

POPE

Sustainable Building Services Consultants

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**ELECTRICAL SERVICES
SPECIFICATION FOR
HARBOUR CONSERVANCY
ITCHENOR**

Project N°: 5453

Revision: T3

Date: January 2025

**Client: Chichester Harbour
Conservancy**

Prepared by:	Keith Heppenstall	Date:	December 2024
Checked by:	Neil Champion	Date:	December 2024

T1	Tender Issue	06/12/2024	KH
T2	Client Feedback Updates	20/12/2024	KH
T3	PV removed	17/01/2025	KH

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PART 1 - GENERAL DESCRIPTION OF INSTALLATIONS

1.1 GENERAL DESCRIPTION OF DEVELOPMENT

The Harbour conservancy building Itchenor. is the main office and workshop for Chichester harbour conservancy and also houses toilets and shower facilities for people using the conservancy's moorings.

This project is for the refurbishment and provision of additional toilets and shower facilities within the existing building.

1.2 SCOPE OF WORKS

The works described in this document include removal of existing redundant equipment, modifications to services containment, submain power distribution, consumer units, final distribution circuits, fixed power, internal and external lighting, power to mechanical services, fire detection system extension, earthing and bonding and all builders' work in connection. This will include fire stopping all mechanical and electrical services openings where they penetrate through separating floors and walls.

The works will include liaison with the design team to ensure compliance with these requirements, systems installation, commissioning and the provision of all relevant documentation for the works. Specialist packages identified will require design input from the specialist sub-contractor. The described systems will be maintained by the installing contractor for the duration of defects liability.

All installations will employ modern technology and controls to achieve minimum energy and water consumption. Sustainable principles will be used throughout the design. All installations must be reliable, durable, and safe and easy to maintain.

The existing building is low enough to be at risk of flooding due to extreme high tides / adverse weather situations. Wherever possible all new electrical cabling and equipment shall be installed with the underside at least +4.500 (1m clear above Reception RG-03 FFL).

1.3 QUALITY OF INSTALLATION

This project requires a robust commercial quality installation, as such, the electrical installation will be viewed not only from a technical aspect, but also from a suitability viewpoint. To this end, if the Contractor installs items and equipment in a manner not befitting the quality of the installation, as judged by the Engineer, it will be replaced as required, at his own cost. The Contractor is required to pay heed to all the detail on the Drawings and in the Specification and ensure that his installation is of a standard appropriate to the project.

1.4 SAMPLES

The Electrical Services Contractor is required to provide samples of all items of equipment that will be on display for approval by the Engineer/Architect/Client prior to ordering. All samples to be complete with the relevant finish. Where the same equipment/faceplate is specified with multiple finish types, samples of each type are required to be provided.

This is to include, but not be limited to, the following:

- Sockets and accessories
- Luminares & Lighting controls
- Assistance Call Alarm Devices
- Hand & Hair Driers
- Access Control Devices

1.5 STRIPPING OUT

The office and workshop are to be retained in operation throughout the project, therefore ensure any services that feed these areas are maintained during the contract.

Within the area to be refurbished / converted, make safe, isolate, cut back to incoming and remove all existing electrical services.

1.6 INCOMING ELECTRICAL SERVICES

The existing property has two separate services entries, presently serving the workshop and the offices via a pair of 100A TPN utility service heads. No changes to the existing are required.

1.7 INCOMING TELECOMMUNICATION SERVICES

No works to the existing telecom services are planned as part of this project. Where the existing client networks exist within the area being refurbished the intention is that the user / client will relocate them clear of the work area before commencement of these refurbishment works.

1.8 DISTRIBUTION BOARDS & CONSUMER UNITS

Provide each new multi-way distribution board or consumer unit, installed wall-mounted, incorporating surge protection, locks, isolators and outgoing MCBs/RCBOs/AFDDs.

All relevant safety notices shall be provided at the consumer unit / distribution board position.

Provide distribution boards & consumer units of the miniature circuit breaker type complete with integral isolators. Label each board to indicate its unique reference in ink in the circuit lists provided and fit numbered circuit distribution board schedules.

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Ensure that all distribution boards and consumer units are BS7671 18th Edition compliant.

Ensure that on completion there is a minimum spare capacity for future circuit breakers of 25% or a minimum of 2 spare ways in each part of the distribution board / consumer unit to allow for future additional circuits, and that all unused ways are fitted with blanks.

Provide adequate earth terminals to enable separate connection of ring circuit CPC's where supplying equipment with possible high earth leakage currents.

Each and every final circuit except the fire alarm circuit shall be provided with individual 30mA RCD protection.

1.9 CABLING SYSTEMS

Sub-Main Cabling

Provide XLPE/SWA/LSZH sub-main cabling installed on perforated steel cable tray to serve the distribution boards and consumer units.

Final Circuit Wiring

Wire final circuits using LSZH Twin and Earth cabling fixed generally to side of ceiling joists concealed by the room ceiling, with recessed concealed vertical drops in conduit throughout the property internally.

Flexible Cables

Make final connections to equipment where high temperatures are present using heat resistant rubber butyl type flexible cables.

Fire Alarm Wiring

Wire alarm system in accordance with manufacturer's recommendations using LSOH hard skin, fire-resistant cabling incorporating 'insudite' insulation to BS 7629 and BS 6387. Terminate cables using the manufacturer's proprietary glands.

Structured Cabling

Wire all structured cabling for all RJ45 and telephone outlets in the same manner as the final circuit wiring as above, using Cat 6A LSZH UTP twisted pair cable.

AV Cabling

Wire all AV cabling for all AV outlets in the same manner as the final circuit wiring as above.

Intruder Detection

Wiring and connections will be to the manufacturer's specification with LSZH insulation using the containment and installation methods as detailed above for final circuit wiring.

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Cable Segregation

Segregation from other services shall be maintained and shall adhere to the following guidelines.

Cable Type	Distance		
	Without Divider or Non-metallic Divider	Aluminium Divider	Steel Divider
Unscreened Power & UTP	200mm	100mm	50mm
Unscreened Power & FTP	50mm	20mm	5mm
Screened Power & UTP	30mm	10mm	2mm
Screened Power & FTP	0mm	0mm	0mm

Note:

- The distance shown is the minimum separation distance between a power and data cable installed in the same containment.
- In the case of screened cabling, if the horizontal cabling length is less than 35m no separation is required.
- For backbone cables the separation distances in the above chart apply end to end.
- Fibre optic cables with metallic content could be covered by these separation guidelines.

1.10 INTERNAL LIGHTING

Provide new lighting throughout the areas covered by the refurbishment, including the external approach route.

Light fittings in bathrooms and shower rooms are to be moisture resistant to the relevant IP rating.

Where luminaires are provided in fire rated ceilings ensure all luminaires are complete with fire hoods or are fire-rated types. Provide a suitable ply insert or supports for luminaires in lay in grid ceiling panels.

All luminaires and lamps are to be LED.

Provide samples of each type luminaire and gain approval from the Client **before** ordering.

Luminaire output colour temperature is to be consistent throughout the property, at 4000K.

Ensure all lighting complies with CIBSE recommendations.

1.11 LIGHTING CONTROLS

Generally, all internal lighting to be controlled from local flush ceiling mounted presence detectors. External lighting shall be time clock controlled, with auxiliary PIR presence detectors outside timeclock hours, and with internal test & override switches.

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Emergency lighting test facilities shall be provided by secret key switches for each circuit, mounted at the relevant distribution boards.

Following installation, the Contractor is to allow for a demonstration of the lighting controls and ensure that automatic timings and detection zones are configured properly.

1.12 EXTERNAL LIGHTING

The new external lighting shall be provided with full cut off dark skies compliant 0% ULOR luminaires.

Dedicated LED fittings are to be utilised.

Before handover, liaise with the Client to ensure the timeclocks are programmed to their requirements.

Ensure all lighting complies with the guidance notes for the reduction of obtrusive lighting and CIBSE recommendations.

1.13 SMALL POWER FOR FIXED AND PORTABLE APPLIANCES

All accessories are to be positioned as required by the internal fit out design.

Power will be provided from each final circuit distribution board / consumer unit to various fixed appliances and general purpose socket outlets throughout the buildings.

Provide socket outlets as identified in the drawings.

Protect all circuits by individual 30mA RCBO's, except the fire alarm service, unless otherwise indicated.

Outlets in the workshop and where exposed to external weather conditions are to be at least IP55.

Provide radial circuits to fixed appliances/machines as indicated. Terminate within local isolators with remote/integral flex outlet plates as necessary. Allow to connect each appliance or piece of equipment as it is delivered.

1.14 POWER TO MECHANICAL SERVICES EQUIPMENT

Provide power and control wiring to the same specification as previously discussed for the electrical installation.

Provide all necessary containment such that others can install the control wiring in accordance with relevant manufacturer's instructions.

Power to mechanical services equipment is to include:

- Local supplies to domestic mechanical extract fans (from lighting circuit)
- Local supplies to packaged cold water booster pump
- Local supplies to ASHPs
- Local Supplies to DHW systems

Liaise with the Mechanical and other Services Contractors to ensure that equipment and supplies are located in positions required. The drawings are not sufficient for this purpose alone.

Extract Fans/Ventilation

Provide the power supplies control wiring and containment for local extract fans as indicated on the drawings. Extract fans are to be supplied & fitted by others, but all cabling is to be provided and installed by the Electrical Services Contractor. Note that all fans are to be provided with a local accessible isolator (generally 3 pole unfused at high level) for maintenance. Electrical Services Contractor to provide the Fan Isolators complete with engraved faceplates.

Ensure that containment is provided and the fans operate via run-on timer from the local lighting circuit or via wall mounted manual switches.

Liaise with the Mechanical and other Services Contractors to ensure that equipment and supplies are located in positions required.

Room Sensors

Provide the containment only for the wall mounted room temperature sensors to the requirements of the Mechanical Services Contractor. The Mechanical Services Contractor will provide all of the underfloor heating room temperature thermostats.

Air Source Heat Pumps

Provide the power supplies and containment for the ASHP and thermal store.

Ensure that containment is provided and undertake the final connection to the boilers in heat resistant cord. The ASHP and Thermal Store units are to be supplied by Mechanical Services Contractor, but all cabling is to be provided and installed by the Electrical Services Contractor. Ensure coordination with Mechanical Services Contractor during installation.

Liaise with the Mechanical and other Services Contractors to ensure that equipment and supplies are located in positions required. Note that fused connection units are generally to be at least 600mm horizontally from sinks.

Fire Alarm System

The existing fire detection and alarm system is no longer fit for purpose. Provide and new analogue addressable fire detection and alarm system within and throughout the existing building to an L4/M standard. Provide an option price to instal the new system as L1/M.

Not all of the necessary detection devices are currently shown on the proposed drawings.

Provide new fire alarm loop mounted I/O devices to shutdown vent systems, and release the existing held open fire segregation doors.

The Electrical Services Contractor must establish the number of cores required (and cable sizes when the equipment and lengths are established) with the manufacturer before installation commences.

The installation will be flush throughout where possible and the removal of one or more detectors will not render any of the remaining devices inoperative.

Provide interfaces as required to integrate operation of the alarm system with all other relevant systems, including access controlled doors and the like.

Sound levels achieved must comply with the requirements of BS 5839. The sounders are expected to feature adjustable power ratings (and hence volume) to be adjusted at the commissioning stage.

Ensure that fire alarm devices satisfy the requirements of BSEN 54-23, DDA, Part M Building Regulations and Equality Act.

Following the completion of the installation, the Contractor shall carry out an audibility test to ensure the requirements of the British Standard are fully met with regard to the required audibility levels. Records of the audibility test and the readings in all rooms shall be included within the O&M manuals.

1.15 VOICE & DATA INSTALLATIONS

Employ a Structured Cabling Installer to provide the new connections to the existing client infrastructure necessary to provide the required remotely connected door controls.

Carry out full testing as specified in the standards for all elements of the structured cabling system, and obtain appropriate passes for each element such as to ensure total structured cabling system compliance with the standards.

Rectify each failure identified during testing by completely replacing the faulty cable or component.

1.16 ACCESS CONTROL SYSTEM

Employ a specialist Installer to provide a new web connected remote monitored electronic code & token access control system to the new facilities. Each and every external WC and Shower door shall be provided with an electronic keypad / RFID Token reader controlled door locking.

A PC on the reception desk shall be used to issue temporary 6 digit access codes to visiting users, and issue registered tokens to long term mooring users, allowing access to the rooms.

The installation shall be ethernet connected, remotely managed, and suitable for high footfall use, with regularly changing keypad codes.

Doors are expected to be provided with fail secure high security releases and leaf mounted night latches with internal free use lever handles and external cylinder keys. The access control system shall manage and operate the door locking to restrict access as required by the client.

Provide 80 preconfigured 24/7 tokens and 20 unconfigured tokens in 1 colour as part of the tender pricing, with all necessary programming software and hardware. Provide pricing options for a further 900 programmed tokens to be provided as part of the installation, in the same colour, and up to 4 time patterns.

1.17 ASSISTANCE CALL ALARMS

Provide each of the proposed adapted rooms with pull cord assistance call alarms, together with remote monitoring at the client reception, and web connected mobile phone external assistance should the user reception be unmanned.

1.18 EARTHING AND BONDING

Include for the earthing and bonding of the whole electrical installation in accordance with BS 7671 Requirements for Electrical Installations, BS Codes of Practice and the local REC/PME Regulations, such that the whole of the installation is effectively earthed.

Bond in all locations all extraneous conductive parts of the installation as required by the current regulations such as sinks, basins, waste pipes, hot and cold water pipes, heating pipes, gas pipes, suspended ceiling grids and general items of mechanical services plant.

Carry out bonding using green/yellow LSF insulated conductors.

Where required the gas and water main is to be bonded to the electricity main with 6491B 10mm² sized green and yellow coloured insulated cable at each intake position; the bonding clips must be clearly labelled with the standard label. Bonding must conform to current I.E.E. Regulations BS7671.

1.19 ELECTRICAL TESTING GENERALLY

The Contractor shall, upon the installation and completion of the works, arrange for the testing and commissioning of the complete new installations, by the equipment manufacturers or their accredited agents or approved installer in accordance with the manufacturers' installation and commissioning instructions and all relevant British Standard Codes of Practice, together with the latest Edition of the IEE Requirements for Electrical Installations (BS 7671).

The Contractor shall be required to demonstrate the full operation and function of the completed systems to the satisfaction of the Employers Agent / Employers

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Representative, immediately prior to the systems being handed over; and all due allowance shall be made for this within the tender sum. All call outs to faults shall be carried out by the specialist installer and not by the manufacturer.

All test, commissioning and completion certificates for the systems shall be duly completed and handed to the Employers Agent/Employers Representative prior to Practical Completion.

List and describe the proposed testing equipment, which will be used on site and/or in the manufacturer's factory.

All equipment used for testing to be certified with a valid calibration certificate, a copy of which is to be provided to the Contract Administrator or their agents at their premises with reasonable notice.

Ensure that at practical completion:

- Detailed electrical installation test certificates are available for all circuits, entirely in accordance with the requirements outlined in BS7671.
- Record drawings and schedules of equipment are submitted.
- Permanent labelling is marked and fixed and required accessory and appliance faceplates are to be engraved with appropriate lettering. Pencilled information is not acceptable. All power accessories should have their circuit reference numbers marked.
- Loose equipment and switchgear has screwed, glued or riveted labels, self-adhesive types are not acceptable except for the labelling of circuit numbers of socket outlets and spurs where electronic printed types are satisfactory. Test switches and three position switches are to be engraved with appropriate lettering.
- Sound levels and fire and emergency lighting certificates are submitted covering the areas of work. Fire alarm sound levels to be measured in each new/refurbished area and room and marked on an A4 plan by electronic means.
- Telephone; data; intruder detection; CCTV, AFILS, access control systems etc are fully tested, commissioned and demonstrated.
- Fire alarm system should be fully soak tested for one week prior to handover.
- Draft record drawings and schedules of equipment are submitted.

1.20 CLEANING DOWN ON COMPLETION

The Contractor shall clean down and make completely safe all the installations provided. Immediately prior to handover, all electrical and mechanical equipment shall be cleaned in accordance with manufacturer's instructions, including inside all diffusers and reflectors for luminaires and within mechanical services plant room areas.

Plaster and paint on accessories and fittings will be removed in accordance with manufacturer's instructions – these shall not be scraped off which may damage the finish.

1.21 MAINTENANCE DURING DEFECTS PERIOD

Ensure that sufficient allowance is made within the Tender Return for the maintenance during the Defects Liability Period. Note that the Tenderer is responsible for the ongoing maintenance of all installations and equipment installed under the Contract during this time, including, but not limited to, the following:

- Smoke Detectors – Clean, check and test, activate smoke detectors and replace batteries where required. Intervals to be as the Code of Practice BS5266.
- Surge Arresting – Test operation of all surge arresting devices.
- Lighting – visual inspection, clean external luminaire diffusers and replace all faulty lamps.
- Emergency Lighting – Carry out performance testing and routine function testing in accordance with BS5839.
- Small power – visual inspection, verify operation of RCD's and RCBO's

Note also that Service Reports for all items of maintenance are to be forwarded to the Client for their records.

1.22 HEALTH & SAFETY MANUALS

Provide all drawings, certifications and manuals/folders at least 4 weeks prior to Practical Completion. Provide draft versions of the manuals in pdf form for electronic comment.

Record information for this project will consist of:

- 2No hardcopy sets of Operating and Maintenance manuals for the electrical installation (including all sub-contractor's information)
- 2No copies of each of the above on CD ROM/USB Key
- 2No hardcopy sets of testing and maintenance folders.

A4 pages of the following:

- Description of the extent of the work carried out
- Cat nos. of equipment and its description,
- M&E Accessories including luminaries with catalogue nos.
- Copies of certification and operating instructions
- Appliance and gas safety certificates
- Copies of distribution board schedules covering new and altered circuits only,
- Sound levels, and similar schedules
- List of lamps required for replacements
- Schedule of manufacturers, wholesalers, suppliers with addresses and phone nos.
- H&S/maintenance advice
- Copies of emergency lighting log books and test sheets for end-user
- Copies of fire alarm and detection system log books and test sheets for end-user
- Paper copy on A3 or A4 folded in pocket and a copy on CD ROM in AutoCAD 2013 and pdf format.

PART 2 – DESIGN STANDARDS & RESPONSIBILITIES

2.1 SCOPE OF DESIGN STANDARDS & RESPONSIBILITIES

This section of the specification defines the design parameters of the consultant designed elements of the electrical services, to allow procurement and commissioning of the installed systems and the required contractor's information necessary for a workmanlike and co-ordinated installation to be achieved.

2.2 CONTRACTOR'S DESIGN ELEMENTS

The Contractor will be responsible for producing and presenting a suitable design solution for the specialist installations compliant with this specification. Design solutions will comprise drawings, calculations, equipment schedules, loadings and capacities, and locations of all plant and equipment.

Full design submissions are required for:

- Final Circuit Containment (Conduit)
- Fire Detection and Alarm System
- Access Control/Security/CCTV

The submitted design may be subject to development before final completion due to co-ordination requirements, overall budgetary restraints or value engineering. The sub-contractor will be required to develop the design intent into a fully coordinated scheme and all necessary liaison with all other trades.

The sub-contractor will also be responsible for assessing the performance of the proposed design and demonstrating to the client before installation that it meets published benchmarks for performance, energy efficiency and sustainability. The Contractor will liaise and discuss fully with the client all aspects concerning the services design and installation.

2.3 REFERENCE GUIDES AND PUBLICATIONS

Ensure that all work conforms to current editions of the following standards:

- British Standards
- Building Regulations
- CIBSE Design Guides
- Clean Air Act
- The Control of Pollution Act
- COSHH Regulations
- Construction Design Management (CDM) Regulations
- Electricity at Work Regulations
- Health and Safety at Work Act
- Loss Prevention Council Recommendations

If a conflict arises between these specifications, advise the Engineer accordingly.

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2.4 INFORMATION TO BE PROVIDED

Submit the following information for approval:

- Drawings indicating proposed configuration of all proposed systems including system schematics. These are to be at a scale of 1:50.
- Working drawings co-ordinated with building fabric, structure and other trades and incorporating circuit references and key site dimensions to provide a neat & workmanlike installation. These are to be at a scale of 1:50 with specific details at 1:20.
- Builders' Work drawings showing all requirements associated with the services installations. These are to be at a scale of 1:100 with specific details at 1:20. Major structural builderswork requirements have already been identified but the sub-contractor must check to ensure that these are compliant with his proposed installations.
- Schedule of all proposed luminaires, plant and equipment, detailing manufacturer, reference number, duties, electrical requirements and accessories. Indicate where alternatives to the preferred manufacturers in this specification are offered.

2.5 PROGRAMME AND DOCUMENT CHECKING

Prepare a schedule, consistent with the main Contract programme, detailing when all drawings will be issued. When issuing the drawings schedule, identify the extent and purpose of the particular issue, and the approval status of all drawings.

2.6 ELECTRICAL CIRCUITING – DESIGN PARAMETERS

Circuits are arranged as follows:

- Lighting circuits
- General sockets – ring final circuits
- Miscellaneous fixed equipment – radial power circuits.

Circuits are protected using MCCB's for sub-mains and MCB's/RCBO's for final circuits. (Type B for power circuits and resistive lighting circuits, and Type C for inductive power and lighting circuits). Socket outlets are protected by RCBO units mounted within local distribution boards with 30mA tripping current characteristics.

Circuits are arranged to allow for 25% spare ways per phase on each individual distribution board.

General purpose power ring circuits are arranged not to serve an area larger than 100m² over one floor.

Power ring circuits supplying general purpose socket outlets arranged to supply no greater than 10 No 2 gang 13Amp socket outlets per circuit.

2.7 CABLE SIZING – DESIGN PARAMETERS

A voltage drop no greater than 3% lighting and 5% other uses over the complete system, split 1% for sub-mains and the remainder for final circuits has been allowed.

The current limiting characteristics of sub-main moulded case circuit breakers has been utilised to minimise prospective short circuit currents at down stream miniature circuit breakers, where necessary. Full discrimination is provided. The tripping characteristics of motor control equipment has been co-ordinated with final circuit/sub-main protective devices under both start-up and over-current conditions (i.e. at mechanical services motor control centres).

The following minimum cable sizes are allowed:

- Lighting circuits 1.5mm²
- Power circuits 2.5 mm²
- Circuit protective conductor 1.5mm²
- Supplementary bonding conductors 4 mm²
- Main bonding conductors to BS 7671 or supply requirements.

Ensure no cable is run within thermal insulation.

Allow for armoured cables run on trays to be installed, spaced at least one cable diameter apart.

Provide every circuit with a separate circuit protective conductor (CPC) For SWA cabling, provide a separate earth core.

PART 3 – PLANT & EQUIPMENT STANDARDS

3.1 MANUFACTURERS

Where manufacturer's products are referred to in this document, they are indicative of the quality of product to be provided. Alternative products of an equivalent quality may be offered but will be subject to approval of the Employer's representatives. Provide related products from a single manufacturer, where possible, to reduce maintenance problems.

3.2 INCUMBENTS

The existing incumbent specialist installer shall be utilised for the detailing, installation, and commissioning of the CCTV, Access Control, Intruder Alarm & Fire Detection systems.

The Alarming Co Ltd
Fareham Heights
Standard Way,
Fareham,
Hampshire
PO16 8XT
01329 314444

3.3 ELECTRICAL DISTRIBUTION EQUIPMENT

Application: Panel Boards
Manufacturer: Eaton
Type: Memshield 3 250A rated
Accessories: Integral switch disconnecter; contactors; outgoing MCB's/RCBO's and Door Lock.

Application: Moulded Case Circuit Breakers (MCCB's)
Manufacturer: Eaton
Type: To match the panelboard

Application: Distribution Boards
Manufacturer: Eaton
Type: Memshield 3 Type B Metal distribution board
Accessories: 125A integral switch disconnecter; contactors; outgoing MCB's/RCBO's and Door Lock.

Application: Miniature Circuit Breakers (MCB's)
Manufacturer: Eaton
Type: Memshield 3

Application: Residual Current Breakers with Overload Protection (RCBO's)
Manufacturer: Eaton
Type: Memshield 3

3.4 CABLING & CONTAINMENT

Application: Underground cabling
Manufacturer: BASEC approved
Type: XLPE/SWA/LSF
Conductor: Stranded copper
Grade: 600/1000V

Application: Sub-Main cabling
Manufacturer: BASEC approved
Type: XLPE/SWA/LSHF
Conductor: Stranded copper
Grade: 600/1000V

Application: General Wiring
Manufacturer: BASEC approved
Type: LSHF insulated
Conductor: 1.5mm² min solid copper with 1.0mm² CPC
Grade: 600/1000V

Application: Flexible cables – general purpose
Manufacturer: BASEC approved
Type: Standard HOFR flexible cords – multi-core
Conductor: 1.5mm² min stranded copper
Grade: 600/1000V

Application: Flexible cables – high temperature applications
Manufacturer: BASEC approved
Type: Heat-resistant rubber butyl
Conductor: 1.5mm² min stranded copper
Grade: 600/1000V

Application: Conduit – Workshops & Plant Rooms Internal and external
Manufacturer: Contractor's Choice
Type: Heavy Gauge Class 4 Galvanised Steel circular Conduit.
Accessories: Joints, bends, tee's, couplers, accessory boxes etc.

Application: Conduit – Offices & FoH Areas
Manufacturer: Contractor's Choice
Type: Heavy Duty White LSZH Plastic Circular Conduit.
Accessories: Joints, bends, tee's, couplers, accessory boxes etc.

Application: **Trunking – Power Distribution**
Manufacturer: Legrand Salamandre MGIP
Type: Galvanised Steel
Fittings: Use bends, tees and angles and accessory boxes of the same type, finish and manufacture
Joints: Use purpose-made jointing pieces. Use specialist mitre blocks and saw guides when cutting.
Finish: Mill Finish

Application: **Trunking – Dado**
Manufacturer: MK Prestige 3D
Type: White
Fittings: Use bends, tees and angles and accessory boxes of the same type, finish and manufacture
Joints: Use purpose-made jointing pieces. Use specialist mitre blocks and saw guides when cutting.

Note that adhesive trunking of any type is not permitted except where specifically detailed herein or on the drawings

3.5 ACCESSORIES AND ANCILLARIES

Note that all accessories that are on display will be installed as follows:

- Securely fixed back to the building fabric,
- Plumb with the surface in or on which they are mounted.
- Square with regards to the surface in or on which they are mounted
- All plastic trim (outlet pin shrouds and the like) to be white not black.

Application: **General Accessories – Front of House and Public areas**
Manufacturer: British General
Range: Moulded Plastic
Finish; Rounded Edge, coloured to suit DDA minimum contrast requirements
Devices: Fused connection units, socket outlets, telephone outlets, media plates, television/FM outlets, fan isolators, etc
TSSOs to be outboard rocker 822DPOB
TSSO with integral USB to be 822U33 or 822UAC
Workmanship: Flush mounted.

Application: **Metalclad Accessories Workshop & Plant Areas**
Manufacturer: British General
Range: Metalclad
Finish; Grey with white switches
Devices: Fused connection units, socket outlets, telephone outlets, media plates, television/FM outlets, fan isolators, etc
Workmanship: Surface mounted

Application:	BS EN 60309 General Socket Outlets (unswitched and switched)
Manufacturer:	CeeNorm
Range:	IP44 Internally, IP 67 externally.
Workmanship:	Surface mounted
Accessories:	Provide every BS EN 60309 socket with a matching trailing cable plug, 50% of which are to be angled plugs (CEEnorm 231 or similar)
Application:	Lighting Control Sensors
Manufacturer:	CP Controls where stand alone By luminaire supplier when integrated into luminaire
Application:	External Lighting Timeclock
Manufacturer:	Sangamo
Type:	Suntracker
Application:	Hand Dryers
Type:	Ultralow power, sensor start, autostop
Manufacturer:	Xlerator Eco
Finish:	Stainless Steel
Rating:	500W
Application:	Hair Dryers
Type:	Wall mounted pushbutton start auto stop.
Manufacturer:	Hyco Topaz Digital
Finish:	White Plastic
Rating:	1500W
Application:	Tubular Electric Heaters
Type:	IP55 Wall mounted linear resistance tube heater
Finish:	White
Rating:	180W/m
Accessories	Embedded Thermostat control and overheat thermal safety fuse. All over steel mesh contact protection safety guards.

3.6 DISTRIBUTION BOARD SCHEDULES

Existing Workshop Distribution Board Retained with Minor Adaptions Memshield 2 Modifications Shown in Red						
Way		RCBO R/ MCB (M)	Circuit Description	Circuit Type	Cable	
		Size (A)			Size (mm ²)	Type
1	L1	R C40	Existing Shower To be Removed	Radial		
	L2	R C20	Socket Pillar Drill	Radial		
	L3	R C20	Socket	Radial		
2	L1	C16	Grinder	Radial		
	L2	C16				
	L3	C16				
3	L1	R C16	Socket	Radial		
	L2	R C32	Ring Main Sockets	Ring		
	L3	R C16	Socket	Radial		
4	L1		Spare			
	L2		Spare			
	L3		Spare			
5	L1	B6	Store Lights To be Removed	Radial		
	L2	B6	Workshop Lights	Radial		
	L3		Spare			
6	L1		Spare			
	L2		Spare			
	L3		Spare			
7	L1	B6	Roof Fans	Radial		
	L2	C16	Compressor Supply	Radial		
	L3		Spare			
8	L1		Spare			
	L2		Spare			
	L3		Spare			
9	L1		Spare			
	L2		Spare			
	L3		Spare			
10	L1	C63	Surge Diverter	Radial	16.0	LSZH
	L2	C63				
	L3	C63				
11	L1		Spare (future PV)			
	L2		Spare (future PV)			
	L3		Spare (future PV)			
12	L1	D32	EV Socket			
	L2	D32	EV Socket			
	L3	D32	EV Socket			

Existing DB4 60A 4 way Sub Distribution Board To Be Stripped Out						
Circuits to be retained and diverted shown in red.						
Way		RCBO R / MCB (M) Size (A)	Circuit Description	Circuit Type	Cable	
					Size (mm ²)	Type
1	L1		Spare			
	L2	R B32	Ring Main Upstairs & Cupboard	Ring	2.5	T&E
	L3	C16	Water Heater Canteen	Radial	2.5	T&E
2	L1					
	L2	R C32	Kitchen double socket (old cooker)	Radial	6	T&E
	L3	C16	Water Heater - Cupboard	Radial	2.5	T&E
3	L1	R C6	Ltg Upstairs & Shower 1	Radial	1.5	T&E
	L2	R C6	Ltg Passageway & Shower 2	Radial	1.5	T&E
	L3	R C6	Ltg Shower 3 & Shower Workshop	Radial	1.5	T&E
4	L1	C40	Shower 1	Radial	10.0	T&E
	L2	C40	Shower 2	Radial	10.0	T&E
	L3	C40	Shower 3	Radial	10.0	T&E

New Replacement DB4 60A 8 way Sub Distribution Board						
All new and retained / extended circuits.						
Way		RCBO R / MCB (M) Size (A)	Circuit Description	Circuit Type	Cable	
					Size (mm ²)	Type
1	L1	R C32	Hand Dryers 3 – 6	Ring	2.5	T&E
	L2	R B32	Ring Main Upstairs	Ring	2.5	T&E
	L3	C16	Water Heater Canteen	Radial	2.5	T&E
2	L1	R C20	Maintenance S/Os	Radial	2.5	T&E
	L2	R C32	Kitchen double socket (old cooker)	Radial	6.0	T&E
	L3	R C20	Hair Dryers	Radial	2.5	T&E
3	L1	R C6	Ltg Upstairs	Radial	1.5	T&E
	L2	R C10	Ltg Showers 3 – 6	Radial	1.5	T&E
	L3	R C10	Ltg Kit Rm + Shower 7	Radial	1.5	T&E
4	L1	R C32	LTHW & DHW Auxiliaries	Ring	2.5	T&E
	L2	R C32	Kit Room Tubular Heaters	Ring	2.5	T&E
	L3	R B16	Kit Room Drying Cabinet	Radial	2.5	T&E
5	L1	R C16	Shower 3 - 7 & Kit Room Vent MVHR	Radial	2.5	T&E
	L2	B10	Access Controls	Radial	2.5	T&E
	L3	R B32	Hand & Hair Driers RG05-RG07	Ring	2.5	T&E
6	L1					
	L2					
	L3					
7	L1					
	L2					
	L3					
8	L1					
	L2	C32	ASHP	Radial	6.0	SWA
	L3	C32	ASHP	Radial	6.0	SWA

3.7 FIRE ALARM SYSTEM

Control Panel	Advanced Electronics
Loop Devices	Apollo Discovery

3.8 ASSISTANCE CALL ALARMS

Manufacturer:	C-Tec
Type	Quantec Surveyor 2
Accessories:	QT951 Addressable Alarm Kit with additional pull cords in showers Remote alarm status reporting / monitoring via mobile networks & mobile phone handsets.

3.9 ACCESS CONTROL SYSTEM

Manufacturer	Paxton Net 2
Equipment	Pushbutton keypads, tokens token readers, wired controllers., PC software, Tokens and Token programming hardware & software.

3.10 SURGE ARRESTING SYSTEMS

Application:	Distribution Boards
Manufacturer:	Furse
Type:	ESP415M1

PART 4 – STANDARDS OF WORKMANSHIP

4.0.0 GENERAL

The following information details standards of workmanship for this project, this is a standard scheduled and may include details of items that are not specific to this project but are retained for information.

4.0.1 SCHEDULE OF RATES

When requested, provide a quantified schedule of rates with sub-totals and totals consistent with the electrical services price.

4.0.2 STANDARDS OF INSTALLATION

Ensure that all work conforms to current editions of the following standards:-

- BS and BS EN Standards
- National Engineering Specification Standard 'Y' Clauses for standards of workmanship
- Building Regulations
- Water & Water Supply and Fittings Regulations 1999
- Construction Design Management (CDM) Regulations
- Clean Air Act
- Gas Safety (Installation & Use) Regulations
- Electricity at Work Regulations 1989
- HVCA Codes of Practice
- Health and Safety at Work Act 1974
- Loss Prevention Council Recommendations
- WRc Directory

4.0.3 STANDARDS OF WORKMANSHIP

Provide a competent supervisor, on site for the duration of the contract, to oversee the works and to ensure that all work is completed in a neat, workmanlike manner. Use only appropriately skilled workmen. Ensure that electrical work is only undertaken by an NICEIC or ECA registered contractor.

4.0.4 TOOLS AND KEYS

Provide all necessary tools and keys for the operation and routine maintenance of the installations.

4.0.5 COMMISSIONING, TESTING AND DEMONSTRATING

Inspect and test the whole of the works in accordance with the IEE Regulations and relevant British Standards, and supply to the Contract Administrator 2 N^o completion certificate complete with his test results, along with the serial numbers of any instruments used together with their last calibration dates.

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On completion of the testing, offer the systems to the Engineer for witness. Allow sufficient time within the programme for both the initial testing and the witness tests thereafter.

Certificate of Practical Completion will not be issued until completion certificates are received.

4.0.6 OPERATING & MAINTENANCE INSTRUCTIONS & HEALTH & SAFETY FILE

As part of the Health and Safety File, supply working instructions for the whole of the plant covered in this Specification prior to Practical Completion, comprising the following:-

- A full description of the installation, including controls
- Schedules of all installed equipment with figure numbers, duties, electrical details and manufacturer's address and telephone number
- All appropriate Certification, etc
- Contractor's emergency call-out numbers
- Distribution Board charts
- Electrical Distribution and Alarm System schematics
- Schedule of Fire Alarm Zones and Addresses
- Fire Alarm Cause and Effect matrix
- Instructions for the safe operation of the systems
- Fault finding procedures
- A schedule of recommended daily, weekly, monthly, quarterly and annual maintenance
- Manufacturers maintenance instructions cross referenced to schedule of installed equipment
- A1 'As installed' drawings including manufacturing and control panel wiring drawings folded to A4 size in clear plastic wallets with schedule
- Disposal instructions

Submit draft copy for approval two weeks before Practical Completion. Within 28 days of completion of the works, supply two paper copies of the completed document and two electronic copies on CD-ROM with 'As Installed' drawings in AutoCAD 14 format.

4.0.7 DEFECTS LIABILITY

The whole of the work is to be guaranteed for a period of twelve months, from the date of the Certificate of Practical Completion. The Contractor will remedy at his own expense all defects in installation, materials and equipment due to faulty design, construction or workmanship which may develop in that period, notwithstanding the fact that the material and equipment is specified in this specification.

Defects affecting the system functionality must be repaired within two working days of them being reported.

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4.0.8 MAINTENANCE

Provide all regular maintenance of the equipment as detailed in the Operating and Maintenance manual including emergency call out for the duration of the Defects Liability period.

4.1.0 CABLES AND WIRING

4.1.1 CONDUIT & TRUNKING GENERAL WORKMANSHIP

Provide conduit and trunking in accordance with BS 7671.

Ensure entire system is electrically and/or mechanically continuous, to BS 7671. Comply with BS 7671 wherever the conduit or trunking passes through the perimeter of a fire compartment (wall, floor or ceiling) Arrange conduit and trunking to present a neat appearance, parallel with other service runs round the building line. Ensure vertical runs are plumb.

Install cable in conduit, trunking or equipment enclosures only when completely erected throughout its length. Make provision in conduit and trunking at expansion and settlement joints to allow for movement of the building structure. Provide circular through or adaptable boxes no more than 300mm either side of expansion or settlement joints for conduit crossing. Join boxes with flexible steel conduit type A or conduits arranged to form a telescopic joint and cover overall with a PVC sleeve to provide minimum degree of protection of IP44 or purpose made telescopic joint protected by a PVC sleeve to at least IP44.

4.1.2 CONDUIT

Cut conduit clean and square with axis. Remove any burs prior to erection. Site form 90° in conduit wherever practical or use circular or adaptable boxes. Construct bends and sets cold with a bending machine. Do not apply heat when forming bends and sets. Use bending tools complying with British Standards appropriate to conduit material. Ensure no indentation or reduction in cross sectional area occurs during installation. Use correct tools to assemble conduit. Ensure no tool marks or damage to components occurs.

Provide draw-in boxes in conduit at maximum intervals of 10m or after bends or sets totalling 180°.

Ensure that cast-in conduits and boxes are firmly secured so that they do not move during subsequent building operations. Ensure that there is no blockage immediately shuttering is removed. Check that there is no mechanical damage to conduit in floor screed prior to screeding. Fix securely before screed is poured. Provide temporary protection to conduits until screeds are laid.

Ensure that conduit boxes to be cast-in will be flush with the face of concrete or plaster. Fit circular boxes with extension rings as required. Ensure fixing holes are countersunk where material thickness allows or use round head screws to prevent damage to cables and remove burs before cables are drawn in. Use two fixings for circular conduit boxes and four for adaptable boxes. Use back outlet boxes where surface conduits pass through walls to outside accessories or lighting points. Secure switch boxes and socket boxes using countersunk steel screws where provision is made for them or if not, use round head screws. Use plug inserts and finally grout in position prior to plastering or screeding.

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Support conduit in accordance with Appendix I of Guidance Note 1 - Selection and Erection, published by the IEE. Ensure conduit is not under mechanical stress. Fix boxes independently of conduit. Where protection is specified as IP44 or greater, ensure fixings of boxes are suitable to maintain degree of protection. Use saddles to fix conduit or crampets in screed or plaster.

Use flexible conduit for final connections to motors, other equipment subject to vibration or adjustment and to thermostats, motorised valves and similar duct or pipeline mounted items. Use sufficient length between equipment and circular through box at end of conduit run (min 450mm) to allow necessary full range of withdrawal, adjustment or movement. Use solid adaptors to terminate flexible conduit. Use covered flexible conduit where exposed to weather or moisture.

For steel conduit, use materials free from defects, rust, scale and oil. Repair any damage caused by threading, bending or erection by painting. Ensure length of thread on conduit matches that in couplers, fittings or equipment with no thread exposed after erection except at running couplers. Ensure conduits butt inside couplers. Use lubricant when cutting threads. Use minimum number of running couplings. For running couplings in Class 2 conduit, use coupler and lock-nut. Paint exposed thread with zinc rich paint. For running couplings in Class 4 conduit, use three-piece conduit unions.

For non-metallic conduit, comply with manufacturer's instructions for bending, setting and jointing of conduit. Use only where indicated. Do not install outside manufacturer's recommended ambient temperature conditions. Use solvents recommended by the manufacturer for welded joints and ensure spigots enter full depth of sockets. Hold joints rigid and in position until weld sets. Remove excess solvent before surface damage occurs. Use slip joints as necessary, but not exceeding 6m on straight lengths to allow for expansion and contraction. Use semi-mastic adhesive where expansion joints are formed. Ensure special care is taken to prevent mechanical damage or warping to conduit where mechanical loads are imposed on the system e.g. lighting fittings.

4.1.3 TRUNKING

Take measurements on site before producing drawings for manufacture of trunking.

Arrange trunking to allow access to wiring. Arrange access so that covers are on a continuous face and cables can be laid in throughout the length of the trunking. Notify where either condition cannot be achieved.

Ensure trunking is independently fixed and supported from the building fabric. Obtain approval for the proposed fixings/ supports. Use two fixings minimum per standard length.

Install steel trunking in accordance with the manufacturer's requirements and those of BS7671. Use trunking to avoid multiple parallel conduit runs, subject to approval. Cut trunking clean and square with axis, prepare ends and remove burrs and sharp edges. Ensure inside edge of trunking is free from anything liable to damage cables either during installation or after covers are fitted. When

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trunking is held in a vice, ensure surfaces remain undamaged and components are not warped. Avoid tool marking or damage to trunking system components. Use only factory made fittings and accessories.

Form circular holes over 6mm diameter in trunking body using correctly sized punch sets. Use twist drill for holes up to 6mm maximum diameter. Use only factory formed openings for accessories. Line unprotected apertures in trunking with PVC or nylon edging strip. Fit ends of runs with removable blanking plates. Do not make connections to covers. Provide a fixed section of cover protruding 25mm either side of fabric where trunking passes through wall, floors or ceiling. Fit cable retaining straps at 500mm intervals except where cover is on top.

4.1.4 CABLE TRAY

Support from the building fabric with a minimum clearance of 20mm. Install fixings at regular intervals to prevent visible sagging when loaded, with maximum spacing 1.2m and 230mm from fittings. Keep cutting of cable tray to a minimum. Cut along a line of unperforated metal. Make good finish with zinc rich paint, primer and top coat, or two pack epoxy paste, as appropriate to tray material and finish.

Fit holes cut in tray for passage of cables with grommets, bushes or other lining. Install all bolts, fixings and hangers with threaded portion away from cables.

For cables on horizontal tray, use ties for each circuit. Use special tensioning tool and crop off tie ends. For cables on vertical tray use cleats bolted to tray for paper, plastic or elastomeric insulated cables, and saddles or clips for MIC. Use cleats sized to grip cable firmly without undue pressure or strain on the cable, but preventing slipping.

On continuous flat surfaces of wood, plaster, brick etc use polypropylene surface fixing clips with pre-fixed hardened steel pin for PVC insulated and sheathed cables. And sheathed or bright MIC cables. Use one hole "P" clips for unsheathed MIC.

4.1.5 LAYOUT & SPACING

Ensure the maximum circuit lengths and groupings of cables indicated are not exceeded. Where dimensions are not indicated, select trunking and conduit sizes in accordance with Appendix A of Guidance Note 1- Selection and Erection, published by the IEE.

Install conduit and trunking clear of other services. Measure distance from external surface of any thermal insulation. Notify instances where minimum clearances cannot be achieved and bond items concerned. Minimum general spacings between conduits, trunking and equipment are:

Insulated steam services	300mm
Other services excluding steam	150mm
Above central heating radiators	1000mm

Appendix K of Guidance Note 1- Selection and Erection, published by the IEE.

4.1.6 CONDENSATION PREVENTION

Install conduit and trunking to ensure that internal condensation does not affect operation of associated circuits. Provide drainage points in accordance with BS 7671. Where conduit passes through external wall between two areas at different temperatures, or, in other locations likely to cause condensation, install a conduit or adaptable box. After wiring, fill box with inert, permanently plastic compound with high insulation value.

4.1.7 PROTECTION & REPAIR OF STEEL COMPONENTS

Paint joints of conduit and minor damages to finish of conduit and trunking immediately after erection or after damage occurs. Use paint compatible with finish as follows:

Galvanised finish, use two coats of zinc rich paint.

Black enamel finish, use two coats of good quality black enamel.

Remove grease, oil, dirt and rust before applying protective paint. Notify serious damage and repair or replace as instructed.

4.1.8 EQUIPMENT CONNECTIONS

Where surface mounted equipment is installed in conjunction with concealed conduit work, terminate concealed conduit at flush mounted conduit or adaptable box. Drill back of equipment, bush for back entry and mount equipment to conceal back box. Connect to fixed equipment via a conduit box located adjacent to the termination point, using either solid or flexible conduit as indicated for final connection to equipment terminations. Use conduit box as cable change point to facilitate changed wiring locally to adjacent equipment. Connect trunking to equipment by specially fabricated connectors or by couplers and externally screwed brass bushes.

4.1.9 CLEANING BEFORE WIRING

Clean inside of conduits and trunking with swabs immediately before wiring. Inspect all components and remove any foreign matter. Fit temporary plugs to open ends of conduit and trunking to prevent ingress of water and solid material.

4.1.10 BUILDERS' WORK

Ensure conduit is not concealed until work has been inspected and approved. Obtain permission before horizontally chasing walls. Ensure that conduit and fittings buried in concrete or behind plaster are protected against corrosion or electrolytic action prior to rendering. Ensure conduit concealed in wall chase is covered by plaster and/or rendering to a minimum depth of 12mm.

4.1.11 WIRING

Comply with BS 7671 when wiring installations. Segregate circuits as indicated. Ensure draw wires are left within empty conduits for use of specialist installers. Use draw wires comprising nylon tapes with fitted eyelets. For concealed conduit, ensure system is installed to enable rewiring to be carried out from boxes for fittings or accessories only. Draw-in boxes will only be permitted with prior permission in writing. Do not use tallow or other substances to facilitate drawing-in of cables.

4.1.12 FLUSH MOUNTED ACCESSORIES

Where accessories are flush mounted in stud walls or ceilings that form fire or acoustic barriers in the property the accessory back boxes shall be fitted with rear mounted putty pads to the following requirements:-

- Hand mouldable, non-setting, self adhesive
- Tested to BS 476 Part 20 1987
- Fire resistance up to two hours
- Age tested as defined in the DafStb guidelines, with subsequent fire testing
- Acoustically tested to DIN EN ISO 140-3: to provides at least 60dB
- NHBC and Robust Details approved

Similarly where accessories are flush mounted in stud walls or ceilings that form the air tight seal to a building perimeter install rear mounted putty pads as above.

Where access limitations prevent the installation of rear mount putty pads then all devices in fire rated, acoustic or air sealed stud walls shall be double gang faceplates and be installed with front install rear mounted acoustic socket and service boxes, such as the Sound Reduction Systems RD Compliant socket boxes.

Flush mounted outlets shall not be mounted back to back in any stud wall or solid wall location. A minimum of 200mm clear horizontal displacement or 400mm clear vertical displacement shall be used.

4.1.13 CABLING

Use new cables, delivered to site with seals intact, manufactured not more than one year prior to delivery, labelled with the manufacturer's name, size, description, BS number, classification, length, grade and date of manufacture. Ensure cable is marked with CENELEC or BASEC classification.

Use and install cables only as directed in the appropriate standard or as directed by the manufacturer in writing. Lay cables in one length unless otherwise indicated. Obtain permission from Contract Administrator for all through joints, and where overall length requirement exceeds practical drum size.

Install cables when ambient temperature is 5°C or greater, using cables stored at or above this temperature for not less than 24hrs. Use drum stands, drum

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axles, fair leads, rollers, cable stockings and other equipment as recommended by the cable manufacturer and as appropriate to the method of installation.

Install LSF cables in accordance with the manufacturer's instructions. Ensure oversheaths are not damaged by abrasion or scuffing.

Install cables in conduit and trunking so that they are orderly and capable of being withdrawn. Arrange single core wiring generally using the loop in method. In vertical trunking, provide pin racks at 3m intervals. Use ties for all wires on the same circuit reference at 2m intervals. Mark ties at 10m intervals with circuit reference number. In vertical conduit, provide cable clamps in conduit boxes at 10m intervals. Allow for full range of movement at building construction movement joints. Make all joints to wiring at terminal blocks in conduit boxes.

On cable tray or rack, place cables side by side or as indicated. Fix using cleats or cable ties so that any cable may be individually removed.

On surfaces, dress cables flat, free from kinks, twists and strain and align parallel to building elements. Take sheathing of cables when glands and clamps are not required into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.

For mineral insulated cables, straighten and dress cables using methods and tools recommended by the cable manufacturer. Use PVC or LSF sheathed cables where colour coded or indicated or where cables may come into direct contact with corrosive material. Fit temporary seals to MIC if the cable is left unterminated underground or if termination is not to be made for twelve weeks.

For flexible cords, ensure cords are gripped securely at both ends.

4.1.14 UNDERGROUND CABLING

Use XLPE/SWA/LSF type cabling for all power circuits laid directly in the ground. Cables will be laid at a minimum depth of 600mm in general open ground and pavements and 800mm when under roadways.

All underground cables will be segregated with other services in accordance with the following Table except where further account is necessary for grouping factors to maintain current carrying capacities of cables.

Cable	HV mm	LV mm	Telephone mm	Coaxial mm	Pipework mm
HV	50	300	300	300	300
LV	300	25	150	150	300
Telephone	300	150	50	50	200
Coaxial	300	150	50	50	200

Unless otherwise indicated all excavations within 600mm of existing services will be by hand digging only.

Before laying, the bottom of the trenches all be cleared of loose stones and covered with a 50mm layer of sand. After laying a further layer of sand will be applied to give 50mm total cover. A traceable warning tape will be placed above each cable laid direct in the ground at a depth of 300mm below the finished ground level.

4.1.15 CABLE JOINTING

Ensure all joints and terminations are made by appropriately qualified cable jointers. Use jointing materials, components and workmanship recommended by the cable manufacturer and the jointing accessory manufacturer. Install cable glands in accordance with BS 6121 Pt5. Cut all cable ends immediately prior to jointing or terminating. Seal cables left unconnected for more than 24hrs to prevent ingress of moisture. Seal plastic sheathed cables using proprietary shrink on end caps.

Strip cables to bring out the cores and expose conductors, for the minimum length required for connection, to leave no exposed length of conductor after termination. Ensure that strands are not damaged when stripping cable cores. Twist strands together. Do not reduce numbers of strands. Secure all strands at termination.

Clean armour thoroughly prior to jointing or terminating.

At connections to equipment and switchgear without integral cable clamping terminals, use compression or solder type lugs for bolted terminal connections, of correct bore. Form all compression connections to components using tools that cannot be released until the correct degree of compression has been reached. Bolt core terminations with lugs to equipment using washers or proprietary shakeproof devices. Do not bunch more than three cores at clamping terminals or bolted connections. Mark cable conductor phasing, or other core identification, at each end of the cables, and at all joints, maintaining consistency of marking with any existing system.

Connect all cores, including multi-core cable spare cores, at all joints and terminations. Bond any unused cores of multicore cables to earth at both ends, unless otherwise indicated.

Terminate or joint MIC cables in accordance with the manufacturer's instructions.

4.2.0 LV SWITCHGEAR AND DISTRIBUTION BOARDS

4.2.1 MCCB SWITCHBOARDS & PANELBOARDS

Provide moulded case circuit breaker switchboards and panel boards complete with 4-pole incoming isolator, outgoing circuit breakers and embedded secondary metering complying with Part L2 of the Building Regulations. Fit engraved labelling to the switchboard and fit a mains schematic distribution diagram in A2-size laminated and screw fixed adjacent to the switchboard. Switch boards are to be floor standing. Panel boards are to be floor standing or mounted on floor stood return edge channel frame.

Switchboards & panel board to be:

- Manufactured and tested to BSEN 60439-1
- Be suitably rated for the anticipated maximum current carrying capacity
- Manufactured to withstand a short circuit of 25kA for 1 second
- Constructed of rigid folded sheet steel with removable gland plates and end walls and lockable steel door
- Form 3b, Type 2 form of separation.
- IP4X degree of ingress protection

Provide kVA maximum demand and kVAh sub-metering for the school, to the lighting and power boards in order to comply with Part L2 of the Building Regulations. These shall be connected together via Modbus serial data gathering.

Install XLPE/SWA/LSF sub-main cables from the main switchboard to supply local distribution boards, plus a number of dedicated items of equipment, such as alarm panels, lifts and mechanical services control panels. The sub-main armoured cables will generally be run internally within ceiling voids and risers.

In each area provide final circuit distribution boards incorporating surge protection, locks, isolators and outgoing MCBs, RCDs and RCBOs.

Provide a separate main earth bar mounted adjacent to the panel board to act as the main earthing terminal for the site.

4.2.2 DISTRIBUTION BOARDS

Provide distribution boards of the miniature circuit breaker type complete with integral isolators and fitted with cylinder door locks. Label each board to indicate its unique reference in ink in the circuit lists provided and fit distribution board schedules of laminated paper adjacent or inside of the door. Screw fix at two positions.

Make internal separation Form 1 unless otherwise indicated. Make fuseboards fully shrouded.

Provide a multi-terminal earthing bar for circuit protective conductors for both insulated and metal cased boards, with one terminal for each outgoing circuit.

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Connect directly to earthing terminal without dependence on exposed conductive parts of enclosure. Provide neutral busbars with one outgoing terminal for each outgoing circuit.

New multi-way distribution boards shall be installed wall mounted incorporating meters, locks, isolators and outgoing MCBs/RCBOs.

All relevant safety notices shall be provided at the distribution board position. This shall include “treatment for electric shock”, “Danger” notices, etc.

Distribution boards to be:

- Manufactured and tested to BSEN60439-3
- Be suitably rated for the anticipated maximum current carrying capacity
- IP31 degree of ingress protection
- Able to be fitted with purpose made extension boxes to house remote din-rail mounted equipment.

Ensure that on completion there is a minimum spare capacity for future circuit breakers of 25% or a minimum of 2 spare TP ways in each part of the distribution board to allow for future additional circuits, and that all unused ways are fitted with blanks.

Provide adequate earth terminals to enable separate connection of ring circuit CPC's where supplying equipment with possible high earth leakage currents.

All distribution boards to be provided with meter packs allowing for Modbus serial data connection to the meter data gathering system. These shall generally be embedded into the DB. Where downstream meters are shown at the DBs for dedicated supplies these shall be fitted in matching extension enclosures fixed tight to the DB. Meters located near the mechanical pulse meters shall be complete with count inputs to act as receivers for the mechanical meters.

Identify each fuseway and MCB way by numbering indelibly. Identify each terminal on neutral busbar and earthing bar with its respective fuseway or MCB way. Provide spare ways as shown on the drawing or schedule. Provide and fix a typed copy of the distribution board schedule in a glazed frame adjacent to the board. Where specific ratings are indicated, incorporate fuses or MCBs, otherwise leave blank for future additions.

4.2.3 CIRCUIT BREAKERS

Moulded Case Circuit Breakers

Provide moulded case circuit breakers which are manufactured to be fully compatible within the panel boards detailed above

Moulded case circuit breakers (MCCBs) to be:

- 25kA Breaking Capacity
- Manufactured to BSEN 60947-1 and BSEN 60947-2
- Capable of operating in temperatures between -25°C and +40°C without the application of de-rating factors
- Capable of locking in the 'off' position
- Fitted with separate removable electronic trip units with adjustable thermal and magnetic characteristics.

Select frame sizes and trip units separately in order to co-ordinate the discrimination conditions of the installation.

Ensure that moulded case circuit breakers are of the same manufacturer as the panel boards for the installation. Ensure that moulded case circuit breakers are fully compatible with the switchboards for the installation.

Miniature Circuit Breakers

Provide miniature circuit breakers which are manufactured to be fully compatible with the distribution boards detailed above.

Miniature circuit breakers to be:

- Minimum 10KA breaking capacity
- Manufactured to BSEN 60898
- Capable of operating at temperatures between -25°C and +40°C without the application of de-rating factors
- Capable of locking in the 'off' position.

Ensure that miniature circuit breakers are of the same manufacturer as the distribution boards for the installation.

Combined MCB/RCD (RCBO Units)

Provide RCBO units which are manufactured to be fully compatible with the distribution boards detailed above.

RCBO units to be:

- Minimum 10KA breaking capacity
- Manufactured to BS EN 60898 and BS EN 61009
- 30mA residual current tripping setting unless otherwise indicated
- Type C magnetic MCB trip setting
- Incorporate reverse polarity protection
- Incorporate neutral protection
- Capable of locking in the 'off' position.

Ensure that RCBO units are of the same manufacturer as the distribution boards for the installation.

4.2.4 FIXING

Fix all equipment independently of wiring system. Use cadmium or zinc electroplated bolts, nuts washers and screws.

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4.2.5 MOUNTING HEIGHT

Mount single items of equipment 1450mm affl. to centre of equipment, unless indicated otherwise. Arrange groups of equipment, other than floor mounted assemblies, so that all parts of equipment requiring access for operation or maintenance are at least 500mm and no more than 2000mm affl., unless indicated otherwise.

4.2.6 ACCESS

Ensure that clearance in front of switchgear and control gear is not less than 1m or as indicated.

4.2.7 MARKING & DRAWING

Number terminals, cables and component parts to correspond with the manufacturer's certified drawings.

4.2.8 CABLE TERMINATIONS

Terminate armoured and MICS cables inside enclosure by securing cables to switchboard with glanding plates or glanding brackets; and outside enclosure with glanding plates or fabricated steel extension boxes.

4.2.9 INSTALLATION AND COMMISSIONING

Install and commission switchgear and control gear in accordance with the appropriate standard and the manufacturer's recommendations. Include CT polarity check in commission tests.

4.3.0 LUMINAIRES, LAMPS AND ACCESSORIES

4.3.1 ORIENTATION

Ensure all luminaires, decorative diffusers, lamps, indicators, etc., are installed in the same direction within any one area e.g.:

1. Wherever possible or applicable in linear lamps to be installed parallel with long axis of the building.
2. All wall-mounted luminaires mains LED indicator lamps to be in the same location i.e. bottom, or side, depending upon luminaire design. LEDs at the top will not be accepted.
3. All ceiling mounted indicator LEDs to be capable of being viewed from the same direction.
4. All decorative diffusers, floating rings, etc., to be uniformly located and in same axis etc.

4.3.2 CLEANLINESS

Ensure luminaires are clean and grease free on handover complete with new lamps. Ceiling tiles containing downlighters luminaires must be strengthened with back boards the same size as the tile.

4.3.3 INSTALLATION

Install surface fittings direct to concrete ceiling or wall, not on surface conduit boxes. Install recessed fittings flush with ceiling. Install semi-recessed fittings as manufacturer's detail. Install wall mounted fittings at the height indicated.

Ensure support is adequate for weight of luminaires. Provide two supports on luminaires longer than 600mm and up to 300mm wide. Provide four supports on luminaires longer than 600mm and over 300mm wide.

Where a luminaire is supported from conduit, provide a conduit box forming an integral part of the conduit system at each point of suspension. Ensure suspensions are vertical. Where conduit enters luminaire, use back nuts and washers to secure luminaire body to conduit support. Provide tube with corrosion resistance equal to conduit system.

Do not support luminaires from conduit boxes made from non-metal or heat sensitive materials, where the temperature of the material may exceed 600C or the mass suspended exceeds 3kg.

Use appropriate size of grommet where cables enter through hole in luminaire body. Ensure that the earthing terminal of Class1 luminaires is connected to the conduit protective conductor of the supply circuit. Clip or tie back loose wiring within the luminaire with proprietary devices at 300mm intervals.

Install lighting switches on different phases at least 2m apart. When light switches on different phases are in a common box, use phase barrier switches.

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4.3.4 EARTHING

Ensure metal framework of equipment is bonded to main earth point. Ensure that cable CPC's are connected to earth bar. Provide earth CPC between earth lug on metal box and accessory casing except where accessory is encased in plastic.

4.3.5 PROTECTION

Ensure there is no physical or electrical damage to accessories when they are removed from their packaging and during installation. Provide masking covers for surface mounted accessories to protect surface from paint. Where accessories are flush mounted, install front plate after painting is finished.

4.3.6 FIXING

Align accessories horizontally and vertically, as indicated. Where accessories are grouped, mount horizontally in line and parallel to each other and equidistant. Fix cover plates to boxes with brass fixing screws.

4.3.7 MOUNTING HEIGHTS

Unless specified on drawings, position of electrical accessories to centre line, Socket outlets 550mm affl., Lighting Switches, Fire Alarm Call Points 1100mm affl. In Kitchen areas outlets to be 200mm centre line above work top.

4.3.8 LAMPS

Lamps are to be installed in luminaires immediately prior to practical completion and not used as means of temporary lighting. The lamps can only be used for testing of the lighting installation and during handover inspections. If any lamps are used for temporary lighting they must be replaced by new ones just prior to practical completion.

4.4.0 FIRE ALARMS

4.4.1 GENERAL REQUIREMENT

The fire alarm system and installation will fully comply with the recommendation of British Standards and the requirements of the local Fire Officer and the Employer's Insurers.

The fire alarm system will operate at 24v dc open circuit line monitored, and be so wired that a full alarm is initiated by any manually operated call point or automatic detector.

Every zone and sounder circuit will be monitored. In the case of addressable systems, each device must be uniquely addressed, and comply in all respects with the manufacturer's recommendations and particular requirements of the specification.

The fire alarm system will be commissioned by the fire alarm equipment manufacturer.

4.4.2 POWER SUPPLIES

All primary power sources or power supplies from secondary sources will be exclusive to the fire alarm protection system. The supply isolating switch will be coloured red and marked "FIRE ALARM – DO NOT SWITCH OFF".

Alarm and detection systems will operate from a secondary battery having a nominal 24 v dc system voltage. The battery charger will be capable of maintaining the batteries in a fully charge condition on a floating trickle charge under normal no alarm conditions within +/- 10% of the system nominal voltage.

The batteries will be of adequate capacity to ensure that in the event of a mains failure, normal operation is maintained for 24 or 72 hours as appropriate then subsequent operation of all sounders under alarm conditions for ½ an hour is achieved.

When the battery charge output falls or falls 20% below the nominal output voltage then both visual and audible supervisory alarms will be activated on the control panel.

All auxiliary isolators, fused connection units and other equipment associated with either the primary or secondary source of power will be clearly labelled "Fire Alarm Do Not Disconnect".

4.4.3 ZONE CHART

A wall mounted zone chart in a glazed frame will be provided adjacent to any fire alarm control panel.

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4.5.0 EARTHING & BONDING

4.5.1 MATERIALS GENERALLY

Use materials and installation methods in accordance with BS 6651, BS7671, BS 7430 and Electricity Supply Regulations as appropriate.

4.5.2 MAIN AND SUPPLEMENTARY EQUIPOTENTIAL BONDS

Material, insulated cable single core to BS6004. Use no joints in equipotential or supplementary bonds.

4.5.3 CIRCUIT PROTECTIVE CONDUCTORS

Provide protective conductors sized in accordance with BS 7671 543-01-03 and Tables 54B, 54C, 54D, 54E and 54F, or provided sized in accordance with BS 7671 543-01-04 Table 54G.

4.5.4 PROTECTIVE CABLE TERMINATIONS

For bolted connections, use crimp type lugs compressed by automatic tool to achieve correct pressure and crimp depth.

4.5.5 EARTHING CLAMPS

Use clamps complying with BS 951.

4.5.6 WARNING NOTICE/LABELS

Provide a permanent label durably marked in letters 4.75mm minimum height: "SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE" in visible position, at each bonding conductor connection to extraneous conductive parts.

4.6.0 IDENTIFICATION

4.6.1 LABELS AND NOTICES

Apply identification labels and notices in accordance with BS 7671 to all electrical cables plant and equipment including components of mechanical systems.

BS 7671 Labels and Notices:

Identification of Protective Devices
Diagrams, charts or tables to comply with Clause 514-09
Warning notices, voltages in excess of 250V.
Periodic inspection and test notices.
Residual current device notices.
Earth electrode safety electrical connection label.
Bonding conductor connector point to extraneous conductive parts label.
Earth free local equipotential bonding areas warning notice.
Electrical separation areas warning notice.
Outdoor equipment socket outlet notice.

4.6.2 MATERIALS

Use materials for labels with a predicted life at least equal to the equipment being identified.

4.6.3 CABLE IDENTIFICATION AT DISTRIBUTION BOARDS

Within distribution boards and consumers' units, etc, all neutral, phase and earth conductors are to be identified to indicate phase and circuit numbers by the use of cable markers.

In addition all sub-mains must be identified by the use of an identification system fitted to the outside of the sheath at the main switch panel and distribution boards. The cable identification to relate to a cable schedule to be provided on the schematic wiring diagram and in the operation and maintenance manual.

Cable markets and cable identification systems will be manufactured by Critchley or equal and approved

4.6.4 UNDERGROUND CABLE IDENTIFICATION

Identify underground external cable routes by means of approved markers along their length at distances not greater than 30m and where a change of direction occurs on such routes. Provide cable markers with a brass plate or impress concrete to clearly indicate the reference of group of cables. Mark and protect direct buried cables with plastic tape yellow printed black "DANGER ELECTRIC CABLES" elsewhere.

4.6.5 CABLE CONDUCTOR COLOUR CODING

Identify cable conductors in accordance with BS 7671 Para 514, note that a lighting sub-circuit switch wire is a phase conductor in a single phase circuit. Code all single-phase sub-circuit wiring red.

4.7.0 TESTING & COMMISSIONING

4.7.1 TEST EQUIPMENT AND CONSUMABLES

Provide test equipment and consumables to complete tests satisfactorily, and to re-test any failed installations following corrective measures.

4.7.2 TESTING

Carry out in the same order as published, the tests required by BS 7671 Section 713 for New Installation or Altered or Added Installation as appropriate.

4.7.3 CONTINUITY

Confirm continuity using an AC or DC source.

4.7.4 EARTH FAULT LOOP IMPEDANCE

Use 25A test current. Measure and record source impedance. If alternative LV supply arrangements are available, measure when using supply with highest impedance. Measure impedance with main equipotential bonding conductors connected. Do not summate values of several parts of each loop. Apply temperature correction factors suitable for the installation recording values.

4.7.5 SETTINGS AND ADJUSTMENTS

Confirm characteristics and settings of protective devices are within maximum and minimum specified tripping times. Check correct operation of devices. Confirm interlocks and sequences operate safely and as indicated.

4.7.6 COMPLETION CERTIFICATES

Provide completion certificates for electrical installations in accordance with BS 7671. Record details of departures from BS 7671 on certificate. Provide copies of calculations justifying departures from BS 7671 and attach to certificates.

4.7.7 CONDUCTIVE PARTS

Test conductive parts simultaneously accessible with exposed conductive parts of extraneous conductive parts. Establish that they are either not an extraneous conductive part or that they are reliably connected by metal to main equipotential bonding. Confirm conductive parts, which are not extraneous conductive parts, are separated from earth by impedance greater than 50,000 ohms. Confirm other conductive parts are bonded to equipotential zone earth bar by an impedance not exceeding 0.1 ohms.

4.7.8 PHASE SEQUENCE

Check and confirm correct polarity of all conductors in all circuits.

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4.7.9 CABLES

Test continuity and insulation of buried cables immediately after backfilling. Test continuity and insulation of buried cables prior to handover.

4.7.10 CONDUIT, TRUNKING AND DUCTING

Test and confirm electrical continuity before installing cables.