A new main switchboard.
- (b) Internal and external lighting services.
- (c) Sockets and power outlets.
- (d) Emergency lighting Services.
- (e) Fire Alarm Services.
- (f) Computer conduit, trunking & wiring.
- (g) Public Address Services
- (h) Connections between the existing school and the Hall.
- (i) Testing and Commissioning of the entire installation.

4.1 ELECTRICAL SUPPLY and MAIN DISTRIBUTION (Element 61)

The design parameters are defined by 'BS 60439', the 'ETCI National Rules for Electrical Installation' and ESB 'National Code of Practice for Customer Interface'.

4.1.1. Central Earthing.

4.1.1.1 The Contractor shall note that the:

- (i) The main water service, incoming fuel oil lines, all other piped services and ducting including metal conduits and trunking, all plumbing services and all exposed structural steelwork are to be effectively segregated or earth bonded which shall comply with the requirements of the E.T.C.I. 'NATIONAL RULES FOR ELECTRICAL INSTALLATIONS and ESB regulations.
- (ii) Earthing connectors to pipes etc. are to be done in a neat manner and are to be aesthetically acceptable, preferably in an area where student access is restricted/limited.
- (iii) The Contractor shall include for connecting 50sq. mm pvc/pvc earthing conductor copper cable from the main earthing terminal to each earth electrode.

- (iv) The Contractor shall include for connecting 50sq. mm pvc/pvc earthing conductor copper cable to any exposed structural steelwork.
- (v) The Contractor shall include for connecting a 25sq. mm pvc/pvc earthing copper cable from the main earthing terminal to the piped service installation.

4.1.2 Central and Local Switchgear

4.1.2.1 Main Distribution Board

The Main Switchboard shall be 'BS 60439' compliant, Type Tested Assembly (TTA) or Partially Type Tested Assembly (PTTA), floor mounted, 'Form 4A Type 2', metal clad type with standard metal 8mm triangular locks fitted and come with a Electronic Moulded case circuit breaker incomer. Electronic Lightning/Surge protection shall be provided on the incoming mains along with shunt trip facility via the Fireman Switch.

A Multi function meter with Modbus communication shall be installed in the main switchboard and shall be connected to the BMS for monitoring purposes. A min of 25% spare space capacity shall be provided.

- (ii) The Main Distribution Board shall conform to E.T.C.I. requirements for Custom Built Assemblies, and shall be supplied to the site pre-assembled by the manufacture or supplier.
- (iii) The new main board shall be erected as indicated on the drawing and as per attached schematic diagram. It shall consist of a sheet steel enclosed to minimum IP41 standard, which shall enclose all the necessary switchgear and components. Switchgear components shall consist of switch fuses, M.C.B.'s, E.L.C.B.'s etc. suitable for 'DIN' rail mounting.
- (iv) Switchgear shall conform to E.T.C.I. requirements for Custom Built Assemblies, and shall be supplied to the site pre-assembled by the manufacture or supplier.
- (v) Switchgear shall be Siemens, Brown Boveri, or equivalent.
- (vi) All fuse units shall be fitted with gauge rings and two spare fuses shall be provided for each

fuse size fitted. The Contractor shall leave the necessary tails for the E.S.B. meters and include for the necessary cabinets and trunking at the main distribution board. The fuse boards and M.C.B. boards shall be properly labelled showing the circuits and rooms severed in each case.

Tests

- (vii) The Contractor shall perform tests on the switchboard when it is substantially complete. The insulation resistance of the switchboard shall be checked with the feeder circuits isolated. The resistance shall be one megohm minimum. The Contractor shall perform one mechanical operational test on all switches and isolators. Final acceptance tests shall be witnessed by the Consulting Engineers.

Earthing

- (viii) The main switchboard shall be provided with an earth bar. This earth bar shall be attached to the main earth electrode in accordance with the clause on earthing in the ETCI and ESB regulations.
- (x) The contractor shall ensure that during the progress of the works the MDB is to be fully protected against the ingress of dust or moisture and that all live parts are adequately protected against inadvertent contact by unauthorised persons.

4.1.3. Surge Protection Equipment.

- 4.1.3.1** Surge Protection Equipment to be provided at main Distribution board. Surge Protection unit 3 phase 400V Class C to be provided.

4.1.4 Distribution Cabling.

Sub-mains circuits shall supply local General Service, Power and Lighting boards from the Main distribution board. Sub mains distribution within the building shall be via XLPE insulated, steel wire armoured, LSF sheathed cable on galvanised steel cable tray in the attic space. A separate CPC shall be installed with every sub-mains feed and should be of the size detailed in the distribution drawings. The armour of the cable should also be bonded at both ends to the distribution equipment by means of a nut and bolt through a tab linked to the earth bar.

4.1.4.1 Cables Associated with Main Distribution Board

- (i) The conductors in the conduits shall be P.V.C. cables to the Irish Standard 201 and 204 (I.M.E.C.) as issued by the I.I.R.S./Eolas and shall be of approved manufactured Cable sizes are to be in strict accordance with the schedule attached with a minimum of 1.5 sw. mm. and conduit capacities as set out in Appendix 12 of the I.E.E. Regulations recent Edition are not to be exceeded. There shall be no joints in conductors between terminal points of any run. In accordance with the E.T.C.I.'s National Rules for Electrical Installations, Third Edition, ET10-2000 Clause 5.1.4.32. the following shall be observed.

The new European harmonised core colour code for multi-core cables will be mandatory in new electrical installations certified on and from 1st April 2006.

The new three-phase core colours are brown, black and grey, with blue for neutral and green / yellow for the earth / protective conductor.

- (ii) A permanent notice shall be fixed by the Contractor at the meter or main fuse position stating that the core colour of the neutral is BLUE where the installation has been done in the new (alternative) colour scheme.
- (iii) Lighting flexible cords shall be of not less than 24/.02 mm Butyl Rubber insulated to BS4180. The flexible cords shall be coloured cream or white. Cable sizes are to be indicated on the plan as shown below:-

Lighting final circuits	2.5sq.mm. P.V.C.
Socket outlet final circuits	4.0sq.mm. P.V.C.
Under sink water heater	4.0sq.mm. P.V.C.
Boiler house Circuit	4.0sq.mm. P.V.C.
Water Boiler Circuit	6.0sq.mm. P.V.C.

Steel Wire Armoured Cables

- (iv) S.W.A cables are to be laid underground and shall be laid in trenches 750 mm deep. The bottom of the trenches are to be free from sharp stones. The cables are to be laid in 300 mm of fine sand and covered by a further 300 mm of fine sand before the trenches are closed in. Where cables are run on the surface walls they are to be secured by galvanised saddles spaced not less than 300 mm apart and secured by brass screws. Anthygron cables up, in or through walls are to be enclosed in conduit.

Anthygron cables surface mounted on walls below 5 m shall be enclosed in conduit. There are to be no underground joints on the cables. Correct type glands are to be used on the cables.

Conduits

- (V) All conduits are to be galvanised welded steel and shall conform to BSS 31 Class E for heavy gauge tubing and shall be of a standards manufactured by ASCM or approved equivalent standard. No tubing less than 16 mm outside diameter is to be used and any conduit considered unsatisfactory by the Architect or Electrical Engineer is to be removed and replaced without delay. The ends of every tube length, nipple or fitting are to be reamed and all threads are to be coated with aluminium paint after assemble. All box inlets shall be plugged or capped whilst awaiting further attachments and all open ends or conduit where entering distribution boards shall be protected unlike manner. Inspection fittings shall be provided at all elbows, normal bends and tees. Back entry elbows or tees shall be used where necessary so that all inspection covers are accessible without disturbing the plaster. All fittings shall be so installed as to permit rewiring inspection fittings shall be flush with the plaster and floor boards over conduit fittings shall be screwed in position. The conduit is to be completely erected before any wires are drawn in.
- (vi) Bell couplings are to be used where conduit runs are attached to trunking to ensure proper earth continuity.

Fixing Conduit & Fittings

- (vii) Surface conduit shall be all cases be run parallel to the walls and ceilings and shall be fixed by means of galvanised spacing saddles giving a clearance of 3 mm and displaced not more than 100 mm apart. All saddles are to be secured with rawl plugs or similar except where the surface necessitates wood plugs. Conduits buried in the plaster shall be secured by means of galvanised pipe hooks and where conduits are laid under flooring supported on joists care must be taken to ensure that the amount of cutting away required is kept to a minimum and no joists are to be notched without the prior consent of the Architect or Electrical Engineer. Brass round-headed screws are to be used for fixing conduit boxes.

Break Joint Rings

- (viii) Break joint rings are to be used on all conduit boxes and ceiling roses finished flush with the plaster.

4.1.4.2 Cabling Associated with Boiler House Panel

The contractor shall also allow for the wiring of the following components for boiler house controls both within the boiler house and through the extension. All motorised valves and room thermostats shall be individually wired back to the boiler house panel. The supply of same will be by others.

Control Panel (located in the main boiler house)

- Oil fired boiler and Burner unit.
- Shunt Pump and Associated Thermostats
- Heating Circulation pump (1 no.) - (1 no. Heating circuit individually controlled)
- 3 Port Motorised Diverting Valves
- Time clock control 7 day 24 hour (including Winter/ Summer time change)
- Room Thermostats
- Frost Thermostat
- Heat Dissipation Thermostat
- Holiday switch (to allow for the non-operation of the heating system but to maintain frost protection).

Remote panel (located in the science room)

- Control to operate heating
- Control 3 port motorised diverting valves throughout
- Summer Winter Switch
- Holiday / Override

4.1 POWER (ELEMENT 62)

The design parameters are defined within the ETCI National Rules for Electrical Installations.

4.2.1 General Power Outlets

All socket outlets shall be switched by MK metal clad surface or equivalent MEM or Legrand. All sockets are to comply with the Building Regulations Part M.

Under no circumstances are sockets to be installed in presses, under worktops or behind radiators. The Contractor should check the exact location of these prior to installing conduit etc.

4.2.2 Fixed Fused power outlet

Wall mounted fixed fused outlet shall be 13A duty complete with neon light of MK metal clad or equivalent MEM or Legrand.

Wall mounted fixed fused outlet suitable for external use, shall be 13A MK IP66 range or equivalent reference.

4.2.3 Supplies to Specialist Equipment

The contractor shall allow for the supply and installation of all electrical power supplies to all specialist equipment as detailed on the enquiry drawings.

4.2.4 Mechanical Plant & Control Wiring

The connections to mechanical plant shall consist of supplies to all mechanical services being installed under this contract which operate at 230V or 400V, as well as low voltage for control cabling.

The wiring in connection with mechanical services shall be in accordance with the system drawings.

4.2.5 Special Purpose Power Outlets (Computer Installation)

The areas as set out below are to be provided with power and data services for the installation of computer work stations.

Wall mounted fixed fused outlets shall be 13A duty complete with neon light of MK metal clad range or equivalent MEM Legrand or Crabtree.

Sockets shall be MK single socket outlets. Suitable for trunking installation 1978 WHI.

Data points shall be MK Single Computer Outlet. Suitable for trunking installation 1952 WHI.

Trunking shall be MK Prestige DADO Trunking without busbars, White in colour, size 210mm(H) x 60mm (D) fixed both horizontally and vertically to meet requirements and should be complete with associated corner parts, couplers, endcaps, etc fixing to wall should be in accordance with manufactures instructions.

4.2.6 Supplies to Services

These shall be wired in 4 sq. mm. P.V.C. cable in conduit in a ring main fashion as shown on the enquiry drawing. All sockets are to be located 500 mm above finished floor level or 300 mm above worktops.

The wiring for the sockets shall be carried out in 600/1000v PVC cable of size not less than 4 mm sq. 3 core enclosed in steel conduit and trunking.

Fixing Conduit & Fittings

Surface conduit shall in all cases be run parallel to the walls and ceilings and shall be fixed by means of galvanised spacing saddles giving a clearance of 3 mm and displaced not more than 100 mm apart. All saddles are to be secured with rawl plugs or similar except where the surface necessitates wood plugs. Conduits buried in the plaster shall be secured by means of galvanised pipe hooks and where conduits are laid under flooring supported on joists care must be taken to ensure that the amount of cutting away required is kept to a minimum and no joists are to be notched without the prior consent of the Architect or Electrical Engineer. Brass round-headed screws are to be used for fixing conduit boxes.

Break Joint Rings

Break joint rings are to be used on all conduit boxes and ceiling roses finished flush with the plaster.

The system requirements are as shown on the system drawings.

Final circuits shall be fed from local sub-distribution boards, as indicated on the system drawings.

4.2.7 Supplies to Equipment

Fixed outlets shall be positioned as indicated on the enquiry drawings and shall be 13A duty switched complete with neon light of metal clad range or equivalent MEM Legrand or Crabtree. Final connections to items of equipment shall be carried out in 2.5 sq. 3core flexible cable heat resistant type.

These shall be wired in 4 sq. mm. P.V.C. cable in conduit in a ring main fashion as shown on the enquiry drawing. All sockets are to be located 500 mm above finished floor level or 300 mm above worktops.

The wiring for the fixed outlets shall be carried out in 600/1000v PVC cable of size not less than 4 mm sq. 3 core enclosed in steel conduit and trunking.

The earth terminal on all sockets shall be connected to the earth terminal in the conduit box

4.2.8 Local Earthing and Bonding

All local bonding shall be carried out in 2.5sq. mm earthing copper cable conductor. The Contractor shall include for 3 N° earth rod and an earth lid inspection pit as furse type RB210 & PT100 respectively and all necessary bonds and clamps. The Contractor shall ensure that the entire building is adequately earthed and bonded.

4.2 LIGHTING (ELEMENT 63)

4.3.1. Primary Lighting

The design parameters are those defined in the Chartered Institute of Building Services Engineers lighting code and the Department of Education & Skills Guidelines.

The Contractor is to provide for all lamps and fittings as described in schedule of lighting points and circuits on drawing and as set out below.

Lighting to provide appropriate illumination is to be provided and shall be of the correct intensity and colour. All spaces including tank rooms, attic space etc. shall have artificial lighting.

Please refer to drawings E2 for the lighting details including layouts and quantity and type of fitting required.

The following outlines the expected Lux levels in each area.

Classrooms and teaching spaces	300lux at 700mm above FFL.
General Purpose Room	300lux at 1500mm above FFL.
Toilet and Storage Areas	120lux at 700mm above FFL.
Entrance and Circulation Areas	120lux at 700mm above FFL.
All other area	120lux at 700mm above FFL.

Lamps and Fittings

The lamps and fittings provided shall be suitable for the required use, be of good quality, robust and easily maintained.

The tube selection shall be based on the most energy efficient and economical solution not only at installation period but throughout the expect life of the installation.

The operation of lighting in each space shall be contained within that specific space. The position of the light fitting with in the specific space shall not give rise to shadows or glare

Lamps and fittings shall not be located so as to present health and safety difficulties in tube and fitting replacement.

Lighting Point Switches

Lighting switches throughout the installation shall be 10 Amp MK metal clad surface or equivalent MEM, Legrand or Crabtree and be complete with back box. All switches are to be surface mounted to the completed wall finish and back box.

Light switches to stores and similar areas are to be push type with auto time delayed release.

All switches are to be mounted 400mm from inside the doorway of the rooms served unless otherwise directed. The switches in classrooms, corridors, cloakrooms etc. unless otherwise indicated are to be mounted 1100mm above floor level.

4.3.2 Emergency Lights

An emergency lighting system shall be provided to the complete complex to cover circulation areas, internal rooms and all final exits.

The system will consist of self-contained non-maintained emergency lights, inverter pack within normal light fittings and exit signs. A test panel shall also be installed to enable the emergency lighting system to be checked out frequently.

The Contractor is to supply and install emergency lights as specified and shown on the enquiry drawings. These are to be wired in 2.5 sq. mm P.V.C. cable in conduit from an adjacent lighting circuit

4.3.3.5 Central Test Units

Emergency lighting central test units are to be located as per the enquiry drawings to enable the end-user to regularly test the system.

4.3.4 Lighting Equipment (Lighting Control)

4.3.4.1 An automatic lighting control system shall be provided in all areas, including toilets.

The lighting system shall comprise of Dimmable Control Daylight/movement Sensors, Auto/Off switches and Momentary switches. The switching arrangements shall be as follows:

A two gang colour coded light switch shall be provided for the main classroom and a single switch shall be provided for the toilet area. Each switch shall operate using an Auto/Off strategy.

If the switch is in the OFF position then the associated lights shall be off.

If the switch is in the ON position then the lights shall turn on to the required light level only if the detectors sense that the room is occupied AND the photocell sense that there is an inadequate lighting level in the room.

In the case of the classroom lights, the two rows of light fittings shall be controlled independently of each other.

There is a detector in the classrooms. This detector individually control all luminaires in the classroom.

The detectors shall operate with a ten minute delay, i.e. No movement in the room for ten minutes will result in the lighting being switched off.

The detector in the toilet area shall operate with a five minute delay, i.e. No movement in the room for five minutes will result in the lighting being switched off.

The light level sensors shall be programmed as follows:

- The Average working plane illumination levels as stated above shall be constantly maintained.

- Each sensor shall adjust the illumination levels of the lights / row of lights connected as required.
- Where day light levels are above the required illumination levels lights shall be switched off.

The light level hysteresis should be set to five minutes to prevent short cycling.

At each light switch a laminated label shall be installed by the Electrical Services Specialist that contains the following wording.

"Light switch to be switched off (switch up) when leaving the room (even if the lights are already off)".

The Electrical Services Specialist shall include for luminaires and switching within the attic space.

The Lighting system shall be commissioned, tested, and demonstrated to the Design team and the employer.

A testing and commissioning cert for the lighting controls, stating that each and every area has been commissioned to the above parameters shall be provided to the consultant engineer prior to handing over the building.

All circulation lighting shall be controlled automatically by daylight/absence sensors. Manual switches shall generally not be provided. However two 'Hand-Off-Auto' override switches shall be provided in or around the classroom 1 for control of the stairwell and circulation lighting.

Street/Area Lighting

The objective of the system is to provide sufficient lighting for safe movement of people outdoors.

The design parameters are outlined in CIBSE Lighting Guide: The Outdoor Environment and guidelines set out by the Department of Education and Skills.

The system shall be as outlined in the enquiry drawings, and shall consist of street lights, lantern type fittings in the vicinity of the

building entrance, and wall mounted fittings around the building perimeter. The external lighting shall be fed from the main switchboard.

External building perimeter lighting shall consist of wall mounted bulkhead fittings. Pole mounted fittings shall be provided for car park, roadway and pathways in the vicinity of the building.

Luminaires outside exit doors shall be complete with 3-hour emergency pack. Separate 24 hour 7 day timers shall be provided for the building perimeter and the car park lighting, with separate 'Hand-Off-Auto' switches in the administration office.

The building perimeter wall mounted fittings including those with 3-hour emergency packs shall not under any circumstance be connected to the internal building lighting circuit or internal building emergency lighting circuit. In the case of an emergency activation of the Fire alarm and / or the Intruder alarm system (as the two systems shall be linked) will activate the external lights. Under power failure all emergency lights shall activate. The tripping of a local MCB does not constitute an emergency.

4.4 COMMUNICATION SERVICES (Element 64)

4.4.1 Communication Services

4.4.2.1 Information Communication Technology

A networked Local Area Network (LAN) cabling system shall be installed for all habitable rooms in the building in accordance with the Department's brief documentation. The system shall comply with Category 6 enhanced UTP (CAT6)/Class E ISO 11801 (fast Ethernet) with outlets as indicated on the drawings.

A central Data Communications Centre (DCC) shall be provided where all data cabling shall be terminated. A 2000mm(h) x 800mm(w) x 600mm(d) cabinet shall be provided at this location for housing patch panels and active equipment. Data cabling shall be terminated in RJ45 outlets at both ends.

Power supply to each cabinet shall be via a separate MCB from the DCC to an industrial type plug and socket to IS/EN 60309, so as to eliminate the risk of nuisance tripping. A trailing lead from the plug shall be terminated in a switched spur in the cabinet which in turn connects to socket outlets. The number of socket outlets within the cabinets can be calculated by dividing the number of network points by twenty-four. At least two additional socket outlets shall be provided for expansion.

The Electrical Services Specialist shall be responsible for the provision of all cabling, outlets, RJ45 patch frames, device leads and patch leads. A Data Services Specialist shall be employed by the Electrical Services Specialist in order to install the cables, carry out all the final connections and commissioning of the system.

A separate telephone line from the service provider's main incoming termination frame to the DCC frame shall be provided for Internet (WAN) connection.

All data cabling shall be installed in a separate ELV compartment of the main LV trunking system and classroom points shall be installed on the dado trunking in the computer section.

Active computer network equipment (hubs, routers, switches, servers, UPS's) is outside the scope of the building contract.

The number of patch leads and device leads shall be 100% of the number of wired points.

4.4.2.3 Telephony

The PABX system and handsets will be supplied and installed by a separate Services Specialist. The Electrical Services Specialist shall provide for attendance to this Services Specialist. The ICT wiring system outlined above shall be utilised for the telephone system signalling. Separate telephone wiring will not be accepted in place of the Cat 6 cabling indicated above. The Electrical Services Specialist shall supply and install a 50 pair multicore telephone cable from the PABX to the telecom service provider's main incoming frame/box. Termination of this cable shall be carried out by the Electrical Services

Specialist at the frame end and by the
Services Specialist at the PABX end.

4.5 SECURITY & PROTECTIVE SERVICES (65)

4.5.1. Fire Alarm Services

The electrical contractor shall allow for the services of a specialist to supply, install, test and commission. Fire Alarm System for the Building.

Automatic Fire Detection Alarm Services;

General

The Fire Alarm and Detection Systems shall comply with the requirements of I.S.3218: 2009 "Code of Practice for Fire Detection and Alarm Systems for Buildings - System design, installation and servicing."

The systems shall comprise of addressable fire detection system type L2.

The Control Panels shall identify the exact location of each device, when activated and shall have the facility to give:

1. A staff alarm tone
2. A general alarm tone

The System shall be supplied by Firecrest Safety Systems Limited, Telephone (021) 487 6444, Fax (021) 487 6988 or similar to approval.

Control Panel

The proposed control panels shall each be an addressable Control Panel Model No.FC-ID3. They shall comply with EMC LVD directives. The Panels shall have a 2 line x 40 character backlit LCD display with membrane control switches; it shall allow up to 100 addresses per loop with each loop having its own processor.

Each Panel shall house the following features:

- 1 8 individual programmable outputs.
- 2 Full upload /download software package.
- 3 Alarm sensitivity and delay adjustments.
- 4 Panel Printer

It shall also have as standard the capability to operate/communicate the following:

A led mimic Panel.
Loop powered addressable sounders
Disability function pager
Disability function bedroom alert unit
A text repeater panel

Sounders

Sounders shall be surface type wired on minimum of two circuits. They shall be coloured red and be fully addressable.

Detection

All sensors on the main system shall comply with EN54 and have Loss Prevention Council Board (LPCB) approval. The sensors shall have a common base and an anti-removal facility.

Smoke Detectors

Sensors shall be analogue addressable low profile type Part No. FSS-751 using the photoelectric principle to measure smoke density and shall, on command from the Control Panel, send data to the Panel representing the analogue level of smoke density. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the Control Panel.

Heat Detectors

Heat sensors Part No. FSS-551 shall be grade 1 type using an electronic thermistor to measure thermal conditions. The thermistor network shall give a voltage output proportional to the external air temperature. The processed signal shall be transmitted to the Control Panel when polled.

Manual Call Unit

The call points Part FSS-700 shall be constructed of flame retardant plastic with clearly visible operating Legend provided on the glass.

They shall be suitable for surface or semi-flush mounting.

The Manual call points shall provide a dipswitch at the rear of the Unit for address setting. Visual indication of operation shall be by LED indicator.

Isolator Modules

Isolator modules shall be suitable for ceiling or wall mounting and shall be fitted approximately every 25 devices as to comply with I.S 3218. They shall not form part of the detector base but be a self-contained device.

Its operation shall be totally automatic and shall not be necessary to replace or reset after its normal operation.

Audio/Visual

Audio Visual Units will be installed where appropriate to their requirements. An Audio/Visual Unit Part No. FC-0002 shall be provided at the main entrance. It shall be weather resistant to IP65 and coloured Red.

I/O Units

I/O Units are to be provided for third party connections to interface with other systems as per the enquiry drawings.

Cable and Wiring

Fire Alarm cable shall be FP 200 ENHAN CED with red PVC sheeting. It shall have a minimum cross-sectional area of 1.5mm and greater if required. All inter-panel wiring shall be twisted pairs, fire-rated and mechanically protected. Suitable conduit boxes shall be used at each device.

Drawing Approvals and Supervision

The Contractor shall include for the provision by the fire alarm supplier of full "working" drawings and site supervision during the installation period.

Final Testing & Commissioning

The Contractor shall include for final testing and commissioning of the entire system by the specialist and shall be responsible for presenting

- (i) A Commissioning Certificate acceptable to the Client's Insurers, the Engineer and the Local Authority.
- (ii) A hardcopy print of each tested device.
- (iii) A hardcopy print of text installed.
- (iv) As installed drawings showing cable runs, device positions and address numbers as supplied by the specialist.

4.5.2 Security Installation

4.5.2.1 Intruder Alarm

The Electrical Services Specialist shall be responsible for supply and installation the intruder alarm system. The intruder alarm system shall comply with IS EN 50131.1 and the current Irish Standard IS. 228. All intruder alarm cabling shall be run in a separate galvanised steel conduit system.

Device quantities and locations are indicated on the system drawings. The system shall be linked to an appropriate monitoring station and operate on a sequential verification basis as required by the Garda Síochána. False

alarms shall be limited as outlined in the British Standard DD243:2004. Operation of the system shall meet the requirements of the "An Garda Síochána Policy on Monitored Intruder Alarms".

A separate phone line shall be provided for the alarm system to allow the line status to be monitored.

Panic attack pushbuttons shall be provided in the principal's and the administration office. Also wireless panic attack system shall be provided to provide protection in external play areas.

Activation of the intruder alarm system shall activate the building perimeter lights.

The intruder alarm system shall be linked to the Fire alarm system and CCTV system. The intruder alarm system shall have a dedicated Fire alarm input and indication.

The intruder alarm system shall be linked to a remote monitoring station. It shall be the Electrical Services Specialist responsibility to set up and maintain the monitoring station account for the first year of operation.

The intruder alarm system installer/commissioner must be a member of the NSAI Directory of Certified Intruder Alarm Installers.

Client Handover & Demonstration:

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

The hand over documents must include the following:

- (a) Certificate of demonstration to Contractor.
- (b) Certificate of demonstration to Employer's Representative.
- (c) Certificate of demonstration to Client.
- (d) Operation manuals.
- (e) Commission Certificate.

4.6 ELECTRICAL SITE SERVICES (Element 60)

4.6.1 Incoming Supply.

A single phase supply is to be provided at the main distribution board located where indicated on the enquiry drawings. Electrical Specialist to allow for all attendances associated with the provision of an electrical supply.

4.6.2 External Lighting

Allow for the supply and installation of wall mounted vandal proof external lighting including appropriate switching, necessary cabling and trunking.

4.6.2.1 Design plan quadrangle vandal proof light fitting and lamp. 38 watt or similar to approval

Type: CRQ382DLP Corner Unit

SECTION 5

GENERAL SPECIFICATION

The successful Electrical Contractor must ensure that all work undertaken and executed in this contract shall comply with all relevant statutory instruments and regulations current at the date of tender, and in particular the following:-

- (a) National Rules for Electrical Installations, ET101/1991 as issued by the Electro Technical Council of Ireland (ETCI) (latest edition including Amendments).
- (b) Code of Practice for the Design, Selection and Erection of Low Voltage Switchgear Assemblies as issued by the ETCI (latest edition including Amendments).
- (c) Irish Standard Specifications.
- (d) Factories (Electricity) Regulations 1972(including Amendments).
- (e) All relevant Acts of the Oireachtas.
- (f) Local Authority Requirements.
- (g) Regulations for Electrical Installations as issued by the Institution of Electrical Engineers (latest edition including Amendments).
- (h) British Standard Codes of Practice.
- (i) SI no. 138 of 1995 Codes of Safety, Health and Welfare at Work (Construction Regulations 1995)

All materials, plant, equipment and accessories supplied shall conform with one or all of the following Specifications as appropriate: -

- (a) Irish Standards Specification.
- (b) British Standards Specification.
- (c) I.E.. Publications.
- (d) V.D.E. Specifications.

Introduction

While the detailed project requirements are described within the general technical specification and drawings, the particular specification provides a description of the services installation and draws attention to particular elements of importance.

Where a contradiction exists between any of the tender documents, this should be addressed to the Employer's Representative during the tender period for clarification. If a contradiction is not identified during the tender process then it shall be at the discretion of the Employer's Representative to identify which document takes precedence.

Access

Where access may be required to any element of the services installation for maintenance proposes, the Electrical Services Specialist shall provide details to the Contractor and the Employer's Representative in the form of a marked up drawing prior to the installation of the services. The Electrical Services Specialist shall also inspect the electrical installation prior to the concealment of services to determine if any access points will be required where not previously identified.

The Electrical Services Specialist shall co-ordinate with the Mechanical Services Specialist to minimise duplication of access requirements.

In the event that an access requirement is not identified to the Employer's Representative prior to the installation of the Electrical services, and the Employer's Representative deems that the location of any services elements that require access are not in an appropriate location for visual or practical reasons, then the services element shall be re-located by the Electrical Services Specialist without charge to the contract.

Sample Installations

Distribution Route

Before any internal services are installed, the Electrical Services Specialist shall install a sample section of the main distribution route with a length of 3 meters. This section shall include the following:

- Electrical services trunking and tray
- Any electrical items to be fitted to services trunking and tray (e.g sensors, detectors, etc.).

by Mechanical Services Specialist

- Sections of each type of water pipework to be used on the project.
- Pipework brackets with appropriate insulation / pipework protection details.
- Drop rods to be trimmed and capped.
- Pipework insulation
- Pipework labelling, all pipes (neat, inline, clear)
- Typical joint detail for each type of pipe
- Pipework paint protection

5.1 MATERIALS

5.1.1 All materials used in the Contract and all of the work done shall be fully in accordance with the qualities and tolerances and all other requirements of the relevant Standards and Codes Practice.

5.1.2 The Contractor shall submit lists of alternative materials for approval at or shortly after the time of tender but he must allow in his tender for the inclusion of the specified materials and materials from nominated manufacturers.

5.2 PLANT

- 5.2.1** The Contractor shall provide for the delivery and erection of the plant on site except where otherwise specified together with all labour, tools, erection materials, scaffolding and instruments and all other apparatus necessary for the completion of the Contract.

5.3 STORAGE

- 5.3.1** All goods which are normally stored in the open shall be adequately protected from the weather and from all other damage. Materials which are not adequately protected shall be removed from site on receipt of instruction from the Consultants and replaced by new materials, all at the Contractor's expense.
- 5.3.2** The Contractor shall provide storage and working areas necessary for the smooth continuity of the works. Materials are not to be stored and preparatory work is not to be carried out within the building, without the express agreement of the Consultants.

5.4 SETTING OUT

- 5.4.1** The contractor shall set out the whole of the work and be responsible for the correct positioning of all equipment, bases, plinths and for any other builder's work which is necessary for the electrical contract. The exact courses of all cables, conduits etc. and other items of equipment shall be approved by the Consultant before erection. The Contractor will be liable for making good any work incorrectly carried out by him or by others due to an error on his part.

5.5 BUILDING PROTECTION

- 5.5.1** The Contractor shall be liable to make good any damage which he causes to the building structure or the finishes there of, to the satisfaction of Architect, Engineer and shall remove all rubbish, plant and unused material from the site on completion.

5.6 CABLING GENRALLY

5.6.1 Voltage Bands

Voltage bands to be considered for the purposes of this Specification are as follows: -

- a) Band 1 "Extra Low Voltage"
Not greater than 50V A.C. between phases or
between phase and earth.
- b) Band 2 "Low Voltage"
Not greater than 600V A.C. between phase
and earth and 1000V between phases.

5.6.2 Segregation of Circuits

5.6.2.1 There are three categories of circuits for the purposes of this Specification, namely: -

- a) Category 1: Low voltage circuits, other than fire alarm.
- b) Category 2: Extra low voltage circuits, other than Fire Alarm Circuits
- c) Category 3: Fire Alarm Circuits

5.6.2.2 There are four possible arrangements for segregation: -

- (a) Segregation by multi-compartment trunking, fire-resistant, for Category 3.
- (b) Segregation by separate conduit/trunking for all three categories.
- (c) All three categories in same enclosure provided that: -
 - (i) Categories 1 and 2 are insulated to the same voltage level.
 - (ii) Category 3 cables are mineral insulated type.
- (d) Categories 1 and 2 cables in same enclosure provided that they are insulated at the same voltage level.
- e) Category 3 cables in separate enclosure.

5.7 SWITCHGEAR ASSEMBLIES AND ENCLOSURES

5.7.1 General

5.7.1.1 Low voltage switchgear assemblies shall be either factory built assemblies (FBA) or custom built assemblies (CBA) as defined below. They shall conform with IEC 439 and ETCI Code of Practice for FBAs.

5.7.2 Factory Built Assemblies

- 5.7.2.1** An assembly constructed in compliance with a manufacturer's recognised type of system which has been type tested by a certifying authority in accordance with IEC 439.

5.7.3 Custom Built Assemblies

- 5.7.3.1** An assembly generally complying with IEC 439 but not type tested. Where CBAs are used the Contractor shall complete and submit to the Engineer a test certificate for the CBA.

5.7.4 Main Incoming Protective Device

- 5.7.4.1** Where the switchgear assembly is connected directly to the ESB supply the main incoming protective device should consist of: -
- (a) A current limiting switch/fuse having a prospective short circuit current of 40kA at 0.2 power factor.
 - (b) A circuit breaker having a rated short circuit current of 40kA at 0.2 P.F. with a short circuit performance category P2 in Accordance with IEC 157.1.
 - (c) The construction of such circuit breakers shall be such that the operating mechanism and contacts can be readily inspected.

5.7.5 Discrimination

- 5.7.5.1** Fuses and circuit breakers in series in a switchgear assembly shall discriminate fully against each other in the event of a fault.
- 5.7.5.2** The 'let-through' energy of the lower rated protective shall be less than the 're-arcing' energy of the higher rated protective device in all instances.
- 5.7.5.3** The Contractor shall be responsible for ensuring that the installed switchgear assembly affords discrimination throughout.

5.7.6 Back-Up Protection

- 5.7.6.1** Back-up protection shall be afforded to protective devices (e.g. over-loads MCBs) which cannot safely break the maximum prospective short circuit assembly.
- 5.7.6.2** Protection shall generally be by high breaking capacity current limiting fuses.

5.7.7 Air Circuit Breakers

- 5.7.7.1** Air circuit breakers shall comply with the requirements of IEC 157-1 and/or B.S. 4752 and VDE 0660.
- 5.7.7.2** They shall be totally enclosed in galvanised sheet steel and shall have an interlocking device on the door to prevent it being opened while the ACB is in the 'ON' position.
- 5.7.7.3** Each ACB shall have adjustable overcurrent and under voltage releases. Breaker contacts shall be silver and arc resisting alloy tipped and shall be encased in deionization arc shutes.
- 5.7.7.4** Each ACB shall have a short circuit breaking capacity of 25mVA for 1 second unless otherwise specified.

5.7.8 Moulded Case Circuit Breakers

- 5.7.8.1** MCCBs shall comply with the requirements of IEC 157-1 and/or BS 4752 and VDE 0660.
- 5.7.8.2** They shall be multi-pole of the quick make and break pattern and shall have integral fixed over current and magnetic release unless otherwise specified. The operating mechanism shall be a trip free, toggle mechanism and visible on/off and trip indication.
- 5.7.8.3** MCCBs shall be enclosed in a galvanised sheet steel or all insulated enclosure as specified elsewhere.

5.7.9 Fuse Links

- 5.7.9.1** Fuses shall comply with the following standards as appropriate:-
 - (i) VDE 0635 Diazed fuses
 - (ii) VDE 0636 Low voltage fuses
Diazed and knife type.
 - (iii) BS 88 Cartridge fuses.
 - (iv) BS 1361 Cartridge fuses Domestic type

(v) IEC Publication 269 Low voltage fuses

5.7.9.2 Diazed fuses shall be complete with screw cap, gauge ring, protection cover and fuse base. Fuses and gauge rings shall be colour coded as follows:-

<u>Current Rating</u>	<u>Colour Code</u>
2	Pink
4	Brown
6	Green
10	Red
16	Grey
20	Blue
25	Yellow

5.7.9.3 Diazed fuses shall be used up to 25 amp rating only for general application and shall be used up to 16A rating slow acting type for motive power circuits.

5.7.9.4 High rupturing capacity fuses shall be used for all other applications (e.g. main switch /fuse units, back-up protection, motive power, etc. and shall be complete with correctly sized fuse bases.

5.7.9.5 Fuse links for use in LV switchgear assemblies shall conform only one of the above standards. Mixed fuse links of various standards shall not be allowed.

5.7.9.6 Unless otherwise specified, the provision of 3 No. spare fuse links of each rating in the installation are to be allowed for, together with an NH fuse handle, gauge ring tool, etc. as appropriate. These are to be accommodated in a spare compartment of the main switchboard.

5.7.10 Miniature Circuit Breakers (MCB's):

5.7.10.1 MCBs shall comply with the B.S. 3871-Part 1 or VDE 0691 as appropriate.

5.7.10.2 MCBs shall incorporate both thermal overload protection by means of bi-metallic strips and short circuit protection by means of electro-magnetic solenoid.

5.7.10.3 MCBs shall have a trip free operating mechanism with visual on/off indication. Contacts shall be of the silver tungsten or silver graphite material complete with a deionising arching chamber and the whole

enclosed in a moulded case, suitable for DIN
rail fixing, or screw mounting as appropriate.

5.7.11 Residual Current Devices (RCD's)

- 5.7.11.1** Unless otherwise specified RCD's shall be of the residual current operating type and comply with B.S. 4293 or VDE 0664 as appropriate. Voltage operated ELCBs shall comply with B.S. 842.
- 5.7.11.2** RCD's shall incorporate a toroidal transformer for sensing earth leakage, a magnetically operated tripping mechanism, silver tipped contacts, a test facility and the whole enclosed in a non-tracking moulded case suitable for DIN rail fixing or separately mounted in an enclosure.
- 5.7.11.3** RCD's shall also have a trip free operating mechanism with visual on/off indication.
- 5.7.11.4** Unless otherwise specified ELCBs shall be designed to trip to currents of 30 milli amps, in two pole or four pole versions as required.
- 5.7.11.5** Switches shall be fault make load break with quick acting make and break contacts. All switches shall have a utilisation category switches AC23 The operating handle shall have a facility for padlocking in the off position and shall be visibly labelled On/Off.

5.7.12 Air-break Switches

- 5.7.12.1** Air-break switch shall be of the MEM range or equal and approved for normal application. Where the switch may be subject to dampness or corrosion it shall be an all insulated type to IP55 in accordance with IEC 144 type Brown Boveri Rotary Cam switch or equal and approved.

5.7.13 Conductors

- 5.7.13.1** Conductors shall comply with B.S. 5425, VDE 0660 and/or IEC 158-1, as appropriate.
- 5.7.13.2** Unless otherwise specified all contractors shall have a utilisation category AC3. They shall be suitable for operation on 220V A.C. and shall incorporate 3 or 4 pole silver tipped contacts which are removable for inspection, be suitable for adding on auxiliary contacts, have cable terminal screws with captive cable

clamps, and the whole housed in a non-tracking enclosure suitable for DIN rail or screw fixing as appropriate.

- 5.7.13.3** The conductors shall be full time rated, shall not overheat and be free from magnetic hum or chatter during operation.

5.7.14 Overload Relays

- 5.7.14.1** Overload relays shall comply with 85 4941, Part 1, VDE 0660 and/or IEC 292-1 as appropriate.

- 5.7.14.2** They shall be compatible with contactors in starters. They shall incorporate adjustable thermal elements for normal operation but where heavy starting currents are concerned saturable core current transformer protection is required. Overload relays shall incorporate a stop/reset button which when pressed will reset a tripped overload and open circuit the normally closed control contact. The mechanism shall be trip-free in operation.

5.7.15 Instruments

- 5.7.15.1** Instruments shall comply with BS 89 and IEC 51 as appropriate. They shall be of the moving iron type for ammeters and voltmeters, induction type for watt meters, etc. Unless otherwise specified instruments shall have class index of 1.5, be suitable for use on AC and be insulation tested to 2KV.

- 5.7.15.2** Instruments for use with transformers shall be such that full scale deflection can be achieved with the transformer ratio.

5.7.16 Current Transformers (CT)

- 5.7.16.1** Current transformers shall comply with BS 3938, VDE 0614 and/or IEC 185 as appropriate.

- 5.7.16.2** Current transformers shall be capable of withstanding the effects of short circuit currents.

- 5.7.16.3** The rated burden (VA) of CI's shall be greater than the sum of the burdens of connecting instruments and they should have the same accuracy class as the instruments connected to it. Provision shall be made for shorting the secondary side of CI's in the event of instruments being disconnected.

5.7.17 Busbars

- 5.7.17.1** Busbar trunking or busbars installed in a switch gear enclosure shall comply with IEC or equal.
- 5.7.17.2** The busbar system shall comprise rectangular busbars in parallel per phase depending on current rating of hard-drawn high conductivity copper mounted in purpose made carriers of glass fibre reinforced polyester material or equal, together with suitable clamps, high tensile steel bolts, nuts, washers and spring washers for tapping off main busbar system.
- 5.7.17.3** Unless otherwise specified the busbar system shall have a maximum prospective short circuit rating of 25 mVA for 1 sec.
- 5.7.17.4** The busbars shall be marked L1, L2, L3, N, E and coloured Red, Yellow, Blue, Black, Green/Yellow respectively.
- 5.7.17.5** Busbars installed in a switchboard shall be enclosed in a separate short circuit proof compartment having a degree of protection of IP20 in accordance with IEC 144.

5.7.18 Enclosure for F.B.A's

- 5.7.18.1** Switchgear enclosures shall be of zinc coated sheet steel, painted dove-grey to BS 694. The enclosures shall form a prefabricated free-standing self-supporting cubicle type FBA. The main incoming device shall be separated from the busbar section which shall be separated from the switchgear compartment by means of suitable short circuit proof barriers. The switchgear compartment shall be separated from the cable compartment by means of a dust and vermin proof barrier.
- 5.7.18.2** All compartments in the FBA shall be accessible from the front. Cubicle doors shall be hinged type with quick release catches and facility for interlocking door when relevant switch is in the "on" position. Doors shall be earthed to the main frame of the FBA by means of a flexible cable connection. All operating components of switchgear push buttons and instruments shall be fitted to

doors and suitable labelled. Doors shall be 14
SWG with side panels 16 SWG minimum.

5.7.19 Environmental Conditions

5.7.19.1 Unless otherwise specified the environmental conditions to which the FBA should withstand without damage to any of its components are as follows:

Ambient Air Temperature	+40 ⁰ c maximum +35 ⁰ c average over 24 hours - 5 ⁰ c minimum
Relative Humidity	90% at + 20 ⁰ c maximum.

5.7.20 Labelling

5.7.20.1 All equipment and components shall be labelled with Black on White trafolyte label screwed fixed to the panels.

5.7.20.2 Lettering shall be 6mm high for main components and 3mm high for control devices, indicators, etc.

5.7.20.3 Where components are wired to a terminal rail in an FBA they shall be labelled and cross referenced with the corresponding number on the terminal.

5.7.20.4 Warning labels shall be Red on White trafolyte type and similar in all other respects to the above.

5.7.21 Testing and Commissioning Certification

5.7.21.1 FBAs and BBA's shall be tested and certified in accordance with requirements of the ETCI Code of Practice for FBAs.

5.7.21.2 A type test certificate shall be provided for the Engineer's approval where an FBA is required.

5.7.21.3 Routine tests shall be carried out on all FBAs and CBAs before they are transported from the place of manufacture and witnessed by the Engineer.

5.7.22 Commissioning

5.7.22.1 FBAs and CBAs shall be commissioned when installed in accordance with the requirements of the ETCI Code of Practice for FBAs.

5.7.22.2 A dielectric test of between 1kV and 2.5 kV AC RMS for 1 minute shall be applied to all poles and earth of the FBA by the manufacturer upon installation by the contractor, and witnessed by the Engineer.

5.7.23 Sub-Distribution Boards

5.7.23.1 MCB sub-distribution boards shall be totally enclosed enamelled sheet steel type suitable for wall mounting with a minimum protection Class of IP54 to IEC 144.

5.7.23.2 Each MCB board shall be provided with its own hinged lid and integral load break switch.

5.7.23.3 MCBs shall comply with IEC 157 and shall be provided with un-adjustable bi-metallic trip for overload protection and instantaneous electro-magnetic trip for short circuit protection.

5.7.23.4 Distribution board shall incorporate 20% spare space for future circuits.

5.7.23.5 Sub-distribution boards shall have circuit identification chart in plastic holder containing the following information:-

5.7.23.6 MCB sub-distribution boards shall be totally enclosed enamelled

1. MCB No.
2. MCB rating
3. No. of points on circuit
4. Cable size
5. Location.

5.7.23.7 Each sub-distribution board chart shall be completed in full by the Electrical Contractor.

5.8 INSTALLATION OF CABLES

5.8.1 Cables Generally

5.8.1.1 Cables shall be installed in continuous unbroken length point to point. Under no circumstances will cable joints be allowed unless with the express permission of the Engineer.

5.8.1.2 All cables shall be protected against mechanical damage. Non-sheathed cables

shall be protected by enclosure in trunking and/or conduit. Sheathed cables shall be run and clipped so as to obviate the risk of damage in normal operation.

- 5.8.1.3** PVC insulated cables shall not be installed in locations where the ambient temperature is 0°C and lower or 65°C and higher.
- 5.8.1.4** The internal radius of installed cables shall not be less than the following:-
- | | |
|---------------------------------|-----|
| (i) PVC insulated cables | 3D |
| (ii) Armoured cables | 8D |
| (iii) Aluminium sheathed cables | 15D |
- 5.8.1.5** Mineral insulated copper sheathed cables 6D (where D is the outer diameter of the cable)
- 5.8.1.6** Sheathed and armoured cables shall be supported by approved proprietary cleats where surface fixed and the support spacing shall not exceed the following
- | | |
|----------------------|-----|
| (i) Sheathed cables | 20D |
| (ii) Armoured cables | 30D |
- 5.8.1.7** Cables shall not be buried in walls, floors or ceiling spaces unless they are enclosed in conduit or trunking or are suitably protected against corrosion and mechanical damage. Buried cables shall always be run either horizontally or vertically.
- 5.8.1.8** Where cables cross through floors, walls, etc. the hole shall be made good with cement or other suitable fire resisting material.
- 5.8.1.9** Cables shall be terminated in accordance with the manufacturer's instructions. Insulation of cable cores shall be brought up to the point of termination. All cores connected to proprietary terminal blocks shall be numbered using PVC sleeve numbers corresponding to the terminal number. Glanding of armoured cables shall be carried out such that earth continuity shall be retained between the cable and armour, gland and connected equipment. Where all insulated equipment is used the cable gland shall be complete with copper earthing tag which shall be electrically connected to an earth stud.
- 5.8.1.10** Cables buried in trenches shall be at least 600 mm below finished surface levels generally

and at least 750 mm below road levels and protected by PVC pipes under roads.

5.8.1.11 Cables shall be laid on a flat bed of 50 mm sand and covered with 50 mm sand before backfilling. Cable warning tape shall in all instances be laid approximately 300 mm below finished surface level. Interlocking cable warning covers complying with B.S. 2484 shall be laid as required by the Engineer. Cables entering a building shall be suitably sealed to prevent the ingress of moisture, gas, etc. Where cables may become subject to mechanical damage they shall be protected to a minimum of 450 mm above floor level by conduit/trunking or other suitable protection.

5.8.1.12 Cables in trenches shall be segregated from other services by the minimum distances given below:-

(i)	Low voltage and extra low voltage	450 mm
(ii)	Medium voltage and low voltage	300 mm
(iii)	Medium voltage and extra low voltage	600 mm
(iv)	Cables (MV LV ELV) and piped services (gas, water)	300 mm

5.8.1.13 Where the separation distances specified above are not feasible the Contractor shall obtain approval from the Engineer on the proposed method of segregation.

5.9. CABLE TYPES

5.9.1 PVC Insulated Cables

5.9.1.1 Cables for drawing-in to conduit or for laying in trunking shall be single core tinned high conductivity copper, PVC insulated 300/500V grade to BS 6004.

5.9.1.2 Black covering shall be supplied on all neutral cables with Red, Blue and Yellow coverings on all phase wires including strapping wired.

5.9.1.3 No cables shall be drawn into conduits until the complete conduit installation and boxes are fixed and until the plastering is finished and passed by the Engineer as sufficiently dry. No pull greater than 15 kg is to be exerted when drawing in cables and talc powder shall be plentifully used to give as easy a draw in as possible.

5.9.1.4 Except where specifically approved by the Engineer, separate services are to be installed

in separate conduit and trunking installations. The phase and neutral wire feeding particular circuits shall be run in the same conduit.

5.9.1.5 Final sub-circuits shall not run in the same conduit or trunking as main or sub-main circuits. Main circuits shall not run in the same conduit as sub-main circuits. Circuits of different voltages (phase to neutral) shall not be run in the same conduit and circuits carrying Alternating Current (AC) supplies shall not be run in the same conduit with DC supplies.

5.9.1.6 Each circuit shall be bound separately with binding tape at intervals of not more than 3m along the complete length of a trunking installation. Identification tags shall be provided for all cables at the same intervals and shall indicate the distribution board, switches etc. to which the circuit is connected.

5.9.1.7 PVC insulated cables installed in trunking should be arranged so that cables approximately equal to each other in size are run together. No cable of more than four sizes larger or smaller than a parallel cable may be run in the same trunking without the specific approval of the Engineer.

5.9.2 PVC PVC SWA PVC Cables

5.9.2.1 PVC insulated, PVC sheathed, steel wire armoured and covered PVC cable shall be 600/100 volt grade. Cable cores shall be high conductivity copper to B.S. 6360. They shall be insulated and sheathed with PVC to B.S. 6746, protected with galvanised steel wire armour to B.S. 1442 and sheathed with an outer covering of PVC to BS 6746 and the whole complying with B.S. 6346.

5.9.2.2 Cables shall be terminated by means of compression glands complying with B.S. 6121. Compression seals are to be used to protect the cable armour and sheathing in damp or high humidity areas. Compression type glands shall incorporate an earth bonding terminal. Under no circumstances should armouring be exposed at the compression gland.

5.9.3 Mineral Insulate Copper Sheathed Cables (MICS)

5.9.3.1 Mineral insulated copper sheath (MICS) cable shall be 600 volt (light duty) or 1000 volt (heavy duty) to B.S. 6207, Part 1. The duty

category shall be as specified in Part 3 of this Specification. Conductor shall be of a single strand high conductivity annealed copper insulated with highly compressed mineral substance and sheathed with a solid drawn tube of annealed copper, with an overall sheath of PVC.

5.9.3.2 Cables shall terminate using brass glands with cold type seals and neoprene insulation sleeves or tails with coloured sleeves for phases and switch wires and Black for neutral. Special care shall be taken to ensure that the mineral insulation has been fully removed from the conductors and the copper surface left clean before applying the sealing compound. Glands shall be of the ring type.

5.9.3.3 At all fittings, switches, plugs or other similar positions, standard B.E.S.A. galvanised boxes shall be used to which shall be fitted the Maker's standard sealing glands.

5.9.3.4 The whole of the sheathing of the cable system shall be electrically continuous across all joints and shall be fully earthed.

5.9.4 Protodur Cables (NYM-J)

5.9.4.1 Protodur cables shall be constructed in accordance with VDE 0250 and designated type NYM-J. The conductors of soft drawn copper (up to 10 sq. mm) are PVC insulated with an overall tough sheath of Protodur, 300/500 volt grade.

5.9.4.2 All cables contain an earth conductor coloured Green/Yellow. Phase conductors are colour coded in accordance with VDE specifications.

5.9.4.3 Protodur cables are suitable for surface installation in normal, wet or damp locations and for direct burial in walls with suitable mechanical protection but not for installation underground. Protodur cables shall not be installed where the ambient temperature is likely to exceed 25°C or drop below 0°C.

5.9.5 Flexible cords

5.9.5.1 Flexible cords shall have a PVC insulated copper conductors with PVC over-sheath of the 300/500V grade complying with B.S. 6500. They shall be twin, three, four or five core as required. Cores shall be colour coded as follows:

Green/Yellow (earth)
Brown Blue Black (4 core type)
with an additional Black core on 5 core types.

- 5.9.5.2** Flexible cords shall be installed where the ambient temperature is likely to exceed 55°C. Heat resistant PVC insulated flexible cords shall be installed where the ambient temperature is likely to reach 70°C (e.g. boiler house generally).

5.9.6 XLPE PVC SWA PVC Cables

- 5.9.6.1** Cables shall be of H.C. copper conductors to B.S. 6360, cross linked polyethylene (XPLE) insulated served with an extruded PVC bedding, single wire armoured and PVC over sheathed, the whole complying with B.S. 5467 : 1977.
- 5.9.6.2** Cables shall be terminated by means of compression glands complying with B.S. 6121. Compression seals are to be used to protect the cable armour and sheath in damp or wet locations with the gland covered by a PVC shroud. Cables are suitable for installation in ambient air temperature of 60°C and ambient underground temperature of 45°C.

5.9.7 EPR Insulated Cables

- 5.9.7.1** EPR (Ethylene Propylene Rubber) insulated cables shall be 600/100 V grade with H.C. copper conductors to B.S. 6360 and EPR insulation to B.S. 5469. EPR cables are suitable for installation in ambient temperatures up to 85°C.
- 5.9.7.2** Flexible cords for use up to 85°C shall have copper conductors with EPR insulation and CSP sheath and the whole complying with B.S. 6500.

5.9.8 Silicone Rubber Insulated Cables

- 5.9.8.1** Silicone rubber insulated cables shall be 300/500V grade with H.C. copper conductor and have an overall glass fibre braid. Cables shall comply with B.S. 6500 and shall be suitable for operation in ambient temperature of 145°C.

5.9.9 Instrumentation Cables

- 5.9.9.1** Instrumentation cables shall be 60/120V Grade with plain annealed stranded copper

conductors to BS 4109. Insulation and bedding shall be polythene to BS 6234 or PVC BS 6746, armouring, steel wire to BS 1442, or lead sheath to BS 801 and the whole sheathed with PVC to BS 6746 as appropriate. Cables shall comply with BS 5308, Part 1 or Part 2 as appropriate with multi core cables numbered along its length and multi pair cables colour coded to relevant BS specification. Cables for installation underground shall be of lead sheathed type only. Instrument cables specified above shall be suitable for operation in an ambient air temperature up to 70 Degrees Celsius.

5.9.10 Communication Cables

- 5.9.10.1** Communication cables shall have 0.5mm dia. nominal single tinned copper conductors, PVC insulated, PETP tape screen and PVC over sheathed for use indoors. Where cables are exposed, subject to mechanical damage or are buried in the ground they shall be further protected with single steel wire armour with a PVC over sheath. Communication cables shall comply with BS 4808 and IEC 189 as appropriate.

5.10 CONDUCTORS IN CONDUIT AND TRUNKING

- 5.10.1** Conductors shall be tinned high conductivity copper PVC insulated to BS 6004. Cable colour codes shall be in accordance with IEI Regulations.
- 5.10.2** All Conductors shall be stranded.
Conductors are to radiate from the fuseboard and no joints are to be permitted except at fittings.

5.11 CONDUIT

- 5.11.1** Galvanised steel conduit shall be heavy gauge solid drawn type complying with B.S. 4568 Class 4. The whole of the conduit system shall be completely erected and securely fixed before any cables are drawn in. Concealed conduit shall be fixed with crampets, exposed conduit shall be fixed with spacer bar saddles at 1200 mm centres.
- 5.11.2** Inspection boxes, draw in boxes, etc. shall be located so they remain accessible at all times.
- 5.11.3** The maximum number of cables installed in a conduit shall not be greater than that given in Appendix 12 of the IEE Regulations, Latest Edition. Cables shall occupy not more than 40% of the cross sectional area of a conduit.

- 5.11.4** The inner radius of a conduit bend must not be less than 6 times the outside diameter of the conduit.
- 5.11.5** Solid elbows and tees shall only be used directly behind accessories or lighting fittings.
- 5.11.6** All burrs shall be removed from the ends of conduits and outlets shall be brushed to prevent the possibility of damage to cables. Exposed conduit threads shall be painted with metallic paint.
- 5.11.7** Metal conduit is considered a protective conductor and so the whole of the conduit system shall be effectively bonded to earth.
- 5.11.8** Where alternating current circuits are concerned the phase and neutral conductors of a circuit must be drawn into the same conduit.
- 5.11.9** The metal conduit system shall be installed in such a manner that it cannot come into contact with piping of other services (e.g. gas, water). Where this is unavoidable all piped services shall be effectively bonded to earth.
- 5.11.10** The conduit installation shall be self-ventilating and drainage outlets (e.g. conduit box with hole drilled in base) shall be provided wherever condensation is likely to occur. Where the conduit system may be subject to ingress of moisture or corrosive vapours etc. all conduit boxes and accessories shall be provided with a PVC gasket.
- 5.11.11** Where conduits pass through floors, walls, etc. the holes shall be made good with cement or other suitable fire resisting material.
- 5.11.12** Conduits run on steel girders, purlins, etc. shall be securely fixed by means of proprietary clips (e.g. Fuse). Under no circumstances will drilling of steelwork be allowed.
- 5.11.13** Where conduit is run on fairfaced blockwork, accessories and saddles shall be fixed on the centre of the block, with vertical conduit drops run on the joint line of the blockwork.
- 5.11.14** The Contractor shall take the necessary steps to prevent the ingress of extraneous materials during the installation of a conduit system.
- 5.11.15** Conduit routes shall be agreed on site between the Engineer and the Contractor, as shall the position of draw-in boxes, etc.
- 5.11.16** Where the conduit system serves vibrating or moveable machinery the final connection shall be made using PVC covered flexible steel conduit conforming to B.S. 731 (type Kopex or equal and approved). Connection to rigid conduit system shall be by malleable iron conduit through box with earth stud or other accessory (e.g. isolator) as specified

elsewhere. An earth wire min. 2.5 sq. mm CSA shall be run in the flexible conduit connected between the conduit box/accessory and the item of equipment to be connected.

- 5.11.17** Flexible cables shall be installed with enough 'slack' to allow for free movement and/or vibration of equipment without unduly affecting the integrity of the rigid conduit system. Only proprietary fittings and accessories shall be used with the flexible conduit system

5.12 INSTALLATION OF PVC CONDUIT

- 5.12.1** The requirements of the above clause shall apply in principle to the installation of PVC conduit. PVC conduit shall not be installed where the ambient temperature is likely to exceed 65° C or drop below 0° C.
- 5.12.2** Accessories connected by PVC conduit which require to be earthed shall have a separate circuit protective conductor, routed back to the earth terminal of the associated distribution board.
- 5.12.3** Adequate allowance shall be made in PVC conduit installation to account for expansion and contraction of the conduit in normal operation. A small gap shall be left between each butting joint. On any particular run of conduit one joint shall be cemented and the other shall be greased or a proprietary jointing compound shall be applied to prevent the ingress of moisture.
- 5.12.4** PVC conduit and accessories shall comply with the requirements of B.S. 4607.

5.13 INSTALLATION OF STEEL TRUNKING

5.13.1 General

- 5.13.1.1** The conduit may be mechanically and electrically continuous throughout and earthed. The conduit shall be run as a loop-in system, with approved type draw-in boxes arranged between fittings, switches, etc., where the length between such points exceeds 9 M. Boxes shall be galvanised malleable iron or pressed steel and shall comply with B.S. 31:1940. No cable shall be inserted until all the conduits and boxes are fixed.
- 5.13.1.2** Conduits shall be firmly fixed with approved saddles to suit the location. The Engineer's approval to the type of finish in each location shall be secured when laying out the work.
- 5.13.1.3** Steel cable trunking shall be manufactured from hot dipped galvanised steel to B.S..

2989, 1975 and the whole manufactured to
B.S. 4678 Part 1, 1971.

- 5.13.1.4** Unless specified otherwise the minimum gauge of metal to be used shall be 1.2 mm for trunking up to 75 x 75 and 1.6 mm for larger sizes.
- 5.13.1.5** Trunking shall be supplied in 3m (nominal) lengths with inturned flanges for cover fixing and increased strength and rigidity. Covers shall be supplied in 1.5m (nominal) lengths and of equal CSA to the trunking. Covers shall be held by means of quick release fasteners.
- 5.13.1.6** Where trunking is fixed upside down on the horizontal cable retaining clips shall be installed at 1000 mm intervals.
- 5.13.1.7** Where vertical runs of trunking exceed 300mm in length, proprietary PVC coated steel cable retaining pins shall be installed around which cables shall be effectively harnessed.
- 5.13.1.8** Trunking lengths shall be coupled using galvanised steel couplers of equal gauge to the trunking together with a copper earth strap fixed outside the trunking. Coupling bolts and nuts shall be M6 pan head cadmium plated with the bolt heads fixed on the inner surface of the trunking.
- 5.13.1.9** Trunking fittings i.e. bends, tees, reducers etc. shall be of the same manufacture as the trunking and each joint made in the trunking shall be bridged by a copper earth strap. Cables in trunking shall not occupy more than 40% of the cross sectional area of the trunking and trunking shall be sized in accordance with Appendix 12 of the IEE Regulations, 15th Edition.
- 5.13.1.10** The whole of the trunking installation shall be run in a neat and workmanlike manner, which should be mechanically and electrically continuous throughout. The trunking installation should be completely erected before any cables are drawn in.
- 5.13.1.11** Trunking shall be fixed at not greater than 1200 mm centres by means of proprietary trunking brackets and M8 cadmium plated bolts, nuts and washers.

- 5.13.1.12** Where trunking passes through walls the whole shall be made good with cement or other suitable fire resisting material and fire barriers of glass wool or other suitable material shall be packed into the trunking and held compressed in position by means of a proprietary retaining plate or trunking lid.

5.13.2 Skirting Trunking

- 5.13.2.1** Skirting trunking shall be manufactured 1.2 mm zinc coated mild steel and supplied in 2000 mm lengths.
- 5.13.2.2** The nominal dimensions of the skirting trunking shall be 150 mm high by 40 mm deep. Trunking finish shall be dark admiralty grey to B.S. 381C Colour 632, unless otherwise specified.
- 5.13.2.3** Joints between trunking lengths shall be made with proprietary butt connectors, straight through or inside/outside right angles as appropriate, with each joint electrically bonded by means of copper earth straps.
- 5.13.2.4** Skirting trunking shall be two compartment with a small compartment at the top for communication wiring and the lower larger compartment for general service socket installation. Where socket outlets are installed on the skirting trunking, pre-punched socket plates shall be installed and effectively screw-fixed to the trunking.
- 5.13.2.5** Proprietary transitions units shall be used where skirting trunking is connected to under-floor trunking (e.g. where skirting trunking traverses a door opening).

5.13.3 Bench Trunking

- 5.13.3.1** Bench trunking shall be manufactured from 1.6 mm zinc coated mild steel and supplied in 2000 mm lengths. Covers shall be a 2 mm gauge and shall overlap bench trunking. Nominal dimensions of right angles shall be 90 x 90 mm. Trunking finish shall be dark admiralty grey to B.S. 381 Colour C632.
- 5.13.3.2** Joints between trunking lengths shall be made with proprietary butt connectors and each joint bonded by means of a copper earth strap.

- 5.13.3.3** Socket outlets shall be installed using proprietary pre-punched plates screw fixed to the trunking.

5.13.4 Flush Floor Trunking

- 5.13.4.1** Flush floor trunking shall be single or multi compartment as specified elsewhere and be manufactured from 1.6mm zinc coated mild steel and supplied in 2000mm lengths.
- 5.13.4.2** Trunking covers shall be one of the following which shall be specified as appropriate in Section D:-
- (a) 3mm zinc coated mild steel fixed by means of countersunk screws.
 - (b) 6.35 steel with anti-skid chequer plate pattern fixed by means of countersunk screws.
 - (c) 3mm zinc coated mild steel recessed into trunking to allow floor covering to be laid on trunking lid. Depth of such recess should be agreed to suit on site requirements
- 5.13.4.3** All above trunking covers are to be fitted with a neoprene cork gasket to prevent the ingress of dust etc.
- 5.13.4.4** Trunking joints shall be as described in C 9.3 above.
- 5.13.4.5** Trunking inspection boxes and service outlet boxes shall be manufactured from similar material to be trunking. Where multi compartment trunking is used boxes shall retain the segregation in all directions.
- 5.13.4.6** Service outlet boxes shall have provision for 4 No. outlets fixed to a pre-punched accessory mounting plate on 4 No. adjustable screws. Accessories for use with flush floor trunking shall be complete with hinged sprung covers.
- 5.13.4.7** Where flush floor trunking joints cable or skirting trunking, proprietary bell mouth accessories shall be used, with each joint effectively earthed as described in C 9.3.

5.13.5 Underfloor Trunking

5.13.5.1 Under floor trunking shall be manufactured from 1.6mm zinc coated mild steel with base plate welded up body to form a single unit.

5.13.5.2 Trunking shall be sized as follows depending on compartmentation:-

Single compartment	75mm wide
Twin compartment	150mm wide
Triple compartment	225mm wide

5.13.5.3 Trunking shall be supplied in 2000mm lengths and finished dark admiralty grey to BS 381C Colour C632. Jointing and earthing of trunking shall be as described in Clause C 9.3 above.

5.13.5.4 Trunking inspection boxes and service outlet boxes shall be manufactured from 1.6mm zinc coated sheet steel complete with cast aluminium frame with recess for the installation of floor covering. Depth of recess specified elsewhere. Frames shall have 4 No. adjustable screws for aligning with floor level. Service outlet boxes shall have a hinged cover with retractable lifting handle and have provision for installation of 4 No. accessories on pre-punched accessory mounting plate.

5.13.5.5 Full segregation of services shall be retained in the service outlet box in all directions.

5.13.5.6 Where floor pedestal outlet boxes are installed they shall be manufactured from zinc coated mild steel and be fitted with 1 1/2" conduit thread screwed spouts fixed to duct outlets in floor trunking.

5.13.6 Lighting Trunking

5.13.6.1 Lighting trunking shall be of similar manufacture to cable trunking except that it shall have a returned lip suitable for the suspension of luminaries. Lighting trunking shall be installed with lighting adapters comprising 20 mm bushing, inside clamp, outside clamp and 20 mm hexagonal locknuts, cable retaining straps, hanger brackets, suspension sets and white PVC clip-on lid.

5.13.6.2 Where lighting trunking joins cable trunking, proprietary transition adapters only shall be used.

- 5.13.6.3** Where lighting fittings are shown on the drawings fixed to trunking it shall be deemed that lighting trunking is required.

5.14. Installation of PVC Trunking

- 5.14.1** The requirements of Clause Installation of Steel Trunking - General, C 9, shall apply in principal to the installation of PVC trunking. Trunking shall be manufactured from high impact PVC, be resistant to corrosion and supplied in 3000 mm nominal lengths. PVC trunking shall be fixed at 1200 mm centres.
- 5.14.2** Accessories connected to PVC trunking which require to be earthed shall have a separate circuit protective conductor of equal cross sectional area to the corresponding phase conductor routed back to the associated distribution board.
- 5.14.3** PVC trunking shall not be installed where the ambient temperature is likely to exceed 65⁰C or fall below 0⁰C.
- 5.14.4** Adequate allowance shall be made in the PVC trunking installation to account for expansion and contraction of the trunking in normal operation. A small gap shall be left between each butting joint. On any particular run of trunking one joint shall be cemented and the other shall be grease or proprietary joint compound shall be applied to prevent the ingress of moisture.

5.15. Installation of Steel Cable Tray and Ladder

- 5.15.1** Cable trays and ladders shall be manufactured from hot dipped galvanised steel. Cable tray shall be used in sizes 150 mm, 225 mm and 300 mm as standard. They shall have a minimum of 1.5 mm gauge metal with return flanges on the sides supplied in lengths of 3000 mm. Only proprietary bends, tees, reducers, etc. shall be allowed with each joint bolted by means of M6 cadmium plated bolts, nuts and lock washers and a 10 sq. mm Green earth wire strapping each joint.
- 5.15.2** Unless otherwise detailed the manufacturer's support system shall be used as far as practicable. Cable tray/ladder shall be supported at 1500 mm intervals generally but the maximum deflection at mid-span shall not exceed 10 mm.
- 5.15.3** Cables shall be fixed to the tray/ladder in a neat and workmanlike manner using PVC cable ties. Where cables rise on a vertical tray/ladder they should also be individually clipped to the tray/ladder at 3000 mm intervals. Cables of 35 mm diameter or greater than be individually clipped to

the tray/ladder throughout their length using proprietary cable cleats.

- 5.15.4** Cable tray/ladder and accessories shall be as manufactured by Ellickson Engineering or equal and approved.

5.16 INSTALLATION OF PVC CABLE TRAY

- 5.16.1** PVC cable tray shall be manufactured from rigid plasticised PVC, chemically resistant, self-extinguishing, non-flammable. PVC tray shall not be used where the ambient temperature is likely to exceed 70°C or fall below -20°C.
- 5.16.2** Unless otherwise detailed the manufacture's support system shall be used as far as practicable. PVC tray shall be supported at 1500 mm intervals and shall be supplied in 300 mm lengths nominal.
- 5.16.3** Cables shall be fixed to the tray using PVC cable ties and they shall be installed in a neat and workmanlike manner.
- 5.16.4** Only proprietary bends, tees, reducers, jointing clamps etc. shall be used in the PVC tray installation.

5.17. EARTHING

- 5.17.1** All metal work adjacent to or pertaining to electrical equipment shall be earthed to the main electrode.
- 5.17.2** All trunking shall have a bare copper earthing wire inside it, which shall be bonded to it at intervals in addition to the earthing strap.
- 5.17.3** Where conduit is made off from trunking it shall be bonded to the trunking by an approved type of earth clip. Connections to all conduits or metal work measured from any point in the installation shall not exceed one ohm. All earthing shall comply with the "Regulations for Electrical Equipment for Buildings" - current edition.

5.18 LIGHTING INSTALLATION

5.18.1 Installation of Luminaries

- 5.18.1.1** Luminaires shall generally be installed in accordance with the manufacturer's instructions, or where none exist they shall be adequately supported to cater for the total weight of the luminaire and associated trunking etc. and shall be located such that adequate ventilation is maintained around the complete luminaire at all times.

- 5.18.1.2** All surface-mounted luminaries shall have pre-punched holes suitable for mounting directly to malleable cast iron circular B.S. conduit boxes.
- 5.18.1.3** Where luminaries are installed in modular false ceiling systems they shall be adequately supported on the false ceiling grid and further supported from the ceiling at two points by galvanised steel threaded rod, chromium plated chain or other suitable fixing to be approved by the Engineer.
- 5.18.1.4** Final connection to luminaries in false ceiling spaces shall be heat by resistance PVC flexible cable through ceiling mounted 2 Amp socket outlet and plug top suitable for fixing to circular conduit boxes B.S. 546.
- 5.18.1.5** Final termination within luminaries shall be shrouded with heat resistant sleeving
- 5.18.1.6** Connections to luminaries with Edison screw cap lamp holders shall be such that outer (screwed) contact is connected to the neutral conductor only.
- 5.18.1.7** Luminaries shall be effectively earthed to the circuit protective conductor. Where steel conduit is used as the protective conductor, the luminaire shall be earthed to an earth stud in the conduit box by 2.5 sq. mm Green PVC earth wire.
- 5.18.1.8** Where luminaries are subject to vibration the final connection shall be made using PVC flexible cable, also a protective chain shall be fixed between the luminaire and schedule of luminaries in conjunction with the normal fixing arrangement.

5.19 GENERAL SERVICE AND LIGHTING ACCESSORIES

5.19.1 Socket Outlets and Plugs

- 5.19.1.1** In general, socket outlets for use at 220V single phase shall be shuttered three-pin (two pole and earthing pin) to B.S. 1363 and corresponding plug tops shall be 13A fused.
- 5.19.1.2** Plugs and sockets for use at 400V shall comply with B.S. 4343 and CEE 17. Unless otherwise specified they shall be manufactured in high impact resistant plastic (polyamid 6) and be waterproofed to IP55 (IEC144).

5.19.1.3 Voltage identification colour coding shall be as follows:-

20/50V	Violet
40/50V	White
110/130V	Yellow
220/240V	Blue
300/400V	Red
500/750V	Black

5.19.2 Lighting Switches

5.19.2.1 Switches for the control of lighting circuits shall be quick make, slow break type connected in the phase wire. Metal plate switches shall be earthed. Where switches in a common enclosure are connected in different phases, insulated barriers shall be incorporated to segregate the phase, and an internal cover shall be provided marked 'DANGER 400V'.

5.19.3 Ceiling Roses

5.19.3.1 Ceiling roses shall be of porcelain with brass terminals including earthing terminal, with break joint ring where installed in plastered ceilings.

5.19.4 Lamp holders

5.19.4.1 Bayonet cap lamp holders shall be of heavy brass construction with brass terminals and plungers and porcelain base to B.S. 52.

5.19.4.2 Edison screw lamp holders for use-where the lamp rating is 200 w or greater or in ELV/DC systems shall be of similar construction to the bayonet cap type described to B.S. 5042 Part 2 and the central contact shall be connected to the phase side in primary lighting circuits or to the positive pole in secondary lighting circuits.

5.19.5 Lamps

5.19.5.1 Incandescent lamps shall be tungsten filament type to IEC 64. Fluorescent lamps shall comply with IEC 81 and control gear shall be manufactured and tested in accordance with B.S. 2818. Discharge lamps shall comply with IEC 188 (high pressure mercury lamps) and control gear shall be in accordance with B.S. 4782.

5.20 MOTOR STARTERS

5.20.1 Unless otherwise specified low voltage motor starts shall be direct on line up to 3.7 kW rating and automatic star/delta type for motors 3.7 kW and greater. Motor starters shall comply with the requirements of B.S. 587, B.S. 4941 and IEC 292.

5.20.2 They shall be provided with thermal overloads with single phasing protection and be of the manual reset type. Contractors shall comply with IEC 158 be of the double contact quick make and break and shall be to AC3 utilisation category unless otherwise specified. Contractor coils shall not overheat in continuous use and be designed so that they are free from hum and chatter in normal operation. Motor starters shall be enclosed in metal enclosures to IP44 unless otherwise specified.

5.21 Push Button Stations

5.21.1 Stop and Start push button stations shall be colour coded red and green respectively, flush mounted, oil tight, with front locking ring and integral legend plate (type telemechanique or equal and approved).

5.21.2 Push-button contacts shall be of the momentary contact type with spring return. Emergency stop push-button stations shall be of the latching type with large red mushroom head.

5.21.3 Indicating lights for the above shall be long life neon type colour coded as follows:

RUN	-	Green
STOP	-	Red
TRIP	-	Amber
OTHER	-	White, blue

5.21.4 Hand-off auto and duty standby switches shall be of the rotary type, selector or key switched as required with positive indication legend plate. All push buttons and selector switches shall be suitable for adding on extra contacts to the operating mechanism.

5.22 MOUNTING HEIGHTS

5.22.1 Unless specified otherwise, mounting heights for equipment and accessories shall be as follows - dimensions are to centre line of equipment:-

- (a) Socket outlets 450 mm AFFL or bench level as appropriate.
- (b) Lighting switches 1100 mm AFFL
- (c) Push button stations 1400 mm AFFL
- (d) Load break switches 1400 mm AFFL

- (e) Fused spur outlets to be agreed on site
- (f) Telephone outlets 450 mm AFFL
- (g) Clock outlets 300 mm below ceiling
- (h) Shaving sockets to be agreed on site
- (i) Fire alarm bell 3000 AFFL
- (j) FA Break glass units 1100 mm AFFL
- (k) Smoke detectors in area not more than 600 mm and not less than 25 mm below ceiling level.
- (l) Heat detectors in area not more than 150 mm below ceiling level and not less than 25 mm below ceiling level.

5.23 EARTHING, BONDING AND LIGHTING PROTECTION

5.23.1 General

The Contractor shall include for the complete earthing installation in accordance with the ETCI national rules for electrical installations and any other ESB requirements.

5.23.2 Earth Electrodes

5.23.2.1 Earth electrodes shall consist of high conductivity copper bonded steel earth rods of nominal 200 mm diameter with hardened steel driving tips and be of the extendible type.

5.23.2.2 Earth electrodes shall be driven vertically into the ground such that the top of the rod is below ground level. The earth electrode shall be covered with a galvanised steel box with reinforced lid engraved "earth electrode" the top of which shall align with the finished ground level.

5.23.2.3 Where more than one electrode is required to achieve the desired earth connection they shall be separated by a distance not less than the depth of the longest rod in the installation.

5.23.3 Earthing Lead

5.23.3.1 The earthing lead shall connect between the main earth electrode and the main earth bar of the associated main switchboard.

5.23.3.2 Unless specified otherwise this shall consist of a 70 sq. mm green/yellow PVC covered copper conductor which shall be terminated by means on non-ferrous high tensile clamp with appropriate nuts, bolts, spring washers, washers to a compression lugged cable end.

5.23.3.3 The earthing lead shall be provided with a factory made test claim within easy access of the earth electrode. The earthing leads shall be labelled **"Safety Electrical Earth - Do Not Remove"** with a metal engraved tap, lettering to be at least 4.5 mm high. Exposed sections of the earthing lead shall be protected by galvanised steel conduit.

5.23.4 Protective Conductor

5.23.4.1 The protective conductor shall consist of one or more of the following: -

- (a) Metal sheaths of armoured cables having a conductance not less than half that of the largest phase conductor.
- (b) Separate earth conductors in multicolour cables of equivalent cross sectional area as the phase conductors.
- (c) Single copper conductors in accordance with the following tables: -

CSA Phase Conductor Smm²

CSA Protective Conductor

S ≤ 16

S

16 ≤ S ≤ 35

16

S > 35

S/2

- (d) Metals parts of equipment and enclosures, steel conduit having the required conductivity for adequate protection.

5.23.5 Equipotential Bonding

5.23.5.1 Main bonding conductors are required at the intake positions of engineering services such as (gas pipes, water pipes HVAC, etc.). These shall be connected directly to the main earthing terminal, main bonding conductors shall consist of 10 sq. mm. Green/Yellow PVC covered copper cables unless specified otherwise. Local bonding conductors are required in bathrooms, at immersion groups, for water supplies to kitchen, etc.). These

shall consist of 2.5 sq.mm green/yellow PVC covered copper conductors connected to the local circuit protective conductor.

5.24 TESTING AND CERTIFICATION

The contractor shall provide, install and wire all of the items of equipment listed but commissioning and testing shall be done by the equipment suppliers. The Contractor shall allow for the commissioning charges in his tender price.

All relevant certificates and instruction manuals are to be made available to the client on completion of the installation.

5.24.1 Fire Alarm Installations

5.24.1.1 The fire alarm system shall be designed supplied installed tested and commissioned to IS 3218 and BS 5893 "code of practice on fire alarm systems" Type L1/L2/L3/L4 P1/P2/P3 as appropriate.

5.24.1.2 The fire alarm system shall comprise of multi ZONE fire alarm panel c/w, reset, zone/fault indication, (analogue addressable as specified) volt free contacts for connection to intruder alarm remote monitoring.

- (i) Break Glass Units at Exits
- (ii) Sounders, 65, dBA at all points or 5 dBA above
- (iii) background ambient noise.75 dBA in sleeping accommodation.
- (iv) Smoke Detectors, (Ionisation/Optical) on escape routes, high risk areas, rooms leading off escape routes.
- (v) Heat detectors, (fixed temp, rate-of-rise) in kitchen, boiler house.

5.24.1.3 Wiring shall be carried out using: 2X 1.5mm. sq. mics cable (surface), or 2X 2 x 1.5mm. sq. Pirelli FP2000 cable (concealed) with low smoke and fume (LSF) outer Sheath.

5.25 EMERGENCY LIGHTING INSTALLATION

5.25.1 The emergency lighting installation shall be designed, installed code of practice for Emergency lighting tested and commissioned to IS 3217 and BS 5266.

5.25.2 The emergency lighting system shall comprise of:

5.25.2.1 Appropriate luminaries complete with integral emergency pack as specified in the Scope of Work section of this document

- 5.25.2.2** Wiring shall be carried out using 3X 1.5mm sq PVC/cu conductor in steel conduit controlled by an emergency lighting test unit, connected to lighting sub distribution board through multi pole relay (see encl. standard detail).

5.26 HAZARDOUS AREA INSTALLATIONS

- 5.26.1** For the purposes of this specification electrical installations in potentially explosive atmospheres which will be considered are as follows:-

- 5.26.1.1** Zone 1 areas with Group II gases and vapours.

- 5.26.1.2** Zone 2 area.

Equipment which will be considered for the above areas are as follows:-

Flameproof (EEx)d
Increased Safety (EEx)e
Intrinsic Safety (EEx)Ib

5.26.2 Definitions

Zone 0 Area:

An area in which an explosive gas / air mixture is likely to occur in normal operation.

Zone 1 Area:

An area in which an explosive gas / air mixture is Not likely to occur or will occur only for short periods of time in normal operation.

Gas 11 Gas/Vapour:

Gases and vapours found in surface industries.
Group 11 gases may be subdivided into the following:-

Group 11A	(inc. petroleum and propane)
Group 11B	(inc. butadiene)
Group 11C	(inc. hydrogen)

5.26.3 Flameproof (EEx)d enclosure

An electrical enclosure in which an internal explosion due to an explosive atmosphere shall have no detrimental effect on the enclosure and shall prevent the transmission of the explosion to the surrounding atmosphere.

5.26.4 Increases Safety (EEx)e enclosure

5.26.4.1 An electrical enclosure, the construction and design of which prevents the occurrence of arcs and sparks in and around the enclosure in normal service.

5.26.5 Intrinsic Safety (EEx)ib

5.26.5.1 Enclosure and circuits. Circuits and associated enclosures the design of which is incapable of producing arcs or sparks likely to cause an explosive condition. (EEx)ib enclosures are suitable for Zones 1 and 2 areas only.

5.26.6. Maximum Surface Temperature

5.26.6.1 The maximum temperature which can safely be attained by an item of apparatus under the most onerous conditions without causing an explosive atmosphere.

5.26.7 Regulations and Standards

5.26.7.1 In addition to clause 2.1 the regulations and standards which specifically relate to electrical installations in potentially explosive atmospheres and which shall be complied with in all respects, are as follows :-

- a) Guide to the selection of Electrical Equipment for use in potentially explosive atmosphere as issued by the Electro technical council of Ireland (latest edition).
- b) National rules for electrical installations in potentially explosive atmospheres, as issued by the Electro technical council of Ireland (latest edition).
- c) CENELEC Standards EN 50.014 - EN 50.020
- d) Irish Standards IS 231 - IS 237
- e) IEC Standards 79 - 79.12
- f) British Standards BS 5345 Part 1-12 (CP 1003) code of practice for the selection installation and maintenance of electrical equipment.

5.26.8 Marking of Equipment and Accessories

5.26.8.1 All equipment and accessories for use in potentially explosive atmospheres shall be

engraved in accordance with IS 231 (EN 50014) section V. Markings shall consist of the following :-

a) Type of Electrical Equipment

Flameproof (EEx)d
Increased Safety (EEx)e
Intrinsic Safety (EEx)ib

b) Gas Vapour Group

Group IIA of which may only be used in Group IIA locations.

Group IIB of which may also be used in Group IIB locations.

Group IIC of which may only be used in Group IIC locations.

c) Temperature Class

For Group II equipment there are six temperature classes to which the maximum surface temperature of the equipment may safely attain under all conditions These are as follows :-

Temperature Class	Maximum Surface Temperature of Electrical Equipment
T1	450 °C
T2	300 °C
T3	200 °C
T4	125 °C
T5	100 °C
T6	85 °C

d) Degree of protection against the ingress of dust and water, namely IP rating in accordance with IEC 144 unless stated otherwise all equipment shall have a degree of protection to IP44 or higher.

e) Manufacturers name, serial number and reference testing organisations approvals.

5.26.9 Cables for Use in Explosive Atmospheres

5.26.9.1 Cables for fixed wiring which may be used are summarised below:

a) PVC insulated cables in galvanised steel conduit to BS 6346 with

flameproof glands and PCP protective shrouds.

- b) PVC PVC SWA PVC cables to BS 5467 with flameproof glands and PCP protective shrouds.
- c) XLPE PVC SWA PVC cable to BS 5467 with flameproof glands and PCP protective shrouds.
- d) Mineral insulated copper sheathed cable with or without PVC sheath to BS 6207 with flameproof glands.

5.26.9.2 Flexible cables which may be used are as follows

- a) Cables having an ethylene propylene rubber (ERP) insulation chlorosulphonated sheath (CSP) galv. steel wire armoured braid and PVC outer insulation all to BS 6883 "Elastomeric" insulated cables for fixed wiring on ships. These cables are classified as Heat Oil and Flame Retardant type (HOFR). They should only be used with appropriate flameproof glands and PCP protective shrouds.
- b) Unless stated otherwise flexible cables shall have a minimum cross sectional area of 2.5 sq mm in all cases.

5.26.10 Rotating Electrical Machines in Potentially Explosive Atmospheres

5.26.10.1 Rotating electrical machines for use in potentially explosive atmospheres shall be suitable for their environment and marked in accordance with above. Particular attention should be paid to the temperature class of the machine and stringent measures shall be taken to ensure that the machine does not exceed the critical temperature during overload or fault conditions.

5.26.10.2 Protective devices which may be used are as follows:-

- a) Current dependent time-lag tripping devices on all phases which are set to the rated current of the machine in and will operate within two hours (2h) with overload condition of 1.05 and 1.2

times rated current and also giving
single phasing protection

- b) Where machines are protected by thermistors only the associated tripping device shall be of a certified type.
- c) Where motors incorporate star/delta starting facilities the overload relays shall be set to 0.58 times the rated current of the motor.

5.26.11 Testing and Inspection

5.26.11.1 In addition to the testing of the electrical installation as required by above, the contractor shall carry out a visual inspection of the completed installation with particular regard to the following:-

- a) Suitability of equipment, apparatus and accessories for the area classification (Zone). Gas Group IIA, IIB, IIC and temperature classification (T1 - T6).
- b) Possible damage to any part of the installation which would negate the effectiveness of the installation to the particular explosive atmosphere.
- c) Ensure all unused entries and equipment are sealed with flameproof stop ends.
- d) Choice and setting of protective devices of rotating machinery and also polarity and phase rotation.
- e) Identification and labelling of all isolating switches and controlling devices.

5.26.11.2 Where the Contractors normal practice conflicts with any item contained in the Specification or drawings, attention of this should be drawn to the engineer for consideration. If no such approach is made, it will be deemed that the Contractors tender reflects the exact requirements of the Specification and drawings and the installation will be carried out accordingly. The client does not bind himself or accept the lowest of any tender.

5.27 IT /DATA CABLES INSTALLATION

5.27.1 Generally

- 5.27.1.1** All cables shall be installed on cable tray or in trunking. The installation shall be flush and concealed.
- 5.27.1.2** All outlets shall be shuttered RJ45 sockets mounted on white face plates.
- 5.27.1.3** All outlets shall be connected to a 4 Pair shielded twisted pair Cat 5E L.S.F. cable (U.T.P) wired directly back to a RJ45 Patch Panel.
- 5.27.1.4** Each cable will be terminated using 4 Pairs, accordingly to the EIA/TIA 568 Standard.
- 5.27.1.5** To comply with the cabling system design, the final length of any cable shall not exceed 90 metres.
- 5.27.1.6** All outlets shall have an identification number of both face plate and patch panel location.
- 5.27.1.7** The data wiring shall be terminated to the 258A spec. shall be as follows:
- 1- white/orange
 - 2- orange
 - 3 - white/green
 - 4- blue
 - 5 - white/blue
 - 6- green
 - 7 - white/brown
 - 8 - brown
- 5.27.1.8** The labelling system shall be FX/999 where F indicates the floor, X represents whether Voice (V) or data (D) and 99 indicates the actual workstation point, e.g. (2nd floor, data cable outlet no 75 - 2D75).
- 5.27.1.9** The data cable shall be tested for correct termination, line mapping impedance and length. All results shall be recorded. It shall be required that 10% of the cables be chosen at random and given a full comprehensive test for line mapping, d.c. loop resistance, impulse noise, impedance and length. A full TDR printout shall also be required for permanent records.
- 5.27.1.10** The labelling system shall be sequential.

5.27.1.11 The termination of the patch panel shall be sequential.

5.27.1.12 A detailed map shall be supplied outlining all the finished outlets together with their labelled addresses

5.28 M.I.C.S. CABLES

5.28.1 Mineral insulated copper sheathed cable shall be of the heavy duty 1000 Volt Grade with seamless copper sheath, mineral insulation and high conductivity copper conductors. PVC over sheath shall be used in certain areas.

5.28.2 The whole of the wiring shall be carried out in strict accordance with the makers instructions and to the approval of the Engineers. The makers cold sealing technique is to be used throughout, special care being taken to ensure that the mineral insulation has been fully removed from the conductors and the copper surface left clean before applying the sealing compound. Glands shall be of the ring type.

5.29 BRACKETS AND SUPPORTS

5.29.1 All brackets, supports and fixings shall be supplied and erected by the electrical Contractor. He shall ensure that the electrical fixtures, trunking and conduit runs do not conflict with other building services.

5.30 MECHANICAL WORK

5.30.1 The Contractor shall liaise with the Mechanical Subcontractor and advise his operatives when the installation shall be regarded as **live**.

5.31 PROTECTION OF THE INSTALLATION AGAINST DAMAGE

5.31.1 The contractor is to take all necessary precautions to protect the installation against damage from any cause including frost up to the time the building is handed over to the school manager.

5.32 COMPLETION

5.32.1 The Contractor shall complete the work in strict accordance with the specification and drawings, apart from any authorised variations and shall leave same in working order to the entire satisfaction of the Architect or Heating Engineer within the period of the building contract.

5.33 OPERATING INSTRUCTIONS

5.33.1 The Contractor shall allow for operating the complete works under full working conditions and for instructing the person nominated by the Employer

- 5.33.2** The employers staff shall be instructed in the correct and most efficient manner for operating installation for a period of one week. He shall give instruction on the maintenance of the plant and equipment etc., including handing over drawings, charts etc., showing cabling as fitted,
- 5.33.3** No oil fired, gas fired or electrically driven equipment supplied or installed under this contract shall be started up without the suppliers commissioning staff present and then only on their instruction.
- 5.33.4** Storage and transport of gas bottles for welding and purging shall be in accordance with Safety Regulations.
- 5.33.5** All hot work shall be properly planned, and protective blankets and fire extinguishers shall be to hand.
- 5.33.6** No work shall take place in confined or stagnant air areas until adequate temporary ventilation has been put in place. Any area in which gas may collect shall be checked with portable gas detector, and confirmed safe before any work takes place.

5.34 ESB NETWORKS

- 5.34.1** The Contractor shall be responsible for necessary liaising with ESB Networks including meeting their specified requirements.

5.35 PAINTING

- 5.35.1** All hanger, supports, steelwork etc., unless galvanised shall be thoroughly wire brushed and given one priming, one flat and one gloss coat of heat resisting paint.
- 5.35.2** All plant items in boiler house, tank room etc., shall be repainted as directed.

5.36 LABELS AND IDENTIFICATION

- 5.36.1** The Contractor shall include in this tender for the supply and installation of suitable engraved plastic labels with 5 mm high lettering. All control panels, switchgear, fuse boards, isolators shall be labelled with this type of lettering and individual fuseways shall be labelled with heavy white card labels with typed lettering. The labels shall be securely fixed by self-tapping screws.

5.37 SPARES AND TOOLS

- 5.37.1** A list of recommended spares obtained from the various plant suppliers shall be supplied not later than the physical completion date for the plant.

- 5.37.2** All tools necessary for operation and maintenance of the plant shall be supplied to the Client not later than the termination of the maintenance period.
- 5.37.3** The Contractor shall also supply as part of this Contract any special tools or appliances necessary for easy dismantling and re-assembly of the equipment.

5.38 SCHEDULE AND CHARTS

- 5.38.1** Schedules and charts of all equipment and valves shall be provided in the boiler room or elsewhere as may be directed. These shall be mounted in a glazed hardwood framed display along with a diagrammatic or similar drawing of the complete installation.

5.39 OPERATING & MAINTENANCE MANUALS

- 5.39.1** The Electrical contractor shall produce the Operating & Maintenance Manuals and hand 1no. copy to the Engineer for comment within 14 days of the handover of the project. This copy will be returned with comments and the electrical contractor shall correct the Manual and resubmit the corrected copy of the Manual to the Engineer within 7 days.
- 5.39.2** The electrical contractor shall submit to the Engineer 2no. copies of the corrected information for distribution to the relevant parties.
- 5.39.3** The contents of the Manual shall be in a logical sequence, each section being indexed for easy reference.
- 5.39.4** The Manual shall be fully indexed and the whole contained ring binder format of good quality.
- 5.39.5** The Manual shall include the following sections:-
- (i). Introduction
 - (ii). General Description of Systems
 - (iii). Design and Performance
 - (iv). Technical Data
 - (v). General Operation & Maintenance Notes, including Operation of Controls
 - (vi). Procedure for Operating & Maintenance
 - (vii). Emergency Procedures
 - (viii). Fault Tracing
 - (ix). Maintenance Schedules and Recommended Interval Periods
 - (x). Commissioning Reports
 - (xi). Spares
 - (xii). Test Certificates
 - (xiii). Manufacturer's Literature and Schedule of Equipment
 - (xiv). As Built Drawings
- (i). **Introduction:**

This shall include the preamble, together with a list of abbreviations and a schedule of record drawings. A list of contact names and addresses of installers and other 'helpful' companies or authorities are to be included.

(ii). **General Description of Works:**

A full description of the whole system together with schematic sketches to enhance the explanatory notes. This section should be written in a form that could be easily understood by non-technical persons.

(iii). **Design and Performance:**

This shall show full details of equipment performance, together with the design operation temperatures

(iv). **Technical Data:**

This shall identify the technical data for each item of equipment.

(v). **General Operations & Maintenance Notes:**

This section shall indicate measuring techniques and necessary equipment to check the equipment performance on a periodical basis. This section shall also give safety precautions, planned maintenance and equipment log.

(vi). **Procedure for Operating & Maintenance:**

(vii). **Emergency Procedure:**

This section shall demonstrate isolation procedures of all equipment, together with all First Aid actions.

(viii). **Fault Tracing:**

A general description of how to locate faults with the equipment, including a description of fault diagnostic systems of individual systems.

(ix) **Maintenance Schedules and Recommended Interval Periods:**

This section shall give frequencies of inspection, lubrication, adjustment, replacements, overhaul, together with log sheets which shall have the headings date, details, action taken, signature'.

(x). **Commissioning Reports:**

Within this section shall be placed copies of all the commissioning and test results.

(xi). **Spares:**

This section shall list all the spares recommended by the equipment manufacturers.

(xii). **Test Certificates:**

This section shall contain all the test certificates as detailed within this specification

(xiii). **Valve Charts:**

If applicable to the project, this section shall contain the valve charts and schedules.

(xiv). **Manufacturer's Literature:**

This section shall contain all manufacturer's literature applicable to the installation

(xv). **As Built Drawings:**

All "As Built" drawings shall be placed in this section

SECTION 6

SCHEDULE OF DRAWINGS

ELECTRICAL SERVICES DRAWINGS

- E1 POWER & GENERAL SERVICES
- E2 LIGHTING SERVICES
- E3 PROTECTIVE SERVICES
- E4 ELECTRICAL SITE SERVICES

SECTION 7

SCHEDULE OF PRICES

ITEM	DESCRIPTION	€ / c
7.1	Electrical Supply and Main Distribution (Element 61))	
1.	Amount for the supply and installation of the sub distribution board.	
2.	Amount for remedial works to the existing main distribution board to facilitate the new science labs.	
3.	Amount for the supply and installation of the complete cabling to the distribution boards.	
4.	Amount for the supply and installation of individual electrical meters to science labs.	
5.	Amount for the earthing of the entire installation.	
6.	Amount for the supply and installation of the power surge equipment.	
7.	Amount to be included for containment associated with the distribution installation.	
	Total for Electrical Supply and Main Distribution To Summary	

ITEM	DESCRIPTION	€ / c
7.2	Power Services (Element 62)	
1.	Amount for the supply and installation of complete sockets outlets.	
2.	Amount for the supply and installation of complete pedestal sockets outlets at benches.	
3.	Amount for the supply and installation of complete fused spur outlets.	
4.	Amount for the supply and installation of workstations.	
5.	Amount for the supply and installation of data points.	
6.	Amount for the supply and installation of complete pedestal data points at benches.	
7.	Amount for the supply and installation of main distribution facilities as per drawings.	
8.	Amount for the supply and installation of wiring for gas services.	
9.	Amount for the supply and installation of wiring for intruder alarm services.	
10.	Amount for the supply and installation of timeclocks and power outlets to undersink water heaters.	
11.	Amount for linking off all services back to the original school block.	
12.	Amount for wiring of all mechanical plant.	
13.	Amount for wiring of all boiler house controls.	
14.	Amount to be included for all containment associated with the power services installation.	
	Total for Power Services To Summary	

ITEM	DESCRIPTION	€ / c
7.3	Lighting Services (Element 63)	
1.	Amount for the supply and installation of complete primary lighting.	
2.	Amount for the supply and installation of complete feature lighting.	
3.	Amount for the supply and complete external lighting.	
4.	Amount for the supply and installation of emergency lighting.	
5.	Amount to be included for emergency lighting central test units.	
6.	Amount for the supply and installation of complete switching.	
7.	Amount for the supply and installation of complete lighting controls.	
8.	Amount to be included for all containment associated with the complete lighting installation.	
	Total for Lighting Services To Summary	

ITEM	DESCRIPTION	€ / c
7.4	Communication Services (Element 64)	
1.	Amount for the supply and installation of telephone system including linking back to the existing system.	
2.	Amount for the installation of IT Services including linking back to the existing system.	
3.	Amount for the installation of P.A. Services including linking back to the existing system.	
	Total for Communication Services to Summary	

ITEM	DESCRIPTION	€ / c
7.5	Security & Protective Services (Element 65)	
1.	Amount for the supply and installation of complete Fire Alarm System including linking back to the existing system.	
2.	Amount for the supply and installation of intruder alarm services including linking back to the existing system.	
3.	Amount to be included for the monitoring of the fire alarm and intruder alarm services	
	Total for Protection to Summary	

ITEM	DESCRIPTION	€ / c
7.6 INDIRECT COSTS		
	Preliminaries	
1.	Amount for the provision of contractor's plant and equipment.	
2.	Amount for the provision of contractor set up including offices, stores, etc. as deemed necessary by the contractor.	
3.	Amount for the provision of contractors on site supervision.	
4.	Amount for the provisions of contractors overheads.	
5.	Amount for the electrical contractor to assist the Project Supervisor at Construction Stage under the current Health & Safety Regulations for complete electrical services installation and associated works.	
6.	Amount for the collection and disposal of all debris, rubbish etc. generated from the building works and maintenance of school interior during works.	
7.	Amount for compilation of As Built documentation and Manuals for the complete electrical installation.	
8.	Amount in respect of costs deemed to be included by the contractor.	
	Insurances	
9.	Amount for general insurances.	
10.	Amount for the provisions of particular insurances.	
11.	Amount to be included for commissioning services.	
	Total Indirect Costs to Main Summary	

SUMMARY			Section Totals
7.1	Electrical Supply and Main Distribution (Element 61)	€	
7.2	Power Services (Element 62)	€	
7.3	Lighting Services (Element 63)	€	
7.4	Communication Services (Element 64)	€	
7.5	Security and Protective Services (Element 65)	€	
7.6	Indirect Costs	€	
Total		€	

