



Harpurhey District Office MCC PSDS Electrical Services Performance Specification

Prepared for: AA Projects Ltd

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DOCUMENT ORIGIN

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SECTION 1 - INTRODUCTION

This Performance Specification is provided to assist with the electrical works associated with the Manchester City Council (MCC) & Equans Public Sector Decarbonisation Scheme (PSDS) for Harpurhey District Office, 6 Moston Lane, Manchester, M9 4DD.

The proposed electrical services scope of works and specification details are described in section 3 & section 4 of this performance specification.

The purpose of this specification is to give an indication of the electrical engineering services required to meet the employer's requirements.

The electrical sub-contractor shall use, as the basis of their tender, the materials and equipment indicated in this document.

The electrical sub-contractor may in addition offer alternatives from the MCC/Equans PSDS Manufacturer list to those indicated in the specification, provided the quality is not compromised. All assumptions made in the preparation of the tender must be provided with the tender return form. Any changes in materials and equipment shall be on an equal and approved basis.

All proposed equipment and material suppliers specified or proposed to be utilized on the project must provide a copy of their Modern Anti-Slavery Policies to demonstrate what systems and controls are in place within their organization's & supply chains to ensure modern slavery is not taking place.

It is intended that the detailed design & co-ordination of the electrical engineering services installations will be the responsibility of the successful electrical sub-contractor.

This specification is divided into nine sections.

Section 1	Introduction
Section 2	Project Directory
Section 3	Scope of Works
Section 4	Specification & Standard Materials and Workmanship
Section 5	Electrical Services Tender Summary

This specification should be read in conjunction with the electrical, mechanical specification and drawings and all other tender / contract documentation.

SECTION 2 - PROJECT DIRECTORY

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Manchester Civic Quarter, Heat Network
Manchester City Council

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SECTION 3 – SCOPE OF WORKS

3.1 General

The proposed works under the PSDS3 scheme consists of the following: -

- Upgrade internal existing lighting to LED lighting to reduce power consumption and improved efficiency.
- Provision of Solar Photovoltaic Array to roof to take advantage of renewable energy.
- Introduction of Loft Insulation to improve building fabric and reduce heat losses.
- Provision of Air Source Heat Pumps (ASHPs) to replace hot water generation and heating.
- Associated Incoming Electrical supply & LV distribution network modifications and upgrade to accommodate the necessary power supplies for the ASHPs

This performance electrical specification relates to all associated electrical services installations. The provision of the ASHP's and associated mechanical services installation / upgrades and improvements to the building fabric insulation levels will be undertaken by others.

3.2 Building Information

The Harpurhey district social services offices was built circa 1967 and has a GIFA of approximately 1879m². The building has a cavity wall construction; however, the building does not appear to have cavity wall insulation.

The loft space is directly accessible above the lay-in suspended ceilings and is very poorly insulated.

The existing lighting systems appear to have been recently upgraded throughout the building and comprise of wholesale replacement of the lighting installation to LED fittings. It also appears that some additional automatic controls have also been installed, as a part of this upgrade.

There is currently no solar PV Array on the site, although the roof has partially suitable orientation to accommodate a Solar PV array.

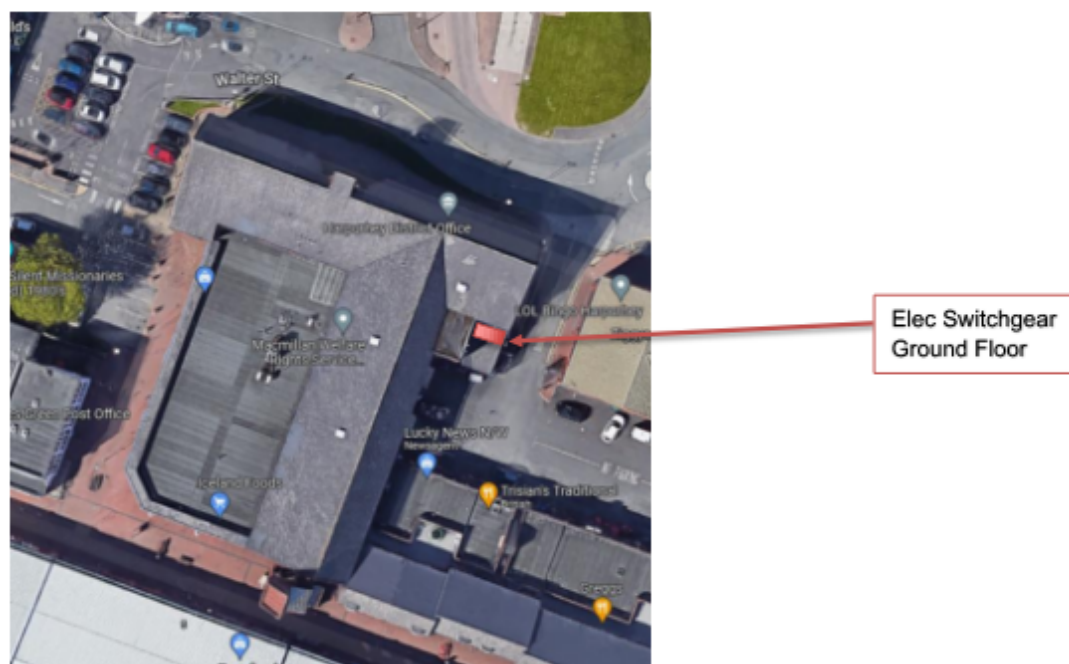
The boiler room is located to the rear of the building accessed via the service yard. The electrical incoming service & switch room shares a space with the bin store and is accessed externally from the entry into the rear service yard.

3.3 Incoming Mains Supply

The existing declared Authorised Service Capacity (ASC) for the site is 115kVA, however historical MD readings indicate the maximum demand for the building is circa 40kVA.

The existing incoming supply enters the building within the shared bin store / switchroom space which is located and accessed from the vehicular entry to the rear service yard. The incoming service terminates at a serves a 200A rated Lucy manufacture head end / meter unit, connecting to a customer 200A isolation switch. This switch connects to an adjacent MCCB panelboard of Schneider (Square D) manufacture, which also serves and adjacent MCCB panel board (also Square D). The MCCB panelboards provide services to distribution boards (Square D) and switchgear installations throughout the site.

Mains Incoming Supply Location:



Proposed Incoming Service Electrical Requirements:

Based on the historical maximum demand information for the building which indicates an existing MD of circa 40kVA and electrical supply requirements / duties provided for the 2No new ASHP's, the new building MD has been assessed to be in the order of 133kVA.

An application has been made to ENWL for a new and upgraded incoming service rated at 140kVA. The order for this incoming service will be placed by the Principal / Main Contractor. The electrical contractor shall however make allowance for attendances, liaison, programming, and coordination with the utility for making safe, disconnection and stripping out of the existing utility services and provision of the new upgraded service.

3.4 Lighting & emergency Installations

The existing lighting installations have been upgraded to LED type, hence no further upgrades are required under this project.

3.5 Solar PV Array

There is currently no existing PV array onsite.

It has been ascertained that although the building has multiple roofs that would be capable of supporting PV arrays, only 3 of these roofs would be considered for PV arrays. These roofs range from SSW, WNW & ESE roofs with pitches at approx. 25degrees. Although, there is sufficient space to add the estimated total PV area included within the PSDS3 application, the WNW and ESE roof areas however, would not gain maximum benefit due to pitch angles and orientation. Hence it has been determined the most efficient location would be on the SSW facing roof, as indicated in the picture below.

The SSW roof has an approximate free area of 280m² for the mounting of PV Panels. This would not meet all the proposed area requirements.

The proposal to provide 315m² PV array of approximately 48.3kWp would not fit on the proposed optimal roof location. Additional PV would need to be provided on the sub-optimal roofing, however due to the orientation / pitch of the roof, these panels would be less efficient resulting in a lower yield of energy, which would need to be considered.

The indicative scheme provides for 2No options utilising either the smaller area of SSW roof or to extend the array on the WNW roof.

Access to the solar array should be infrequent since the pitch of the roofs would facilitate the self-cleaning under normal weather conditions experienced in the UK.

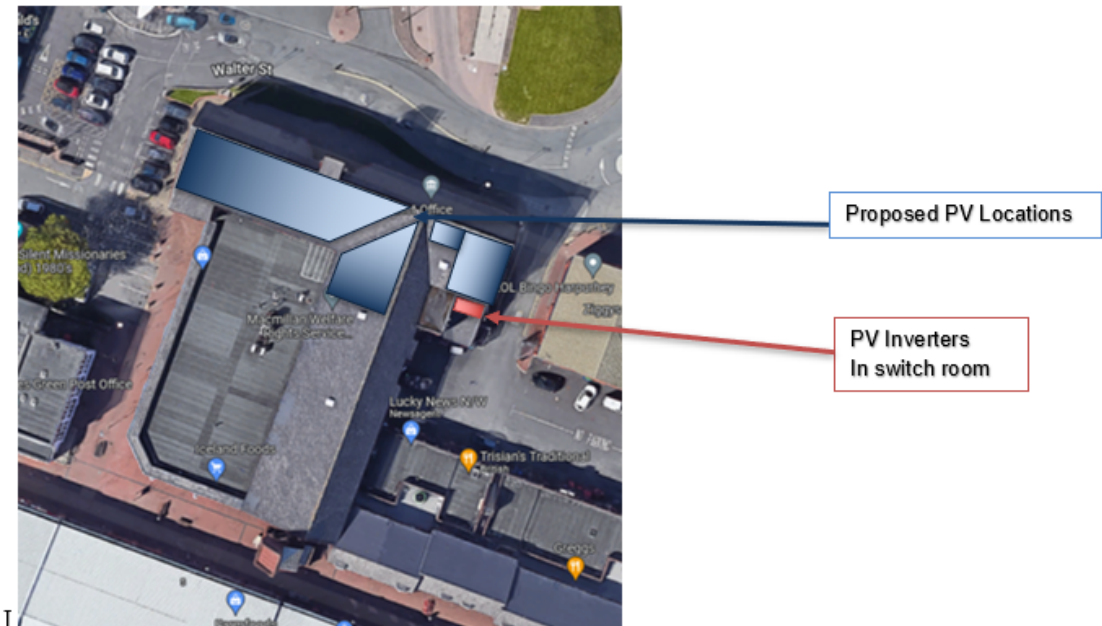
Scaffold would be required to be provided to allow access to the roof for installation.

The scaffold would also need to extend over the adjacent properties and permissions will need to be sought prior to any commencement of works. Future maintenance would also require a means of external access to the roof, most likely in the form of scaffold due to the inaccessibility to mobile working platforms.

The existing electrical switch room would provide sufficient space to provide a small inverter suitable for the proposed array, subject to requirements for the upgraded incoming electrical service and switchgear installations.

Proposed PV array location and indicative panel sizing solution:

PV Array Location:



Building	kWp	PV Area (m ²)	Panel Size		Panel Area (m ²)	No.	Panel Output
			Length (mm)	Width (mm)			W
Harpurhey District Offices	48.3	239	1765	1048	1.85	129	375

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Section 4 -Stage 3 Performance Specification & Standard Materials & Workmanship

PSDA Decarbonisation Works for
Manchester City Council

23-11-2022

PSDS Decarbonisation Works

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Ss_70_10_70_35

Grid-connected photovoltaic systems

Systems

Ss_70_10_70_35 Grid-connected photovoltaic systems

1. Description: Refer to tender / planning drawings for details of proposed installations which typically accord with Salix requirements and available funding.

A specialist contractor shall be employed to design, supply, install test, commission and set to work the complete photovoltaic string array.

The specialist contractor shall develop the indicative scheme proposals into fully detailed design solutions for supply, installation and commissioning, including G99 applications, and certifications.

Where, roof mounted, the installations shall be bracketed to roof joists ensuring that any waterproof membranes are maintained.

The string arrays shall be connected to inverters typically located within the switchroom or plantroom areas and connected to the electrical distribution system.

Please note, the client requirement for all equipment and suppliers proposed to be used on this project is that proof is provided and demonstrated through the supply chain of adherence to modern anti-slavery standards.

2. System performance: [Ss_70_10_70/210 Design of photovoltaic systems](#); [Ss_70_10_70/220 Structural and weatherproofing considerations](#); [Ss_70_10_70/230 Photovoltaic arrays](#)
3. System manufacturer: Submit proposals To be sourced from Manchester City Council approved and preferred manufacturers schedule, being one of the following. Canadian Solar, JA Solar, Bosch & Trina Solar
4. Input source: Refer to tender drawings
5. Mounting: [Pr_80_77_27_31 Free-standing mounting frames for solar modules](#)
6. Switchgear and controls: [Pr_65_72_43_42 Inverters](#); [Pr_60_70_48_62 Photovoltaic array junction boxes](#); [Pr_60_70_48_47 Low-voltage switch-disconnectors](#); [Pr_65_72_43_64 Power conditioning units](#)
7. Cable type: [Pr_65_70_48_73 Heavy-duty cross-linked elastomeric-insulated and sheathed low-smoke halogen-free \(LSHF\) heat-resistant flexible single-core cables](#); [Pr_65_70_48_38 Heavy-duty cross-linked elastomeric-insulated and sheathed flexible cables](#)
8. Cable sizes: Submit proposals
9. Rewireable installation: Required.
10. Concealed installation: Required.
11. System accessories: [Pr_80_51_51_22 Digital metering equipment](#); [Pr_65_72_27_48 Low-voltage power supply surge protection devices](#); [Pr_65_72_27_62 Photovoltaic installation direct current \(d.c.\) surge protection devices](#); [Pr_60_70_65_63 Photovoltaic modules](#)
12. Execution: [Ss_70_10_70/630 Installing PV module arrays](#)
13. System completion: [Ss_70_10_70/810 Testing and commissioning photovoltaic systems](#); [Ss_70_10_70/820 Documentation](#); [Ss_70_10_70/815 PV array performance tests](#)

System performance

Ss_70_10_70/210 Design of photovoltaic systems

1. Design: Complete the design of the photovoltaic system.
2. Standards: In accordance with [BS 7671](#), [BS IEC 62548](#) and [EREC G99](#).

3. **Testing and commissioning:** Incorporate adequate measures to allow full testing and commissioning of the completed system.
4. **Proposals:** Submit detailed design drawings, manufacturers' literature and technical information, and calculations showing estimated annual energy yield using the method prescribed in the [BRE](#) publication Simplified Building Energy Model (SBEM).
5. **Approvals:** Obtain written approval of the Distribution Network Operator.

Ss_70_10_70/220 Structural and weatherproofing considerations

1. **Modifications to existing structures:** Assess the existing structure to ensure that it can sustain a significant increase in permanent or imposed loading.
2. **Supports and fixings**
 - 2.1. **Requirement:** No impairment to the thermal and weatherproofing performance of the building fabric.
 - 2.2. **Arrangement of fixings or proposed supporting structure:** Submit proposals.
 - 2.3. **Submittals to include:** Electronic drawing in dwg format and pdf format, together with written confirmation of compliance with requirement.
 - 2.4. **Timing of submittals:** 7 days prior to placing orders for any equipment

Ss_70_10_70/230 Photovoltaic arrays

1. **Nominal output**
 - 1.1. **Peak power:** Refer to indicative proposals on tender drawing
 - 1.2. **Number of strings:** Submit proposals
 - 1.3. **String voltage (maximum):** Submit proposals

Products

Pr_60_70_48_47 Low-voltage switch-disconnectors

1. **Manufacturer:** Submit proposals
2. **Standards:** To [BS EN IEC 60947-1](#) and [BS EN IEC 60947-3](#).
3. **Third-party certification:** [ASTA Type test certification](#).
4. **Rated operational voltage (Ue):** 500 V.
5. **Rated operational current (Ie):** To accord with installation
6. **Rated operational frequency:** 50 Hz.
7. **Switch arrangement:** TPN.
8. **Service conditions:** Normal.
9. **Terminals:** Suitable for the connection of copper conductors.
10. **Mechanical interlocking:** Rotary handle capable of accepting up to three padlocks.
11. **Enclosure**
 - 11.1. **Ingress protection (minimum):** To [BS EN 60529](#), IP56.
 - 11.2. **Material:** Polycarbonate.
 - 11.3. **Gland plates:** Pre-drilled cable knock-outs.
12. **Execution:** [Pr_60_70_22/665 Installing low-voltage switchgear generally](#)

Pr_60_70_48_62 Photovoltaic array junction boxes

1. **Manufacturer:** Contractor's choice
2. **Standard:** To [BS EN IEC 61439-1](#) and [BS EN IEC 61439-2](#).
3. **Enclosure**

- 3.1. Material: Polycarbonate.
- 3.2. Degree of protection: To [BS EN 61140](#), Class II.
- 3.3. Ingress protection (minimum): To [BS EN 60529](#), IP65.
- 3.4. Impact protection (minimum): To [BS EN 62262](#), IK10.
4. Busbar rating: Contractor's design
5. String fuses
 - 5.1. Fuse type: gR d.c. to [BS EN 60269-4](#). Miniature circuit breakers to [BS EN 60898-2](#).
 - 5.2. Ratings: Contractors' design
6. Labelling
 - 6.1. Identification labels: 'PV array junction box'.
 - 6.2. Safety labels: 'Danger, contains live parts during daylight'.

Pr_60_70_65_63 Photovoltaic modules

1. Description:
2. Manufacturer: From Manchester City Council Approved Supplier List:- Canadian Solar, JA Solar, Trina Solar, Bosch
3. Standards: To [BS EN IEC 61730-1](#) and [BS EN IEC 61730-2](#).
4. Third-party certification: MCS-certified product
5. Application class: To [BS EN 61140](#), Class II.
6. Cell type: Either polycrystalline to [BS EN 61215-1](#) or monocrystalline to [BS EN 61215-1](#).
7. Format: Welded frame modules.
8. Framework
 - 8.1. Material: Anodized aluminium. Self-coloured GRP.
9. Module interconnections
 - 9.1. Standard: To [BS EN 62852](#).
 - 9.2. Module connectors: Polarized and suitably rated for the applicable d.c. voltage and current.
 - 9.3. Ingress protection (minimum): To [BS EN 60529](#), IP65.
10. Nominal output of module
 - 10.1. Peak power: 375Watt
 - 10.2. Power output tolerance: 0/3%.
11. By-pass diodes: Three, integral to panel.
12. Output warranty: Minimum of 80% power output after 25 years.

Pr_65_70_48_38 Heavy-duty cross-linked elastomeric-insulated and sheathed flexible cables

1. Manufacturer: Contractor's choice
2. Standards: To [BS EN 50525-1](#) and [BS EN 50525-2-21](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#))-certified.
4. Sheath colour: Black.
5. Execution: [Pr_65_70_48/665 Installing flexible cables](#)

Pr_65_70_48_73 Heavy-duty cross-linked elastomeric-insulated and sheathed low-smoke halogen-free (LSHF) heat-resistant flexible single-core cables

1. Manufacturer: Contractor's choice
2. Standard: To [BS EN 50618](#).

3. Third-party certification: British Approvals Service for Cables ([BASEC](#))-certified.
4. Cable type: H1Z2Z2-K.
5. Sheath colour: Black.
6. Execution: [Pr_65_70_48/665 Installing flexible cables](#)

Pr_65_72_27_48 Low-voltage power supply surge protection devices

1. Description: To be provided connected to new Main LV MCCB panel boards and PV array submain circuits
2. Manufacturer: Submit proposals
3. Standard: To [BS EN 61643-11](#), Type 1.
4. Operating voltage and frequency (nominal): 400 V at 50 Hz.
5. Number of poles: 3P+N
6. Maximum continuous operating voltage (Uc): 500 V.
7. Mode of protection: Lines to earth, lines to neutral, neutral to earth.
8. Lightning impulse current (Iimp):
9. Minimum short-circuit current rating (Iscrr): 50 kA.
10. Thermal overload protection: Required.
11. Protection status indicators: Green LED indicating full protection status. Red LED indicating no protection – failure of device.
12. Remote monitoring: Not required
13. Ingress protection (minimum): To [BS EN 60529](#), IP20.
14. Mounting method: Suitable for 35 mm DIN rail.
15. Execution: [Pr_65_72_27/610 Installing surge protective devices for low-voltage power supplies](#)

Pr_65_72_27_62 Photovoltaic installation direct current (d.c.) surge protection devices

1. Manufacturer: Submit proposals
2. Standard: To [BS EN 61643-31](#), Type 1.
3. Number of poles: Three.
4. Maximum continuous operating voltage (Ucpv): 500 V.
5. Mode of protection: '+' to '-', '+' to earth, and '-' to earth.
6. Lightning impulse current (Iimp): 25 kA per mode.
7. Nominal discharge current (In): 20 kA per mode.
8. Protection status indicators: Green LED indicating full protection status. Red LED indicating no protection – failure of device.
9. Remote monitoring: Not required
10. Ingress protection (minimum): To [BS EN 60529](#), IP 20.
11. Mounting method: Suitable for 35 mm DIN rail.
12. Execution: [Pr_65_72_27/630 Installing surge protective devices on d.c. side of photovoltaic installations](#)

Pr_65_72_43_42 Inverters

1. Description: For converting DC to AC for connection to the mains power supply.
2. Manufacturer: Submit proposals from Manchester City Council approved supplier schedule
3. Standard: In accordance with [Energy Networks Association EREC G99/1-6](#).
4. Input

- 4.1. Voltage range: 200–500 V d.c.
- 4.2. Current (maximum): 32 A.
5. Output
 - 5.1. Power rating: Refer to tender drawings schedule for indicative scheme to suit the PV array design
 - 5.2. Nominal voltage: 230 V a.c.
 - 5.3. Nominal frequency: 50 Hz.
 - 5.4. Voltage harmonic distortion: <4% with linear load.
 - 5.5. Overall efficiency (minimum): 95% at rated capacity.
 - 5.6. Maximum power point tracker (MPPT): Required.
6. Topology: Transformerless or Galvanic isolation via integral transformer.
7. Enclosure
 - 7.1. Material: Polycarbonate.
 - 7.2. Ingress protection (minimum): To [BS EN 60529](#), IP 65. or To [BS EN 60529](#), IP 21. to accord with installation.

Pr_65_72_43_64 Power conditioning units

1. Description: Power conditioning units convert d.c power, generated by the array to a.c. power, that is compatible with the voltage, phase, power factor and frequency characteristics of the mains. The main component of the PCU is the inverter; however, the PCU could also contain a maximum power point tracker (MPPT), a.c. and d.c. protection devices, battery charge regulator, and an electricity grid utility interface (to comply with [EREC G99/1-6](#) or [EREC G98/1-4](#) as applicable).
2. Manufacturer: From Manchester City Council approved supplier list:- Canadian Solar, JA Solar , Trina Solar, Bosch.
3. Standards: In accordance with [Energy Networks Association EREC G99/1-6](#). or In accordance with [Energy Networks Association EREC G98/1-4](#), appropriate to the installation.
4. Arrangement: Multi-string inverter capable of accepting input from six parallel strings.
5. Inverter
 - 5.1. Input
 - 5.2. Output
 - 5.2.1. Power rating: To match the PV array
 - 5.2.2. Nominal voltage: 400 V a.c.
 - 5.2.3. Nominal frequency: 50 Hz.
 - 5.2.4. Voltage harmonic distortion: <3% with linear load.
 - 5.2.5. Overall efficiency (minimum): 95% at rated capacity.
 - 5.3. Maximum power point tracker (MPPT): Required.
 - 5.4. Topology: Galvanic isolation via integral transformer or Transformer less. Transformer less.
6. Communications and signalling: Total generated kWh. Input current and power. Mains voltage and frequency. PV voltage. RS 232 port. RS 485 port.
7. Enclosure
 - 7.1. Material: Polycarbonate.
 - 7.2. Ingress protection (minimum): To [BS EN 60529](#), IP 65.

Pr_80_51_51_22 Digital metering equipment

1. Manufacturer: Submit proposals
2. Standards: To [BS EN 50470-1](#) and [BS EN 50470-2](#). To [BS EN 50470-1](#) and [BS EN 50470-3](#).
3. Third-party certification: [Measuring Instruments Directive](#)-approved.

4. **Display:** Eight-digit (including two decimal places) and display of import/ export arrow via backlit LCD; with imp/ kWh LED.
5. **Rated voltage:** 400 V a.c.
6. **Phase arrangement:** Three phase, four-wire.
7. **Rated frequency:** 50 Hz.
8. **Metering functions:** Voltage between phases (V). Voltage between phases and neutral (V). Phase currents (A). Frequency (Hz). Power factor cos ϕ . Active power (kW). Reactive power (kVA(r)). Active energy (kWh). Reactive energy (kVA(r)h).
9. **Mounting:** DIN rail-mounted. or Surface-mounted.
10. **Ingress protection (minimum):** To [BS EN 60529](#), IP54.
11. **Outputs:** Pulse output to [BS EN 62053-31](#) for active and reactive energy. GSM. Modbus
12. **Execution:** [Pr_80_51_51/620 Installing electrical monitoring and metering equipment](#)

Pr_80_77_27_31 Free-standing mounting frames for solar modules

1. **Manufacturer:** Submit proposals
2. **Material:** Extruded aluminium frame and rails.
3. **Tilt angle:** Variable 25–40°.
4. **Dimensions:** To suit solar module size
5. **Module orientation:** Refer to tender drawings for indicative arrangement
6. **Cable ways:** Integral within mounting frame with clip in UV resistant cover.

Execution

Pr_60_70_22/665 Installing low-voltage switchgear generally

1. **Clearance (minimum)**
 - 1.1. **Front access switchgear:** 1000 mm in front of switchgear.
2. **Fixing equipment**
 - 2.1. **Generally:** Fix independently of wiring installation with zinc electroplated fasteners.
 - 2.2. **Indoor equipment:** Fix using internal lugs.
 - 2.3. **Outdoor equipment:** Fix using external lugs.
3. **Orientation:** Accurate and square to vertical and horizontal axes. Align adjacent items of switchgear on the same horizontal axis.
4. **Extension boxes:** Provide where necessary.
5. **Gland plates:** Non-ferrous for single core cables.
6. **Identification**
 - 6.1. **Neutral and earth bar terminals:** Label with the outgoing circuit reference.
 - 6.2. **Cable terminations:** Label with circuit reference, with push-on plastics markers.

Pr_65_70_48/635 Installing low-voltage cables

Shared by: [Pr_65_70_48_75 Low-smoke halogen-free \(LSHF\) insulated single-core non-sheathed cables Type A](#) and [Pr_65_70_48_75 Low-smoke halogen-free \(LSHF\) insulated single-core non-sheathed cables](#)

1. **Standard:** In accordance with [BS 7671](#).
2. **Timing:** Do not start internal cabling until building enclosure provides permanently dry conditions.
3. **Preparation:** Store cables above 5°C for 24 hours before installation.

Clear cable path of debris.

4. Installation temperature (minimum): 5°C.
5. Cables: Install in one length. Dress cables flat, free from twists, kinks and strain.
6. Cable pulling: Do not overstress. Prevent kinks and twisting of the cable.
7. Cable protection: Cables passing through walls and floors to be sleeved with conduit or pipeduct to a minimum of 300 mm. Bush at both ends. Ensure that appropriate fire stopping materials are used to maintain the original fire integrity of the wall or floor around the penetration.
8. Concealed cable runs to wall accessories: Run vertically from the accessory.
9. Exposed cable runs: Direct to surface.
10. Distance from other services running parallel (minimum): 150 mm. Position cables below heating pipes.
11. Jointing and termination
 - 11.1. Final circuit cables: At electrical accessories only.
 - 11.2. Core connections: Using compression lugs to equipment without integral clamping terminals.
 - 11.3. Terminating cables when not using glands: Take sheathing of cables into accessory boxes and equipment and protect against abrasion with grommets.

Pr_65_70_48/665 Installing flexible cables

1. General requirements: [Pr_65_70_48/635 Installing low-voltage cables](#)
2. Cables: Grip securely at connections. Where cord grips do not form an integral part of the accessory or equipment, provide separate proprietary cord grips.

Pr_65_72_27/610 Installing surge protective devices for low-voltage power supplies

1. Standards: In accordance with [BS 7671](#) and [DD CLC/TS 61643-12](#).
2. Point of installation: At main low-voltage switchboard. & on a.c. side of photovoltaic system inverter.
3. Mounting arrangement: Within the enclosure of the equipment to be protected or separate enclosure.
4. Connection arrangement: In parallel with the main circuit current carrying path.
5. Interconnecting cable
 - 5.1. Cable type: Device manufacturer's standard.
 - 5.2. Cable size: Device manufacturer's standard.
 - 5.3. Cable installation: Tightly bind connecting leads together.

Pr_65_72_27/630 Installing surge protective devices on d.c. side of photovoltaic installations

1. Standards: In accordance with [BS 7671](#) and [PD CLC/TS 51643-32](#).
2. Point of installation: On d.c. side of photovoltaic system inverter.
3. Mounting arrangement: Separate enclosure, or within the enclosure of the equipment to be protected.
4. Interconnecting cable

Pr_80_51_51/620 Installing electrical monitoring and metering equipment

Shared by: [Pr_80_51_51_23 Digital multifunction metering equipment](#)

1. Standard: In accordance with [BS 7671](#).
2. Digital metering equipment: Connect to building management system.

Ss_70_10_70/620 Installing photovoltaic systems generally

1. **Standards:** In accordance with [BS 7671](#) and [EREC G99](#). In accordance with [BS 7671](#) and [EREC G99](#).
2. **Installer:** [Microgeneration Certification Scheme](#) accredited.
3. **Materials:** Separate dissimilar metallic materials to prevent bi-metallic corrosion.
4. **Fixing equipment:** Fix independently of any other systems installation with zinc electroplated fasteners indoors and stainless steel fasteners outdoors.
5. **Orientation:** Accurate and square to vertical and horizontal axes. Align adjacent items of switchgear on the same horizontal axis.
6. **Cable installation**
 - 6.1. **Timing:** Complete installation of d.c. cabling before connecting to PV array.
 - 6.2. **Routes and arrangement:** Install positive and negative conductors from the same string together. Minimize length of d.c. cable runs.
7. **Cable terminations:** Label string cables with push-on plastics markers showing unique circuit reference.

Label main incoming d.c. and outgoing a.c. cables at power conditioning unit with push-on plastics markers showing unique circuit reference.

Ss_70_10_70/630 Installing PV module arrays

1. **General requirements:** [Ss_70_10_70/620 Installing photovoltaic systems generally](#)
2. **Fixings:** Suitable for wind loading. Minimum of four clamps per module, placed symmetrically.
3. **PV modules**
 - 3.1. **Layout:** Submit proposals. Refer to tender drawings for indicative proposals
 - 3.2. **Mounting:** Allow adequate ventilation between building fabric and underside of PV module.
 - 3.3. **Electrical connection:** Interconnect between PV modules using integrated connection cables, connector plugs and string cables to form an array consisting of two strings, each string consisting of four modules.
4. **Interconnecting string cable routes:** Interconnecting string cables should be inaccessible to building occupants, but easily accessible to maintenance personnel. Routes should be as short as practicable to minimize voltage drop.

Cables shall be laid on cable tray

System completion

Ss_70_10_70/810 Testing and commissioning photovoltaic systems

1. **Standards:** In accordance with [BS 7671](#). In accordance with [EREC G99](#). To [BS EN 62446-1](#).
2. **Notice before commencing tests (minimum):** 48h
3. **Witnessing of testing and commissioning:** Required.
4. **Approval:** Obtain written approval of the Distribution Network Operator.
5. **Specialist commissioning engineer:** Installer appointed, independent specialist commissioning agent

Ss_70_10_70/815 PV array performance tests

1. **Standard:** To [BS EN 62446-1](#), Annex C.
2. **Test conditions:** Minimum irradiation level 600 W/m².

Ss_70_10_70/820 Documentation

1. Operating and maintenance instructions
 - 1.1. **Scope:** Submit for the system giving optimum settings for controls.
 - 1.2. **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. **Format:** Electronic
 - 1.4. **Number of copies:** Two.
2. Record drawings
 - 2.1. **Content:** General arrangement drawings showing the location of modules, PV array junction boxes, d.c. isolation switches, PV generator junction boxes, power conditioning units, energy meters, a.c. isolation switches and point of connection to a.c. distribution network. Include cabling routes, conductor material and c.s.a., insulation type and colour, number of cores per cable, number of cables in ducts, on tray or ladder.
 - 2.2. **Format:** Electronic drawing.
 - 2.3. **Number of copies:** Two.
3. Submittal date: At handover.
4. Site test results and system performance analysis: Submit.
5. Test equipment calibration certificates: Submit.
6. System commissioning completion certificate: Submit.
7. Approval of Electricity Distributor (grid-connected systems only): Submit.
8. Warranty for system: Submit.
9. Microgeneration Certification Scheme: Submit certificate.

Ω End of System

Ss_70_30_25_25

Earthing and bonding systems

Systems

Ss_70_30_25_25 Earthing and bonding systems

1. Description: Upgrade existing earthing and bonding installations to accommodate new switchgear and equipment installations and modification to existing installations.
2. System performance: [Ss_70_30_25/210 Design of earthing and bonding systems](#); [Ss_70_30_25/220 Electricity distributor's requirements](#); [Ss_70_30_25/230 Equipotential bonding in buildings with information technology equipment](#)
3. Main incoming earth: Establish with the Electricity Distributor.
4. Main protective bonding conductors: [Pr_65_70_48_75 Low-smoke halogen-free \(LSHF\) insulated single-core non-sheathed cables Type A](#)
5. Circuit protective conductors: Cable armour or Cable armour and auxiliary, as required.
6. Earth terminal type: [Pr_65_70_46_24 Earth bars](#)
7. Electrical identification: [Pr_40_10_57_29 Equipment labels and warning notices](#)
8. Execution: [Ss_70_30_25/620 Measurement of characteristics of existing installations](#); [Ss_70_30_25/630 General installation](#); [Ss_70_30_25/670 Installing main protective bonding conductors](#); [Ss_70_30_25/710 Earthing of metal fencing around substations](#); [Ss_70_30_25/720 Notices and labels](#); [Ss_70_30_25/730 Installing functional earthing conductors](#)
9. System completion: [Ss_70_30_25/810 Inspection and testing](#); [Ss_70_30_25/820 Documentation](#)

System performance

Ss_70_30_25/210 Design of earthing and bonding systems

1. Standards: In accordance with [BS 7671](#) and [BS 7430](#).
2. Design: Complete the design of the earthing and bonding systems.
3. Earthing conductor: Size in accordance with [BS 7671](#), Regulation 543.1.3. Size in accordance with [BS 7671](#), Regulation 543.1.4. Size to [BS 7454](#).
4. Main protective bonding conductors
 - 4.1. Connect the following to the main earthing terminal: Connection should be made between the main earthing terminal and extraneous-conductive parts of an installation including, but not limited to, water service pipes, gas installation pipes, other service pipes and ducting, central heating and air conditioning systems, exposed metallic structural parts of the building, and the lightning protection system. Note that some LPS are required to be separated from the building structure and therefore a protective bonding connection to the LPS will be subject to the agreement of the lightning protection specialist.
 - 4.2. Size (minimum): In accordance with [BS 7671](#), Regulation 544.1.1.
5. Supplementary bonding conductors
6. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Ss_70_30_25/220 Electricity distributor's requirements

1. Evidence of compliance: Submit, in accordance with the requirements of the Electricity Distributor.

Ss_70_30_25/230 Equipotential bonding in buildings with information technology equipment

1. Standard: To [BS EN 50310](#).

Products

Pr_40_10_57_29 Equipment labels and warning notices

Shared by: [Ss_70_30_45_45 Low-voltage distribution systems](#)

1. Description: To be provided to identify all new switchgear and cabling installations and connections to existing switchgear and LV distribution systems.
2. Manufacturer: Contractor's choice
3. Material: Face-engraved rigid plastic laminate.

Pr_65_70_46_24 Earth bars

1. Description: Re-utilise existing where existing, otherwise provide as new.
2. Manufacturer: Contractor's choice
3. Material
 - 3.1. Bar type: Hard drawn copper to [BS EN 13601](#).
 - 3.2. Finish: Bare.
 - 3.3. Support: PVC-U.
4. Size
 - 4.1. Profile: 50 x 6 mm.
 - 4.2. Length: To suit installation
5. Predrilled connections (minimum): To suit installation
6. Disconnecting links: Two.
7. Execution: [Pr_65_70_46/610 Installing earth bars](#)

Pr_65_70_48_75 Low-smoke halogen-free (LSHF) insulated single-core non-sheathed cables Type A

1. Manufacturer: Contractor's choice
2. Standards: To [BS EN 50525-1](#) and [BS EN 50525-3-41](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#))-certified.
4. Size: As required by BS7671 and cable calculations /schedules
5. Execution: [Pr_65_70_48/635 Installing low-voltage cables](#)

Execution

Pr_65_70_46/610 Installing earth bars

1. Standards: In accordance with [BS 7671](#) and [BS 7430](#).
2. Main earth bar location: Next to the main switchboard or next to the incoming electricity point of supply.
3. Multiple earth bars: Connect with a conductor ring.
4. Mounting
 - 4.1. Orientation: As required by installation
 - 4.2. Support spacing (maximum): 300 mm for 25 mm bar, and 450 mm for 50 mm bar.
 - 4.3. Clearance between wall and earth bar (minimum): 30 mm.

See [Pr_65_70_48/635 Installing low-voltage cables](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

Ss_70_30_25/620 Measurement of characteristics of existing installations

1. External earth fault loop impedance (Z_e): Direct measurement.
2. Earth fault loop impedance (Z_s): Calculate from measurement of the sum of the resistance of the line conductor and the resistance of the circuit protective conductor and addition to external earth loop impedance (Z_e).
3. Results: Submit.

Ss_70_30_25/630 General installation

1. Standards: In accordance with [BS 7430](#) and [BS 7671](#).

Ss_70_30_25/670 Installing main protective bonding conductors

1. Separate and continuous connections: Install between each service and the main earth terminal.
2. Bonding connections at main earth terminal: Connect with compression lugs and phosphor bronze nuts and bolts and spring washers.

Ss_70_30_25/710 Earthing of metal fencing around substations

1. Earthing arrangement: Independent earth.

Ss_70_30_25/720 Notices and labels

1. Earth bars: Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
2. Earthing and main protective bonding connections: Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
3. Supplementary bonding connections: Describe each connection and label with 'SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE'.
4. Telecommunications functional earth connections: Label with 'TELECOMMS EARTH – DO NOT REMOVE'.
5. Earth free locations: For areas utilizing protection by earth-free local equipotential bonding label with 'THE PROTECTIVE BONDING CONDUCTORS ASSOCIATED WITH THE ELECTRICAL INSTALLATION IN THIS LOCATION MUST NOT BE CONNECTED TO EARTH – EQUIPMENT HAVING EXPOSED-CONDUCTIVE-PARTS CONNECTED TO EARTH MUST NOT BE BROUGHT INTO THIS LOCATION'.

Ss_70_30_25/730 Installing functional earthing conductors

1. Standards: To [BS 6701](#) and in accordance with [BS 7671](#).

System completion

Ss_70_30_25/810 Inspection and testing

1. Standards: In accordance with [BS 7430](#) and [BS 7671](#).
2. Continuity of protective conductors
 - 2.1. Parallel earth paths: Isolate before testing.
 - 2.2. Equipment: Continuity tester with short circuit current not less than 200 mA, and a no load d.c. or a.c. voltage between 4 V and 24 V.
3. External earth fault loop impedance (Z_e): Direct measurement.
4. Earth fault loop impedance (Z_s): Calculate from measurement of the sum of the resistance of the line conductor and the resistance of the circuit protective conductor and addition to external earth loop impedance (Z_e).

Ss_70_30_25/820 Documentation

1. Operating and maintenance instructions
 - 1.1. **Scope:** Submit for the system giving optimum settings for controls.
 - 1.2. **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. **Format:** Electronic.
 - 1.4. **Number of copies:** Two.
2. Record drawings
 - 2.1. **Content:** Location and arrangement of plant in plant rooms.
 - 2.2. **Format:** Electronic drawing.
 - 2.3. **Number of copies:** Two.
3. **Submittal date:** At handover.

Ω End of System

Ss_70_30_45_40

Low-voltage site connection systems

Systems

Ss_70_30_45_40 Low-voltage site connection systems

1. **Description:** The development shall be provided with a new and upgraded supply as detailed in the notes on the tender drawings.
The main / Principal Contractor shall place the orders and make payment for the upgraded supplies.
The electrical contractor shall make allowance for attendances, liaison with and coordination with the DNO Electricity Northwest (ENWL), to arrange for providing the new incoming service and to make safe and strip-out and removal / suitable disposal of redundant incoming switchgear installations.
The electrical contractor shall also make allowance for attendance, liaison and coordination with the end-users preferred supplier / meter provider and ENWL for installation of the new utility metering installations.
2. **System performance:** [Ss_70_30_45/220 Supply characteristics](#)
3. **Nature of current:** Alternating.
4. **Phase:** Three-phase, four-wire.
5. **Voltage:** 400 V.
6. **Electricity distributor:** Electricity North West.
7. **Electricity supplier:** TBC
8. **Metering:** Single meter.
9. **Execution:** [Ss_70_30_45/630 Management of electricity distributor](#); [Ss_70_30_45/640 Location of incoming point of supply](#)
10. **System completion:** [Ss_70_30_45/810 Site supply characteristics](#); [Ss_70_30_45/820 Phase sequence](#); [Ss_70_30_45/830 Documentation for incoming low-voltage electricity supply](#)

System performance

Ss_70_30_45/220 Supply characteristics

1. **Anticipated maximum demand (kV·A):** Refer to tender drawings for details.
2. **Earthing type:** TN-C-S.
3. **Maximum prospective short-circuit current:** Typical 18kA, otherwise obtain from DNO and submit proposals.
4. **Maximum external earth fault loop impedance:** Typical 0.15 ohm, otherwise obtain from DNO and submit proposals
5. **Overcurrent device at incoming point of supply**
 - 5.1. **Type:** Fuse to [BS EN 60269-1](#) and [BS HD 60269-2](#).
 - 5.2. **Rating:** Refer to tender drawings for details of new / upgraded supply applications.

Execution

Ss_70_30_45/630 Management of electricity distributor

1. **Establishing the supply:** Manage and liaise with the electricity distributor to establish an incoming electricity supply.
2. **Evidence of liaison:** Submit.

Ss_70_30_45/640 Location of incoming point of supply

1. **Incoming point of supply:** Coordinate the location, and establish the spatial requirements for the electricity distributor's equipment and metering. New installation to be provided prior to making safe and stripping out of existing installation.
2. **Location and colour coding of equipment:** In accordance with [NJUG guidelines on the positioning of underground apparatus for new development sites. Volume 2.](#)
3. **Incoming earthing arrangement:** Establish with the electricity distributor. PME system indicated on ENWL quotation for supply.

System completion

Ss_70_30_45/810 Site supply characteristics

1. **Prospective short-circuit current (Psc):** Measure and submit results.
2. **External earth fault loop impedance (Ze):** Measure and submit results.

Ss_70_30_45/820 Phase sequence

1. **Phase sequence:** Verify.
2. **Means of identification:** Describe within the operation and maintenance manual.

Ss_70_30_45/830 Documentation for incoming low-voltage electricity supply

1. **Operating and maintenance instructions**
 - 1.1. **Scope:** Submit for the system, giving optimum settings for controls.
 - 1.2. **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. **Format:** Electronic.
 - 1.4. **Number of copies:** Two.
2. **Record drawings**
 - 2.1. **Content:** For all low-voltage distribution circuits, the cable origin at the site boundary, route to service cut-out, method of installation, depth of trench, details of ducts (including sizes and position of cable joints).
 - 2.2. **Drawing format:** Electronic drawing.
 - 2.3. **Number of copies:** Two.
3. **Submittal date:** At handover.

Ω End of System

Ss_70_30_45_45 Low-voltage distribution systems

Systems

Ss_70_30_45_45 Low-voltage distribution systems

1. **Description:** Refer to tender drawings. Provide new MCCB Panelboard of same manufacture as existing Schneider (Square D) switchgear installations. The new MCCB Panel board shall be arranged to receive the new upgraded incoming electrical services and to provide supply to the existing site LV distribution and switchgear installations, by connecting to a suitable rated TPN isolator.

The new Main LV MCCB Panelboard shall also provide separate supplies to each of the new ASHP's. The new Panelboard shall be provided with a Type 1 SPD and shall be provided with a metering section to measure the incoming service and meters for each of the outgoing ways, including the whole existing LV distribution systems.

The metering shall be capable of measuring kW, KWh, KVA, Amps, Volts, Hz & Harmonics.

The metering type shall be provided as pulsed output or Modbus type to accord with the proposed target & monitoring (T&M) software installations and arranged to transmit this information to the T&M systems.

The T&M systems shall be provided as a part of the specialist controls package of works, including BMS controls (Trend) under the mechanical services contractor.

The Panel board shall be provided with a minimum of 2No spare TPN outgoing ways.

2. **System performance:** [Ss_70_30_45/211 Design of low-voltage distribution systems](#); [Ss_70_30_45/221 Conduit, trunking and ducting generally](#); [Ss_70_30_45/215 Low-voltage distribution circuit cables generally](#); [Ss_70_30_45/225 Grading study](#)
3. **Connection to low-voltage supply:** At meter operator's terminals
4. **Switchgear:** To accord with existing site installations, where switchgear equipment is available and not in obsolescence. Typically, Schneider manufacture (Square D), or Eaton manufacture MCCB Panelboards shall be provided.
5. **Protective devices :** [Pr_65_72_27_53 Moulded case circuit breakers](#)
6. **Distribution circuit cabling:** [Pr_65_70_48_90 Thermosetting insulated thermoplastic-sheathed low-smoke halogen-free \(LSHF\) armoured cables](#)
7. **Containment:** [Pr_65_70_11_17 Cable trays](#)
8. **Containment accessories:** [Pr_20_29_63_50 Masonry plugs](#); [Pr_20_29_76_85 Stainless steel hexagon head screws](#); [Pr_20_29_08_84 Stainless steel hexagon-headed nuts and bolts](#)
9. **Rewireable installation:** Required.
10. **Concealed installation:** Required. Containment & cabling to be boxed in and painted where surface fixed and routed internally.
11. **Monitoring and metering:** [Pr_80_51_51_23 Digital multifunction metering equipment](#)
12. **Electrical identification:** [Pr_40_10_57_25 Electrical shock treatment signs](#); [Pr_40_10_57_29 Equipment labels and warning notices](#)
13. **Execution:** [Ss_70_30_45/615 Alterations to existing switchgear](#); [Ss_70_30_45/625 Installing low-voltage distribution systems](#)
14. **System completion:** [Ss_70_30_45/811 Inspecting, testing and commissioning of switchgear generally](#); [Ss_70_30_45/821 Documentation for low-voltage distribution systems](#)

System performance

Ss_70_30_45/211 Design of low-voltage distribution systems

1. System designer: Member of the Institution of Engineering and Technology (IET).
2. Design: Complete the design of the low-voltage distribution system.
3. Standard: In accordance with BS 7671.
4. Provision of low-voltage distribution: Provide electrical supplies to equipment requiring power.
5. Spare capacity throughout the low-voltage distribution system: New Switchgear & cabling Installations, Minimum 10% of current carrying capacity.
6. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Ss_70_30_45/215 Low-voltage distribution circuit cables generally

1. Proposed selection of low-voltage distribution cables: Submit drawings, technical information, calculations and manufacturers' literature.
2. Conductor sizes (minimum): 16 mm².
3. Cable sizes not stated: Submit.
4. Format: Amtech.

Ss_70_30_45/221 Conduit, trunking and ducting generally

1. Standard: In accordance with BS 7671.
2. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
3. Conduit, trunking and ducting sizes not stated: Submit.

Ss_70_30_45/225 Grading study

1. Scope: Complete for the low-voltage distribution system (including existing, if any).
2. Fault calculations: Include fault impedance and short circuit fault current analysis.
3. Protective devices : Coordinate the selection and adjustment of protective device settings to achieve discrimination throughout the fault level range. Grade so that a fault on any outgoing branch circuit is cleared by the switching device installed in the faulted branch circuit without affecting the other outgoing branch circuits. Demonstrate discrimination using time-current coordination curves with single line diagrams, in the study report.
4. Manufacturers' details and recommended settings: Include in study report.
5. Study report
 - 5.1. Format: Printed output from proprietary electrical design software
 - 5.2. Number of copies: Two.

Products

Pr_20_29_08_84 Stainless steel hexagon-headed nuts and bolts

1. Manufacturer: Contractor's choice
2. Bolts
 - 2.1. Standard: To BS EN ISO 4014. To BS EN ISO 4016.
 - 2.2. Size
 - 2.2.1.Thread diameter: To accord with installation
 - 2.2.2.Length: To accord with installation
 - 2.3. Steel grade: A2 to BS EN ISO 3506-1. A4 to BS EN ISO 3506-1.

3. Nuts
 - 3.1. Standard: To [BS EN ISO 4032](#). To [BS EN ISO 4033](#). To [BS EN ISO 4034](#).
 - 3.2. Property class: To match bolt strength.
4. Accessories: Locking nut. Plastics cap to bolt head.

Pr_20_29_63_50 Masonry plugs

1. Manufacturer: Contractors choice
2. Format: To suit substrate, loads to be supported and conditions expected in use.
3. Size: To suit installation

Pr_20_29_76_85 Stainless steel hexagon head screws

1. Manufacturer: Contractor's choice
2. Screws
 - 2.1. Standard: To [BS EN ISO 4017](#). To [BS EN ISO 4018](#).
 - 2.2. Steel grade: A2-50 to [BS EN ISO 3506-1](#). A4-50 to [BS EN ISO 3506-1](#).

Pr_40_10_57_25 Electrical shock treatment signs

1. Description: To be provided in incoming electrical switchroom.
2. Manufacturer: Contractor's choice
3. Format: Plastics encapsulated.
4. Content: Text and images.
5. Size: Contractor choice to suit available space in installation.

See [Pr_40_10_57_29 Equipment labels and warning notices](#) in [Ss_70_30_25_25 Earthing and bonding systems](#)

Pr_65_70_11_17 Cable trays

1. Manufacturer: Contractor's choice
2. Standard: To [BS EN 61537](#).
3. Material: Metal. Galvanised steel.
4. Resistance against flame propagation: Non-flame-propagating.
5. Electrical properties
 - 5.1. Continuity characteristics: With electrical continuity.
 - 5.2. Conductivity characteristics: With electrical conductive system component.
6. Coating material: Hot-dip-galvanized.
7. Mechanical properties
8. Features
 - 8.1. Flange type: Return.
9. Execution: [Pr_65_70_11/621 Installing cable tray and cable ladder](#); [Pr_65_70_11/661 Cable support zones](#)

Pr_65_70_48_90 Thermosetting insulated thermoplastic-sheathed low-smoke halogen-free (LSHF) armoured cables

1. Manufacturer: Contractor's choice
2. Standard: To [BS 6724](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#))-certified.
4. Size: As required by calculations

5. Sheath colour: Black.
6. Execution: [Pr_65_70_48/680 Installing low-voltage armoured cables](#); [Pr_65_70_48/720 Cables in ducts](#); [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#)

Pr_65_72_27_53 Moulded case circuit breakers

1. Manufacturer: To accord with proposed panel board installations. Typically, as existing installations. Schneider, or Eaton manufacture are preferred.
2. Standards: To [BS EN IEC 60947-1](#) and [BS EN 60947-2](#).
3. Third-party certification: [ASTA Type test certification](#).
4. Rated operational current (Ie): As required by calculations
5. Number of poles: As circuit schedules.
6. Rated operational voltage (Ue): 400 V a.c.
7. Rated insulation voltage (Ui): 500 V a.c.
8. Rated frequency: 50 Hz.
9. Rated ultimate short-circuit breaking capacity (Icu): 25 kA. 36 kA.
10. Rated service short-circuit breaking capacity (Ics): 100% of Icu.
11. Utilization category: B.
12. Protection
 - 12.1. Type: Electronic.
 - 12.2. Characteristics: Interchangeable. Integral.
 - 12.3. Settings: Adjustable thermal, and magnetic.
13. Adjustment: Rotary dials.
14. Communications
15. Suitable for isolation: Required.
16. Mechanical interlocking:
17. Service conditions: Normal.

Pr_80_51_51_23 Digital multifunction metering equipment

1. Manufacturer: Schneider or equal and approved - submit proposals
2. Display type: Liquid crystal display (LCD).
3. Metering functions: Active energy (kWh). Active power (kW). Apparent power (kVA). Frequency (Hz). Maximum active power demand (kW). Phase currents (A). Power factor. Pulsed output (kWh). Voltage between phases (V).
4. Mounting: Recessed into switchgear.
5. Execution: [Pr_80_51_51/620 Installing electrical monitoring and metering equipment](#)

Execution

Pr_65_70_11/621 Installing cable tray and cable ladder

1. Standards: In accordance with [BS 7671](#) and [IET Guidance Note 1](#).
2. Preparation
 - 2.1. Burrs and sharp edges: Make smooth.
 - 2.2. Cutting: Minimize and make good edges. Cuts to cable tray to be square along an unperforated line.
 - 2.3. Treatment of cut surface: Extend 25 mm beyond the cut. Match finish of cable supports.

3. **Access:** Provide space around cable ladder and tray to permit access for installing and maintaining cables.
4. **Joints and expansion couplers**
 - 4.1. **Position:** Locate between the bracket support and the quarter point.
 - 4.2. **Number of joints:** Minimize.
 - 4.3. **Lengths of cable ladder and tray:** Maximize.
 - 4.4. **Ends:** Blank with end plates.
5. **Changes of size and direction:** Manufacturer's accessories of the same material type, pattern, finish and thickness as cable supports.
6. **Fire barriers:** Provide where required to maintain fire performance of fabric.
7. **Protective covers:** Provide to cables requiring mechanical protection.
8. **Support**
 - 8.1. **Fixing arrangement:**
 - 8.2. **Clearance from building fabric (minimum):** 20 mm.
9. **Components:** Avoid contact between dissimilar metals.
10. **Routing of cable ladder and tray:** Submit drawings showing the proposed routes of cable ladder and cable tray.

Pr_65_70_11/661 Cable support zones

1. **Ceiling voids:** Provide clear distance of 150 mm (minimum) between underside of any cable supports and brackets and the topside of ceiling.

Pr_65_70_48/680 Installing low-voltage armoured cables

1. **General requirements:**
2. **Earthing:** Bond armour to equipment and main earthing system.
3. **Connections to apparatus:** Moisture proof, sealed glands and shrouds.

Pr_65_70_48/720 Cables in ducts

1. **Cable installation from cable drums:** Submit method statement.
2. **Single-core trefoil cable groups and protective conductors:** Install within a single duct and bind at 1 m intervals.

Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket

1. **Cabling:** Install when cable supports are complete.
2. **Position:** Place single and multicore cables side by side.
3. **Fastening**
 - 3.1. **Fastenings generally:** Secure cables, do not indent sheaths. Position to enable any submain cable to be individually removed.
 - 3.2. **Submain cables <95 mm²:** Where necessary, modify the horizontal and vertical spacing to suit the cable type and the particular application
 - 3.3. **Submain cables >95 mm²:** Where necessary, modify the horizontal and vertical spacing to suit the cable type and the particular application
 - 3.4. **Final circuit cabling:** Cable ties at 250 mm (maximum) spacing.
 - 3.5. **Extra-low-voltage and fibre-optic cabling:** Cable ties at 250 mm (maximum) spacing.

See [Pr_80_51_51/620 Installing electrical monitoring and metering equipment](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

Ss_70_30_45/615 Alterations to existing switchgear

1. **Standards:** In accordance with manufacturer's instructions and type test certification.
2. **Alterations:** Submit records of alterations made to assemblies.

Ss_70_30_45/625 Installing low-voltage distribution systems

1. **Standard:** In accordance with [BS 7671](#).
2. **Layout:** Position cabling and equipment to provide safe and easy access for operation and maintenance.

System completion

Ss_70_30_45/811 Inspecting, testing and commissioning of switchgear generally

1. **Standard:** In accordance with [BS 7671](#).
2. **Notice before testing and commissioning:** Seven days.
3. **Switches and circuit breakers:** Clean to remove all visible traces of dust.
4. **Protective devices settings:** Configure to match the grading study.
5. **Switchboard monitoring:** Continuous for 30 minutes following first energizing.
6. **Additional inspecting and testing:** Check levelling and alignment of assembly. Check operation of instruments and metering devices. Check and adjust tightness of busbar connections and supports. Check tightness of bolted connections. Check earth connections at compartments, switches and earth electrodes. Check polarity and phase sequence of protective devices. Manually operate protective devices. Check functional operation of circuit breakers. Check operation of switch tripping devices.
7. **Testing and commissioning results:** Submit two copies.
8. **Certificates of calibration for meters and instruments:** Submit.

Ss_70_30_45/821 Documentation for low-voltage distribution systems

1. **Operating and maintenance instructions**
 - 1.1. **Scope:** Submit for the system giving optimum settings for controls.
 - 1.2. **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. **Format:** Electronic.
 - 1.4. **Number of copies:** Two.
2. **Record drawings**
 - 2.1. **Content:** Location, route and depth of underground cables. Location of LV switchgear including distribution boards. Routes of trunking, conduit, cable tray and cable ladders. Schematic drawings showing all low-voltage distribution circuits: the cable origin, circuit designation, cable type, size, number of cores, size and type of overcurrent protective device.
 - 2.2. **Drawing format:** Electronic drawing.
 - 2.3. **Number of copies:** Two.
3. **Submittal date:** At handover.

Ω End of System

Ss_70_80_25_05

Amenity lighting systems

Systems

Ss_70_80_25_05 Amenity lighting systems

1. **Description:** The existing external luminaire installations, where indicated on the tender drawings shall typically be replaced and upgraded to LED type generally as described on the drawings. The areas indicated for upgrade are dictated by usage, potential energy savings and cost allowances provided for against this aspect of the decarbonisation proposals for upgrade of external/ amenity lighting installations.
The Indicative schemes generally provide for direct replacement of existing fittings with LED and reutilising existing lighting points and wiring installations. In a limited number of instances, supplementary lighting / emergency lighting points & 'live wire' installations may need to be provided and cost provision for same should be included.
2. **System performance:** [Ss_70_80_25/220 Design of amenity lighting systems](#); [Ss_70_80_25/250 Lighting performance of external lighting systems](#); [Ss_70_80_25/270 Lighting cables generally](#); [Ss_70_80_25/280 Conduit, trunking and ducting generally](#)
3. **Electrical supply:** Re-use of existing lighting circuits.
4. **Final circuit cabling:** Typically, re use of existing circuits. Final connections shall, where required be undertaken with new HR LSF flexible cables
5. **Containment:** As existing
6. **Columns and brackets:** As existing. New brackets to be provided where required to suit exiting columns and new LED luminaire arrangements.
7. **Luminaires:** Refer to indicative proposals on tender drawings
8. **Lamp types:** LED
9. **Controls**
 - 9.1. **Types:** Typically, as existing. Refer to tender drawings for details of any alternative proposals.
10. **Electrical identification:**
11. **Execution:** [Ss_70_80_25/610 Removing external lighting systems](#); [Ss_70_80_25/620 Installing external lighting systems](#); [Ss_70_80_25/630 Modifying existing external lighting systems](#); [Ss_70_80_25/720 Cleaning external lighting systems](#)
12. **System completion:** [Ss_70_80_25/812 Commissioning of external lighting systems](#); [Ss_70_80_25/820 Documentation for external lighting systems](#)

System performance

Ss_70_80_25/220 Design of amenity lighting systems

1. **Design:** Complete the design of the amenity / external lighting installations, typically as indicated on the tender drawings.
2. **Standards:** In accordance with [BS 5489-1](#).
3. **Proposals:** Submit detailed design drawings, including circuit diagrams, luminaire layouts, luminaire photometric data including flux fraction ratios, polar intensity curves and utilization factors, lamp and luminaire technical information, road surface reflectance values, power density and efficacy of the installation. Include computer-generated point calculations with contribution from inter-reflected light, maintenance factor calculations, schedule of design and calculated maintained average illuminance values, and a schedule of design and calculated uniformity values.

Ss_70_80_25/250 Lighting performance of external lighting systems

1. **Task area:** Refer to tender drawings for areas where upgrade proposed.

2. Maintained average illuminance level (lx): Refer to tender drawings for performance requirements

Ss_70_80_25/270 Lighting cables generally

1. Standard: In accordance with [BS 7671](#).
2. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
3. Conductor sizes (minimum)
 - 3.1. Lighting circuits: Typically, existing lighting circuits and points to be re-utilised.
 - 3.2. Final connection: 0.75 mm².
4. Cable sizes not stated: Submit.

Ss_70_80_25/280 Conduit, trunking and ducting generally

1. Standard: In accordance with [BS 7671](#).
2. Requirement: Where such installations are required, submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
3. Conduit, trunking and ducting sizes not stated: Submit.

Execution

Ss_70_80_25/610 Removing external lighting systems

1. Scope: Make safe and removal and safe disposal of existing external luminaire installations serving areas as or were indicated on the tender drawings.

Ss_70_80_25/620 Installing external lighting systems

1. Standard: In accordance with [BS 7671](#).

Ss_70_80_25/630 Modifying existing external lighting systems

1. Existing luminaires: Clean.

Ss_70_80_25/720 Cleaning external lighting systems

1. Electrical equipment: Clean immediately before handover.

System completion

Ss_70_80_25/812 Commissioning of external lighting systems

1. Setting for control devices: Submit.
2. Operation of control devices: Verify.
3. Orientation of adjustable luminaires: Adjust to give optimum performance.

Ss_70_80_25/820 Documentation for external lighting systems

1. Operating and maintenance instructions
 - 1.1. Scope: Submit for the system giving optimum settings for controls.
 - 1.2. Product information: Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. Format: Electronic
 - 1.4. Number of copies: Two.
2. Record drawings

- 2.1. **Content:** General arrangement drawings showing the location of columns, electrical cut-outs, enclosures for remote control gear, luminaires, time switches, daylight sensors and cable distribution cabinets.
- 2.2. **Format:** Electronic drawing.
- 2.3. **Number of copies:** Two.
3. **Submittal date:** At handover.

Ω End of System

Ss_70_80_33_35

Hardwired general lighting systems

Systems

Ss_70_80_33_35 Hardwired general lighting systems

1. **Description:** The existing low energy fluorescent luminaire installations shall be replaced and upgraded to LED type generally as described on the drawings. The areas indicated for upgrade are dictated by usage, potential energy savings and cost allowances provided for against this aspect of the decarbonisation proposals for upgrade of lighting installations.
The Indicative schemes generally provide for direct replacement of existing fittings with LED and reutilising existing lighting points and wiring installations. In a limited number of instances, supplementary lighting / emergency lighting points & 'live wire' installations may need to be provided and cost provision for same should be included.
2. **System performance:** [Ss_70_80_33/210 Design of general lighting systems](#); [Ss_70_80_33/215 Design of emergency lighting systems](#); [Ss_70_80_33/220 Escape route lighting](#); [Ss_70_80_33/225 Open area lighting](#); [Ss_70_80_33/240 Lighting performance](#); [Ss_70_80_33/270 Lighting cables generally](#)
3. **Final circuit cabling:** [Pr_65_70_48_75 Low-smoke halogen-free \(LSHF\) insulated single-core non-sheathed cables](#)
4. **Containment:** Typically, re-use of existing installations
5. **Luminaire types:** Typically, as indicated on Tender Drawings. Manchester City Council Preferred approved manufacturer supplier is Dextra Lighting
6. **Lamp types:** LED
7. **Connections to luminaires:** Typically, re-use of existing points and wiring installations. New HR LSF flexible wiring, where required.
8. **Lighting controls:** Typically, as existing unless otherwise indicated on the drawings & proposed luminaire specification
9. **Execution:** [Ss_70_80_33/610 Removing lighting systems](#); [Ss_70_80_33/620 Modifying existing lighting systems](#); [Ss_70_80_33/630 Installing general lighting systems](#); [Ss_70_80_33/640 Installing emergency lighting systems](#); [Ss_70_80_33/720 Labelling of lighting controls](#)
10. **System completion:** [Ss_70_80_33/810 Testing and commissioning of general lighting systems](#); [Ss_70_80_33/812 Testing and commissioning emergency lighting systems](#); [Ss_70_80_33/820 Documentation relating to general lighting](#); [Ss_70_80_33/822 Documentation relating to emergency lighting](#)

System performance

Ss_70_80_33/210 Design of general lighting systems

1. **Design:** The tender drawings provide for an indicative design solution and performance requirements for each installation. The contractor shall corroborate adapt, develop if/where required and take responsibility and ownership of the schemes.
2. **Standard:** In accordance with [SLL Code for lighting](#).
3. **Design calculations:** Luminaire efficacy method.
4. **Submit the following information:** Luminaire layout drawings. Computer generated point calculations with contribution from inter-reflected light showing isolux contour plots for working plane and room surfaces. Lamp and luminaire technical information. Schedule of design and calculated maintained average illuminance values.

Ss_70_80_33/215 Design of emergency lighting systems

1. **System designer:** The tender drawings provide for an indicative design solution and performance requirements for each installation. The contractor shall corroborate adapt, develop if/where required and take responsibility and ownership of the schemes.
2. **Design:** Complete the design of the emergency lighting and signage systems.
3. **Standards:** To [BS EN 1838](#), [BS EN 50172](#) and in accordance with [BS 5266-1](#).
4. **Submit the following information:** Luminaire layout drawings. Lamp and luminaire technical information. Schedule of design and calculated maintained average illuminance values.
5. **Emergency lighting classification**
 - 5.1. Type: X.
 - 5.2. Duration of emergency mode: 180 minutes.

Ss_70_80_33/220 Escape route lighting

1. Minimum horizontal illuminance at floor level on centre line of escape route: 1 lx.

Ss_70_80_33/225 Open area lighting

1. Position: As tender drawings

Ss_70_80_33/240 Lighting performance

1. Maintained average illuminance level (lx): As tender drawings
2. Colour rendering index (Ra): 80–89.
3. Colour temperature (K): 3500. 4000.
4. Means of control: Typically, as existing unless otherwise indicated.

Ss_70_80_33/270 Lighting cables generally

1. **Standard:** In accordance with [BS 7671](#).
2. **Requirement:** Submit proposals, including detailed design drawings, technical information, calculations and manufacturers' literature.
3. **Conductor sizes (minimum)**
 - 3.1. Lighting circuits: 1.5 mm²
 - 3.2. Final connection: 0.75 mm².
4. Cable sizes not stated: Submit.

Products

Pr_65_70_48_75 Low-smoke halogen-free (LSHF) insulated single-core non-sheathed cables

1. **Manufacturer:** Contractor's choice
2. **Standards:** To [BS EN 50525-1](#) and [BS EN 50525-3-41](#).
3. **Third-party certification:** British Approvals Service for Cables ([BASEC](#))-certified.
4. **Size:** Min 1.0mm csa
5. **Execution:** [Pr_65_70_48/635 Installing low-voltage cables](#)

Execution

See [Pr_65_70_48/635 Installing low-voltage cables](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

Ss_70_80_33/610 Removing lighting systems

1. **Scope:** Make safe existing lighting circuits and disconnect remove and safely dispose of existing redundant luminaires. If indicated, pass existing LED luminaires to end user for re-use, or reutilise existing LED luminaires in alternative areas as replacements for existing fluorescent luminaires.
2. **Disposal of batteries:** In accordance with manufacturer's recommended procedures.

Ss_70_80_33/620 Modifying existing lighting systems

1. Existing luminaires: Clean.

Ss_70_80_33/630 Installing general lighting systems

1. **Standard:** In accordance with [BS 7671](#) and [CIBSE Commissioning Code L](#).
2. **Commissioning method statement:** Submit prior to commissioning.
3. **Luminaire layout:** Typically, as indicated on tender drawings.
4. **Connection of luminaire-supporting couplers**
 - 4.1. General luminaires: White plug with white cover.
 - 4.2. Flex length (maximum): Where required, to match existing
5. **Switches and controls**
 - 5.1. Location: Typically, as existing unless otherwise noted on the tender drawings

Ss_70_80_33/640 Installing emergency lighting systems

1. **Standards:** In accordance with [BS 5266-1](#) and [BS 7671](#).
2. **Permanent electrical supplies to self-contained emergency luminaires:** Derive from the closest general lighting circuit.

Ss_70_80_33/720 Labelling of lighting controls

1. **Equipment and sensor identification labels:** Provide.
2. **Lighting controls:** Label each component describing its purpose.
3. **Output circuits:** Label each cable at point of connection to lighting distribution boxes, master distribution boxes and lighting control modules.

System completion

Ss_70_80_33/810 Testing and commissioning of general lighting systems

1. **Standards:** In accordance with [BS 7671](#) and [CIBSE Commissioning Code L](#).
2. **Test results:** Submit two copies of system commissioning completion certificate in accordance with [CIBSE Commissioning Code L](#), Appendix LA4.
3. **Certificates of calibration for meters and instruments:** Submit.

Ss_70_80_33/812 Testing and commissioning emergency lighting systems

1. **Commissioning:** In accordance with [BS 5266-1](#), Annex H. or In accordance with [BS 5266-1](#), Annex I, as appropriate.
2. **Results:** Submit two copies of emergency lighting completion certificates, in accordance with [BS 5266-1](#), Annex H, Figures H.1, H.2, H.3, and H.4. or Submit two copies of an emergency lighting completion certificate, in accordance with [BS 5266-1](#), Annex I, Figures I.1 and I.2 as appropriate.
3. **Certificates of calibration for meters and instruments:** Submit.

Ss_70_80_33/820 Documentation relating to general lighting

1. Operating and maintenance instructions

- 1.1. **Scope:** Submit for the system giving optimum settings for controls.
- 1.2. **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
- 1.3. **Format:** Electronic copies
- 1.4. **Number of copies:** Two.
2. **Record drawings**
 - 2.1. **Content:** General arrangement drawings showing the location of luminaires, lighting circuit distribution boxes, master and slave distribution boxes, switch modules, manual and automatic switches and controls including time switches, passive infrared detectors, and daylight sensors .
 - 2.2. **Format:** Electronic drawing.
 - 2.3. **Number of copies:** Two.
3. **Submittal date:** At handover

Ss_70_80_33/822 Documentation relating to emergency lighting

1. **Operating and maintenance instructions**
 - 1.1. **Scope:** Submit for the system giving optimum settings for controls.
 - 1.2. **Product information:** Include product description, date of purchase, performance characteristics, application (suitability for use), method of operation and control, and cleaning and maintenance requirements.
 - 1.3. **Format:** Electronic copy.
 - 1.4. **Number of copies:** Two.
2. **Record drawings**
 - 2.1. **Content:** General arrangement drawings showing the location of emergency luminaires, lighting circuit distribution boxes, master and slave distribution boxes, switch modules, manual and automatic emergency lighting test panels .
 - 2.2. **Format:** Electronic drawing.
 - 2.3. **Number of copies:**
3. **Submittal date:** At handover.
4. **Logbook:** Submit, including the following information: date of commissioning of the system, including any certificate relating to alterations;

Date of each periodic inspection and test;

Date and brief details of each service, inspection or test carried out;

Dates and brief details of any defects and of remedial action taken;

Date and brief details of any alteration to the emergency lighting installation;

If any automatic testing device is employed, a description of the main characteristic and the mode of operation;

Details of replacement components

of luminaires such as lamp type, battery and fuses.

Ω End of System

Ac_70_60_49/110

Low-voltage electrical installation testing and inspecting

Activities

Ac_70_60_49/110 Low-voltage electrical installation testing and inspecting

1. Description: The contractor or his appointed sub-contractor shall allow for the complete inspection & testing of the electrical installations in accordance with BS7671.
2. General requirements
 - 2.1. Electrical test engineer: Electrical installation contractor.
 - 2.2. Approval: [National Inspection Council for Electrical Installation Contracting \(NICEIC\)](#).
 - 2.3. Evidence of approval: Submit.
 - 2.4. Test equipment calibration: UKAS approved.
3. Execution: [Ac_70_60_49/620 Inspection and testing electrical installations generally](#);
[Ac_70_60_49/610 Test equipment calibration](#)
4. System completion: [Ac_70_60_49/860 Electrical installation certificates](#)

Execution

Ac_70_60_49/610 Test equipment calibration

1. Test equipment calibration: UKAS approved.

Ac_70_60_49/620 Inspection and testing electrical installations generally

1. Standards: In accordance with [BS 7671](#) and [IET Guidance Note 3](#).
2. Notice before commencing tests (minimum): 5 days
3. Installed equipment standards: Verify and confirm compliance with the relevant equipment standards.
4. Electronic devices: Isolate to prevent damage during testing.
5. Continuity of protective conductors
 - 5.1. Parallel earth paths: Isolate before testing.
 - 5.2. Equipment: Continuity tester with short circuit current of at least 200 mA, and a no load d.c. or a.c. voltage between 4 V and 24 V.
6. Insulation resistance (minimum)
 - 6.1. SELV and PELV circuits: 1 megohm when tested at 250 V d.c.
 - 6.2. Other circuits less than or equal to 500 V (excluding SELV and PELV): 2 megohm when tested at 500 V d.c.
 - 6.3. Circuits above 500 V: 2 megohm when tested at 1000 V d.c.
7. External earth fault loop impedance (Ze): Direct measurement.
8. Earth fault loop impedance (Zs): By direct measurement.
9. Measurement locations: Origin, switchgear, fixed equipment and outlets, circuit extremities.
10. Prospective fault current
 - 10.1. Method: Direct measurement.
 - 10.2. Location: Origin, and at points where protective devices are required to operate under fault conditions.
11. Phase sequence: Verify.
12. Cable containment: Measure electrical continuity and insulating properties of containment. Submit results.

System completion

Ac_70_60_49/860 Electrical installation certificates

1. **Description:** An electrical installation certificate must be provided for new installations, or for an addition or alteration to an existing installation.
2. **Standard:** In accordance with [BS 7671](#), Appendix 6. To [National Inspection Council for Electrical Installation Contracting \(NICEIC\)](#) standard.
3. **Format:** Electronic, type written results.
4. **Test equipment identity:** Record on test certificates.
5. **Certificates of calibration:** Submit for each test instrument.
6. **Schedule of test results:** Submit two copies.

Ω End of Activity



Specification created using NBS Chorus

SECTION 5 – ELECTRICAL SERVICES TENDER SUMMARY**MCC PSDS – Harpurhey District Office, 6 Moston Lane, Manchester, M9 4DD.**

The tender is required to fully complete this tender breakdown with a sum against each description for inclusion within this tender submission. Failure to comply will mean the tender will NOT be accepted.

Item	Sect	Description	Cost
1.		General Conditions & Prelims	
	a.	Preliminaries	£
	b.	Design Development	£
	c.	Installation Drawings	£
	d.	Testing & Commissioning	£
	e.	Record Drawings	£
	f.	O&M Manuals	£
	g.	CDM Regulations	£
	h.	Preparation Log Books (TM 31)	£
	i.	Builders work in connection/attendances on incoming electrical supply and ducts.	£
2.	a	Liaison, coordination & attendances with utility for new incoming electrical service	£
	b	Supply cabling between utility service head and main switch board	£
3.		New & modification of LV switchgear installations including CPD devices, metering & SPD.	£
4.		LV distribution cabling to new switchgear and ASHP installations	£
5.		Containment installations	£
6.		Internal & emergency lighting & lighting controls upgrade and modifications (where applicable)	£
7.		External amenity lighting upgrade to LED type (where applicable)	£
8.		Fire detection installations modification & extension to cover roof (where applicable)	£
9.		Solar PV installations, G99 application, testing & commissioning	£
10.		Earthing & Bonding	£
11.		Electrical testing & commissioning of electrical services installations	£
12.		Identification Labelling	£

Item	Sect	Description	Cost
		Electrical Services Sub Total	£
13.		Provisional Sums	
	a.		£
	b.		£
	c.		£
14.		Contingencies	
	a.		£
	b.		£
	c.		£
15.		Electrical Services Grand Total	£

Amount in words: _____

Signed (Authorised Person): _____

Print Name: _____

On behalf of (name of Company): _____

Designation: _____

Address: _____

Tel No: _____

Fax No: _____

Quotation Reference: _____

SCHEDULE OF DAYWORK CHARGES

Daywork Basic Labour Rates (to be submitted with tender)

In the event of acceptance of our tender, we agree that where extra work is to be valued at Daywork Prices, materials and labour shall be charged at net cost plus the following percentages, which cover all establishment charges, profit and discount.

Labour plus	%
Materials plus	%
Plant plus	%
Expenses plus	%

The names of the workmen concerned will be included on vouchers specifying the time spent on the work and any materials used shall also be detailed on the voucher. We will obtain a signature to verify the time spent and material used from a representative of the Employer on site and submit a signed voucher to the Engineer not later than the end of the week following that in which the work has been executed.

The following net basic rates of labour exclusive of all allowances, on costs and profit are applicable to the various operatives as stated below.

Foreman	£ per hour
Advanced Fitter	£ per hour
Fitter	£ per hour
Mate	£ per hour
3rd Year Apprentice	£ per hour

Signed (Authorised Person): _____

Print Name: _____

On behalf of (name of Company): _____

Designation: _____

Address: _____

Tel No: _____

Fax No: _____

Quotation Reference: _____