

DAVIES PARTNERSHIP

DOCUMENT TITLE:

Electrical Services Specification

PROJECT:

Air Source Heat Pump Installation

Y Llwyfan

Carmarthen Campus

CLIENT:

University Of Wales Trinity St David

ENERGISING
ENVIRONMENTS

daviespartnership.co.uk

Document Control

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Ss_70_30_25_25 Earthing and bonding systems

Systems

Ss_70_30_25_25 Earthing and bonding systems

1. Description:

The complete supply, delivery, installation and commissioning of the earthing and bonding system shall be provided throughout the installation in accordance with the requirements of BS 7671, IET Wiring Regulations and Guidance note 8.

Incoming earthing Arrangement - Provided by DNO

The installation shall connect to the sites existing main earth terminal via the earth bar in the main electrical panel at the intake to the building.

All earthing and bonding within the building is existing and shall be retained.

The following specific items shall be bonded: -

The new heat pump distribution board.

Mechanical Plant,

Mechanical Services - such as ducting, pipe work, Plant,

Electrical containments,

Earth loop impedance shall be not greater than those set out in the respective regulations of BS 7671.

The surface of all equipment to which earthing bonds are fixed shall be cleaned from paint and other nonconducting materials.

A bolted earthing clamp conforming to BS 951 must be used for the termination of all earthing/bonding conductors to pipework, radiators, etc. (where fully metallic systems are installed).

Connections to earthing clamps must be made using crimped lugs Earth clamps/final terminations must be mounted in a manner to prevent damage to clothing, limbs etc.

Great care is to be taken in bonding and earthing the installation, and tests are to be carried out as the work progresses to check the electrical continuity of all metalwork conduits, trunking, trays, etc. and earth continuity conductors.

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](#); [Ss_70_30_25/240 Functional earthing design](#)
3. Main incoming earth: Refer to description.
4. Main earth electrode type: Refer to description.
5. Main protective bonding conductors: [Pr_65_70_48_75 Single core non-sheathed \(LHSF\) insulated cables](#)
6. Supplementary bonding conductors: [Pr_65_70_48_75 Single core non-sheathed \(LHSF\) insulated cables](#)

7. Circuit protective conductors: Cable armour.
Cable armour and auxiliary.
Core of cable.
8. Earth terminal type: Pr_65_70_46_24 Earth bars
Distribution Network Operators earth terminal block.
9. Accessories: Pr_65_70_46_29 Earthing clamps
10. Electrical identification: Pr_40_10_27_24 Electrical diagrams; Pr_40_10_27_27 Electrical shock treatment signs; Pr_40_10_57_29 Equipment labels and warning notices
11. Execution: Ss_70_30_25/610 Removing earthing and bonding systems; Ss_70_30_25/620 Measurement of characteristics of existing installations; Ss_70_30_25/630 General installation; Ss_70_30_25/640 Installing earth conductor joints and connections; Ss_70_30_25/650 Installing surface barriers around earth rods; Ss_70_30_25/660 Installing earthing conductor; Ss_70_30_25/670 Installing main protective bonding conductors; Ss_70_30_25/680 Installing supplementary bonding conductors; Ss_70_30_25/690 Dissimilar metals; Ss_70_30_25/700 Earthing and bonding of street furniture; 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
12. 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 to BS 7454.
Size in accordance with BS 7671, Regulation 543.1.3.
Size in accordance with BS 7671, Regulation 543.1.4.
4.
 - 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
 - 5.1. Bond the following: In accordance with BS 7671.
 - 5.2. Size (minimum): Minimum of 2.5 mm² if sheathed or where mechanical protection is provided, otherwise 4 mm².
6. Circuit protective conductors: Size to BS 7454.
Size in accordance with BS 7671, Regulation 543.1.3.
Size in accordance with BS 7671, Regulation 543.1.4.
Refer to drawings.
7. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.
Refer to drawings.

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](#).
2. Objectives: To reduce the potential for touch voltages between items of IT equipment. To provide a common earth reference point for all equipment. To reduce the effects of electromagnetic interference.
3. Earthing network type: Submit proposals.

Ss_70_30_25/240 Functional earthing design

1. Standard: To [BS 6701](#).
2. Objectives: To allow equipment which requires an earth connection to operate correctly and safely.
3. Connection type: Direct to main earth bar.
To a separate dedicated earth-electrode network.
To a separate functional earth bar connected directly to the main earth bar.

Products

See [Pr_40_10_27_24 Electrical diagrams](#) in [Ss_70_10_30_70 Reciprocating internal combustion engine](#)

See [Pr_40_10_27_27 Electrical shock treatment signs](#) in [Ss_70_10_30_70 Reciprocating internal combustion engine](#)

See [Pr_40_10_57_29 Equipment labels and warning notices](#) in [Ss_70_10_30_70 Reciprocating internal combustion engine](#)

Pr_65_70_46_24 Earth bars

1. Manufacturer: Contractor's choice.
2. Material
 - 2.1. Bar type: Hard drawn copper to [BS EN 13601](#).
 - 2.2. Finish: Bare.
Tinned (in wet or high humidity environments).
 - 2.3. Support: PVC-U.
3. Size
 - 3.1. Profile: 50 x 6 mm.
 - 3.2. Length: Allow 25% spare for future.
4. Predrilled connections (minimum): Allow 25% spare for future.
5. Disconnecting links: Two.
6. Execution: [Pr_65_70_46/610 Installing earth bars](#)

Pr_65_70_46_29 Earthing clamps

1. Manufacturer: Contractor's choice.
2. Standard: To [BS 951](#).
3. Material: To suit environment.

Pr_65_70_48_75 Single core non-sheathed (LHSF) insulated cables

Shared by: Ss_70_80_25_05 Amenity lighting systems , Ss_75_50_11_25 Emergency assistance call systems Type A , Ss_70_80_33_35 Hard-wired general lighting systems , Ss_70_30_45_45 Low voltage distribution systems and Ss_70_30_80_35 Hard-wired voltage small power systems

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. Cable type: H05Z-K.
H05Z-U.
H07Z-K.
H07Z-U.
H07Z-R.
5. Size: Refer to drawings. Otherwise submit proposals.
6. Reaction to fire class
 - 6.1. Fire behaviour: Manufacturers standard requirements.
 - 6.2. Additional classification for smoke production: Manufacturers standard requirements.
 - 6.3. Additional classification for flaming droplets and/ or particles: Manufacturers standard requirements.
 - 6.4. Additional classification for acidity: Manufacturers standard requirements.
7. Execution: [Pr_65_70_48/635 Installing low voltage cables](#); [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#)

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 incoming electricity point of supply.
Next to the main switchboard.
3. Multiple earth bars: Connect with a conductor ring.
4. Mounting
 - 4.1. Orientation: Horizontal.
Vertical.
 - 4.2. Spacers: Ceramic.
 - 4.3. Support spacing (maximum): 300 mm for 25 mm bar, and 450 mm for 50 mm bar.
 - 4.4. 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](#)

Pr_65_70_48/660 Installing low voltage cables in conduit and trunking

1. Cable installation: Orderly and capable of being withdrawn.
2. Single core wiring: Arrange using the loop-in method.
3. Cables within trunking: Tie at 2 m intervals for cables of the same circuit reference. Label ties with circuit reference number at 10 m intervals.
4. Cables in vertical conduit: Provide cable clamps in accessible conduit boxes at 5 m intervals.
5. Extra-low-voltage cables: Install within a separate partition from low-voltage cables where installed in multi compartment trunking.

Ss_70_30_25/610 Removing earthing and bonding systems

1. Scope: Complete installation.

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): Direct measurement.
3. Results: Submit.

Ss_70_30_25/630 General installation

1. Standards: In accordance with BS 7430 and BS 7671.

Ss_70_30_25/640 Installing earth conductor joints and connections

1. Number of joints: Minimize.
2. Contact surfaces: Clean. Coat with corrosion inhibitor.
3. Bimetallic joints: Do not cross-contaminate.
4. Protection to joints and connections: Apply heat shrink clear sheathing.
Apply oxide inhibiting compound.
Apply rubberized spray coating.
Apply thixotropic corrosion prevention fluid.
Apply waterproof tape.
5. Connections to test points: Clamp.
6. Copper tape jointing
 - 6.1. Type: Cold pressure weld.
Phosphor bronze clamps, nuts, bolts and washers.
Rivet and sweat-solder whole joint.
Thermic weld.
 - 6.2. Copper tape overlap (minimum): 100 mm.
7. Protective cable terminations: Compression lugs with phosphor bronze nuts, bolts and washers.

Ss_70_30_25/650 Installing surface barriers around earth rods

1. Non-conducting barriers: Install to prevent personnel or livestock contact with the ground within 2 m of earth rods.
2. Location and design: Submit proposals.

Ss_70_30_25/660 Installing earthing conductor

1. Conductor location: Install between the main incoming earth and the main earthing terminal in one continuous length.
2. Connection: Make with compression lugs and phosphor bronze nuts and bolts and spring washers.
3. Earthing conductor route: Minimise length.
4. Connection to earth electrodes: Heavy duty copper alloy mechanical clamps.
5. Protection to earthing conductor: Rigid conduit.

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 conductor routes: Minimise length.

3. Bonding connections at main earth terminal: Connect with compression lugs and phosphor bronze nuts and bolts and spring washers.

Ss_70_30_25/680 Installing supplementary bonding conductors

1. Earth connections: Connect with compression lugs.

Ss_70_30_25/690 Dissimilar metals

1. Connecting dissimilar metals: Prevent electrolytic action.

Ss_70_30_25/700 Earthing and bonding of street furniture

1. Standards: In accordance with BS 7671 and the Electricity Distributor's requirements.
2. Supplies to street furniture: Use cables with separate phase, neutral and protective conductors.

Ss_70_30_25/710 Earthing of metal fencing around substations

1. Earthing arrangement: As per Electricity Distributor site specific requirements.

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.
2. Labelling: Cable sheath continuously marked with the words 'TELECOMS FUNCTIONAL EARTH' with a label at the CMET connection stating 'TELECOMMS EARTH – DO NOT REMOVE'. Cable sheath green/ yellow with a label at all connection points stating 'SAFETY/ TELECOMMS EARTH – DO NOT REMOVE'.

System completion

Ss_70_30_25/810 Inspection and testing

1. Standards: In accordance with BS 7430 and BS 7671.
2. Notice before commencing tests (minimum): 24 h.
3. Continuity of protective conductors
 - 3.1. Parallel earth paths: Isolate before testing.
 - 3.2. 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.
4. External earth fault loop impedance (Z_e): Direct measurement.
5. Earth fault loop impedance (Z_s): Direct measurement.

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: Paper print drawing.
Electronic drawing
 - 1.4. Number of copies: three
2. Record drawings
 - 2.1. Content: Location and arrangement of plant in plant rooms.
Location, size and route of earth electrodes.
Location of earth terminals.
 - 2.2. Format: Paper print drawing.
Electronic drawing
 - 2.3. Number of copies: three
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:

The existing supply head and CT metering arrangement is to be upgraded as a separate contract direct by the client. The contractor shall allow for liaising with the client and for replacing the tails between the meter and the main panel with 185mm² XLPE/LSHF cabling.

The supply for the new heat pumps is to be taken from the existing Dorman Smith MCCB panel board in main switch room. A new 160A TP adjustable MCCB is to be installed in a spare way within the board.

A new 5 core 50mm² XLPE/SWA/LSHF is to be installed from the new MCCB in the ground floor switch room to a new MCB distribution board in the basement boiler room utilising the existing containment for the submains feeding the 2 existing boards in the boiler room. A provisional sum has been included for adding/replacing containment if the existing is found to be inadequate. No "as installed" drawings are available however the assumed route of the cables are indicated on the tender drawings. On possession of the site, the Contractor shall confirm the existing cable routes.

Where the cable route passes between fire compartments the Contractor shall ensure the fire stopping is reinstated. Allowance shall be made for any builders works associated with the new cable installation which should include removal and reinstatement of fire stopping, core drilling of walls and floors, removal and reinstatement of cable boxing out, including paint finishes where appropriate.

An 8 way 250A Hager Invicta 3 MCB distribution board is to be installed in the basement boiler room located above the pressurisation unit. Exact location to be coordinated and agreed on site with the mechanical Contractor and the estates department. This board will feed 3 No heat pumps in the adjacent heat pump compound. The board is to have a side meter enclosure for 3 No multi function meters connected to the heat pump supplies, along with integral surge protection.

GENERAL

All Panel/Distribution boards are to be complete with a hinged door to be complete with standard manufacture locks and 4 number key sets each.

All distribution/Panel/Section boards shall be of the Manufacture and range as detailed on the accompanying schematic.

All distribution boards shall be located as indicated on accompanying Electrical Layout drawing, with unhindered access. Distribution boards shall be labelled and are to have complete typewritten circuits charts (detailing all associated circuitry details of all outgoing final circuit ways) placed within a robust plastic wallet fixed to the inside of the hinged lockable door.

All distribution/Panel/Section shall be complete with incoming and outgoing protective devices and blanking plates as indicated on accompanying schematic.

CONTAINMENT AND CABLING SYSTEMS

There shall be a comprehensive containment installation throughout the development, ensuring the cables are fully supported throughout their length in line with the IET Wiring Regulations. Wiring systems shall be supported such that they will not be liable to premature collapse in the event of a fire in compliance with BS7671, Section 52. This includes the fixing method within the structure, i.e.

PVC plugs will not be accepted given they are not heat/ fire resistant. Suitable fire retardant/resistant means of fixing must be employed throughout.

The containment installation types are as follows;

Primary and Submains Distribution; (as detailed inline with Project or Tender Drawings)

- Containment System 1 (External services) Perforated Galvanised Steel Cable Tray
- Containment Type 1 – Heavy Gauge
- Cable type 1 - Multi Core XLPE/SWA/LHZH

Primary and Submains Distribution; (as detailed inline with Project or Tender Drawings)

- Containment System 2 (Internal services) – Galvanised cable basket
- Containment Type 2 – Metal
- Cable type 2 - Multi Core XLPE/SWA/LHZH

Low Voltage Systems; (As detailed inline with Project or Tender Drawings)

- System Designation 3 - LV Services
 - Containment System 3 – Galvanised Conduit
 - Containment Type 3 – Metal
 - Cable type 3 - Insulated LSZH Singles

Low Voltage Systems; (As detailed inline with Project or Tender Drawings)

- System Designation 3 - LV Services
 - Containment System 3 – Galvanised Trunking
 - Containment Type 3 – Metal
 - Cable type 3 - Insulated LSZH Singles

LABELS & IDENTIFICATION

The function and operation of every switch, shall be adequately described by engraved labels. Labels shall be formed with Traffolyte plastic, having white fascia with black lettering (minimum height of letter 4mm). Each label shall be secured by at least 2No. 2mm chromed raised head bolt, locked in position by a serrated washer beneath each nut.

A schedule of proposed labels shall be submitted to the Engineer for approval prior to production.

Warning labels shall be fitted in all places where the removal of covers, or access panels may expose live equipment operating at a pressure exceeding 230 Volts between phases or to earth.

Warning labels shall be of Traffolyte engraved laminate with red lettering on a white background, and shall bear the inscription 'DANGER - LIVE PARTS OVER 230V' in letters not less than 10mm high, or a suitable EEC standard label of the same size.

All distribution boards and switch gear/ isolators are to be labelled with engraved traffolyte labels detailing the following information:

- DB reference
- Sub main cable size/ characteristics

- Feeder circuit/ rating and location.

Final wording/ referencing to be agreed with Client prior to ordering.

2. System performance: Ss_70_30_45/211 Design of low voltage distribution systems; Ss_70_30_45/215 Low voltage distribution circuit cables generally; Ss_70_30_45/221 Selection of conduit, trunking and ducting; Ss_70_30_45/225 Grading study; Ss_70_30_45/231 Input power supply characteristics; Ss_70_30_45/235 Service conditions for low voltage switchgear and controlgear assemblies; Ss_70_30_45/240 Service conditions and special performance requirements for uninterruptible power supply (UPS) equipment
3. Connection to low-voltage supply: At Meter Operators meter terminals.
4. Switchgear: Pr_60_70_22_11 Cable distribution cabinets; Pr_60_70_22_19 Cubicle switchboards; Pr_60_70_22_22 Distribution boards; Pr_60_70_48_44 Low voltage fuse-switch disconnectors; Pr_60_70_48_47 Low voltage switch disconnectors; Pr_60_70_48_46 Low voltage switch-disconnector fuses; Pr_60_70_48_06 Busbar chambers; Pr_60_70_48_49 Low-voltage switchgear tripping units
5. Protective devices : Pr_65_72_27_11 Cartridge fuses; Pr_65_72_27_47 Low-voltage fuses Type A; Pr_65_72_27_52 Miniature circuit breakers Type A; Pr_65_72_27_72 Residual current circuit breakers; Pr_65_72_27_73 Residual current circuit breakers with integral overcurrent protection Type A
6. Distribution circuit cabling: Pr_65_70_48_79 Split concentric PVC insulated and sheathed cables; Pr_65_70_48_89 Thermosetting insulated and PVC sheathed armoured cables; Pr_65_70_48_90 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables; Pr_65_70_48_29 Fire resistant screened (LSHF) cables; Pr_65_70_48_88 Thermosetting insulated armoured fire resistant (LSHF) cables; Pr_65_70_48_75 Single core non-sheathed (LHSF) insulated cables; Pr_65_70_48_51 Mineral insulation cables; Pr_65_70_48_41 Heavy-duty mineral insulated cables; Pr_65_70_48_55 Multicore screened thermosetting insulated (LSHF) sheathed cables; Pr_65_70_48_61 PVC insulated and sheathed cables; Pr_65_70_48_13 Crosslinked EVA insulated single core non-sheathed cables; Pr_65_70_48_63 PVC insulated single core non-sheathed cables; Pr_65_70_48_74 Single core heat resistant non-sheathed thermoplastic PVC insulated cables; Pr_65_70_48_62 PVC insulated flexible single core cables for switchgear and controlgear wiring; Pr_65_70_48_91 Thermosetting insulated and thermoplastic sheathed (LSHF) cables; Pr_65_70_48_92 Thermosetting insulated non armoured PVC sheathed cables; Pr_60_70_48_66 Power busbar trunking
7. Cable accessories: Pr_65_70_11_13 Cable cleats; Pr_65_70_11_15 Cable ties; Pr_40_10_57_96 Warning marker tapes; Pr_65_70_11_62 Plastic ducts for buried electric cables; Pr_40_10_57_66 Plastics warning marker boards; Pr_65_70_12_92 Underground concrete cable protection covers; Pr_65_70_11_62 Plastic ducts for buried electric cables
8. Containment: Pr_65_70_11_12 Cable baskets; Pr_65_70_11_14 Cable ladders; Pr_65_70_11_17 Cable trays; Pr_65_70_11_19 Channel cable supports; Pr_65_70_11_09 Buried conduit; Pr_65_70_11_71 Rigid conduit; Pr_65_70_11_31 Floor cable trunking and ducting; Pr_65_70_11_18 Cable trunking
9. Containment accessories: Pr_65_70_11_20 Conduit fittings; Pr_20_29_03_17 Chemical anchor cartridges; Pr_20_29_03_16 Chemical anchor capsules; Pr_20_29_76_15 Coach screws; Pr_20_29_03_28 Expansion anchors; Pr_20_29_08_84 Stainless steel hexagon headed nuts and bolts; Pr_20_29_76_85 Stainless steel hexagon head screws; Pr_25_80_81_42 Intumescent linear gap seals; Pr_25_80_81_44 Intumescent trunking pillows; Pr_20_29_63_50 Masonry plugs; Pr_20_29_03_83 Stainless steel chemical anchor rods; Pr_20_29_03_84 Stainless steel chemical anchor sockets
10. Rewireable installation: Required.
11. Concealed installation: Required.
12. Monitoring and metering: Pr_80_51_51_22 Digital metering equipment; Pr_80_51_51_04 Analogue metering equipment; Pr_80_51_51_19 Current transformers; Pr_80_51_51_23 Digital multifunction metering equipment; Pr_65_72_27_74 Residual current monitors

13. Power conditioning equipment: Pr_65_72_43_01 Active electrical filters; Pr_65_72_43_05 Automatic power factor correction equipment; Pr_65_72_43_39 Hybrid electrical filters; Pr_65_72_43_60 Passive electrical filters; Pr_65_72_27_50 Mains power supply transient overvoltage suppression devices; Pr_60_70_64_93 Uninterruptible power supply (UPS) units; Pr_60_70_64_94 Uninterruptible power supply (UPS) remote alarm panels
14. Accessories: Pr_80_77_27_08 Battery shelving racks; Pr_75_51_52_15 Control and protective switching devices; Pr_30_36_08_62 Padlocks and keys; Pr_80_77_28_60 Padlock and key cabinets; Pr_75_51_17_87 Tariff and load control radio tele-switches; Pr_75_51_17_88 Tariff and load control time switches; Pr_60_70_48_05 Automatic transfer switching equipment (TSE); Pr_60_70_48_07 Busbar trunking feed units; Pr_60_70_48_08 Busbar trunking fire barrier units; Pr_60_70_36_75 High-voltage safety matting
15. Electrical identification: Pr_40_10_27_24 Electrical diagrams; Pr_40_10_27_27 Electrical shock treatment signs; Pr_40_10_57_29 Equipment labels and warning notices
16. Execution: Ss_70_30_45/605 Factory inspections; Ss_70_30_45/611 Removing low voltage distribution systems; Ss_70_30_45/615 Alterations to existing switchgear; Ss_70_30_45/621 Alterations to existing busbar trunking; Ss_70_30_45/625 Installing low voltage distribution systems; Ss_70_30_45/626 Installing multi-box assemblies; Ss_70_30_45/631 Electrical property measurement of low voltage systems; Ss_70_30_45/641 Thermal video imaging surveys of low voltage distribution systems; Ss_70_30_45/650 Connection to the incoming supply
17. System completion: Ss_70_30_45/811 Inspecting, testing and commissioning of switchgear generally; Ss_70_30_45/814 Inspecting, testing and commissioning UPS equipment; Ss_70_30_45/821 Documentation; Ss_70_30_45/831 Spares and consumables; Ss_70_30_45/840 Maintenance; Ss_70_30_45/812 Inspecting, testing and commissioning automatic power factor correction equipment; Ss_70_30_45/813 Inspecting, testing and commissioning harmonic filters

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).
Member of the Chartered Institution of Building Services Engineers.
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: 20% 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): Submit.
3. Cable sizes not stated: Submit.
4. Format: Amtech. Hevacomp.

Ss_70_30_45/221 Selection of conduit, trunking and ducting

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: Produced by industry standard design software such as Amtech or Hevacomp.
Printed output from proprietary electrical design software.
PDF output from proprietary electrical design software.
 - 5.2. Number of copies: One of each.

Ss_70_30_45/235 Service conditions for low voltage switchgear and controlgear assemblies

1. Service conditions
 - 1.1. Ambient air temperature
 - 1.1.1. Indoor locations:

BS EN 61439-1 defines normal conditions of temperature as being within a range between -5° to 40°C, with average over a 24 hr period less than 35°C.
Normal conditions unless highlighted in Description.
 - 1.1.2. Outdoor locations: *BS EN 61439-1 defines normal conditions of temperature as being within a range between -25° to 40°C, with average over a 24 hr period less than 35°C.*
Normal conditions unless highlighted in Description.
 - 1.2. Relative humidity
 - 1.2.1. Indoor locations: *BS EN 61439-1 defines normal conditions of relative humidity (RH) as not exceeding 50% at a maximum temperature of 40°C. Higher levels of RH may be permitted at lower levels of temperature.*
Normal conditions unless highlighted in Description.
 - 1.2.2. Outdoor locations: *BS EN 61439-1 permits temporary levels of levels of RH to reach 100% at a maximum temperature of 25°C. 'Temporary', however, is not defined.*
Normal conditions unless highlighted in Description.
 - 1.3. Pollution degree category: *BS EN 61439-1 defines four categories of pollution conditions:*
 - *Pollution degree 1: No pollution or only dry, non-conductive pollution occurs.*
 - *Pollution degree 2: Normally, only non-conductive pollution occurs. Occasionally, a temporary conductivity caused by condensation may be expected.*
 - *Pollution degree 3: Conductive pollution occurs or dry, non-conductive pollution occurs which becomes conductive due to condensation.*
 - *Pollution degree 4: The pollution generates persistent conductivity caused, for instance, by conductive dust or rain or snow.*

BS EN 61439-1 informs that, unless otherwise stated, assemblies for industrial applications are generally for use in a pollution degree 3 environment. However, other pollution degrees may be considered to apply, depending upon particular applications or the micro-environment.
Pollution degree 3 unless highlighted in Description.

- 1.4. EMC environment: Refer to *BS EN 61439 -1, Annex J, which defines two environment types A and B.*
- *Industrial locations which include frequently switched heavy inductive or capacitive loads, high currents and magnetic fields and certain types of industrial, scientific and medical equipment fall within Environment A.*
 - *Locations which are supplied directly at low voltage from the public mains network are considered to be residential, commercial or light-industrial, and therefore fall within Environment B.*
- 1.5. Altitude : *BS EN 61439-1* defines normal conditions as being when the installation does not exceed 2000 m.
Normal conditions unless highlighted in Description.
- 1.6. Special service conditions: *BS EN 61439-1, section 7.2 lists examples of special service conditions, e.g. exposure to strong electric or magnetic fields, attack by fungus or small creatures, installations where fire or explosion hazards exist.*
Not applicable unless detailed in Description.
- 1.7. Conditions during transport and storage: *BS EN 61439-1, section 7.3 informs that special agreement shall be made between the user and manufacturer if conditions of transport, storage and installation, e.g. temperature and relative humidity, differ from those values defined within the standard as being 'normal'.*
Normal conditions unless highlighted in Description.

Products

See Pr_20_29_03_16 Chemical anchor capsules in Ss_70_10_70_35 Grid-connected photovoltaic systems

See Pr_20_29_03_17 Chemical anchor cartridges in Ss_70_10_70_35 Grid-connected photovoltaic systems

See Pr_20_29_03_28 Expansion anchors in Ss_70_10_70_35 Grid-connected photovoltaic systems

See Pr_20_29_03_83 Stainless steel chemical anchor rods in Ss_70_10_70_35 Grid-connected photovoltaic systems

See Pr_20_29_03_84 Stainless steel chemical anchor sockets in Ss_70_10_70_35 Grid-connected photovoltaic systems

See Pr_20_29_08_84 Stainless steel hexagon headed nuts and bolts in Ss_70_10_70_35 Grid-connected photovoltaic systems

Pr_20_29_63_50 Masonry plugs

Shared by: Ss_75_40_02_11 Card access control systems , Ss_75_40_53_86 Surveillance CCTV systems , Ss_75_10_21_88 Telecommunications systems , Ss_75_50_11_57 Nurse call systems , Ss_70_80_33_35 Hard-wired general lighting systems , Ss_75_40_02_05 Audio intercom systems , Ss_75_10_21_21 Data distribution systems , Ss_75_40_75_40 Intruder detection and alarm systems , Ss_75_10_70_88 Television distribution systems and Ss_70_30_80_35 Hard-wired voltage small power systems

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

See Pr_20_29_76_15 Coach screws in Ss_70_10_70_35 Grid-connected photovoltaic systems

See Pr_20_29_76_85 Stainless steel hexagon head screws in Ss_70_10_70_35 Grid-connected photovoltaic systems

See [Pr_25_80_81_42](#) Intumescent linear gap seals in [Ss_70_10_70_35](#) Grid-connected photovoltaic systems

See [Pr_25_80_81_44](#) Intumescent trunking pillows in [Ss_70_10_70_35](#) Grid-connected photovoltaic systems

See [Pr_30_36_08_62](#) Padlocks and keys in [Ss_70_10_30_70](#) Reciprocating internal combustion engine

See [Pr_40_10_27_24](#) Electrical diagrams in [Ss_70_10_30_70](#) Reciprocating internal combustion engine

See [Pr_40_10_27_27](#) Electrical shock treatment signs in [Ss_70_10_30_70](#) Reciprocating internal combustion engine

See [Pr_40_10_57_29](#) Equipment labels and warning notices in [Ss_70_10_30_70](#) Reciprocating internal combustion engine

[Pr_40_10_57_66](#) Plastics warning marker boards

Shared by: [Ss_70_80_25_05](#) Amenity lighting systems

1. Manufacturer: Contractor's choice.
2. Material: High-density polyethylene (HDPE).
Steel reinforced pre-cast concrete.
3. Size
 - 3.1. Height (minimum): For marker posts, *1000 mm above ground when installed.*
For marker blocks, *150 mm.*
 - 3.2. Width (minimum): 140 mm.
 - 3.3. Depth (minimum): 75 mm.
4. Legend: Danger – electrical cables below.
5. Execution: [Pr_40_10_57/710](#) Installing above ground warning markers

[Pr_40_10_57_96](#) Warning marker tapes

Shared by: [Ss_70_80_25_05](#) Amenity lighting systems

1. Manufacturer: Contractor's Choice.
2. Standard: To [BS EN 12613](#), Type 1. To [BS EN 12613](#), Type 2. To [BS EN 12613](#), Type 2. To [ENA 12-23](#).
3. Material: Polyethylene. Polypropylene.
4. Wire detection aid: Required.
5. Format
 - 5.1. Background colour: Yellow.
 - 5.2. Text colour: Black.
6. Legend: 'CAUTION – ELECTRIC CABLE BELOW' every 300 mm along the tape length.
7. Execution: [Pr_40_10_57/700](#) Installing warning devices for underground cables and pipelines

[Pr_60_70_22_11](#) Cable distribution cabinets

Shared by: [Ss_70_80_25_05](#) Amenity lighting systems

1. Description: Feeder Pillars
2. Manufacturer: As drawings otherwise submit proposals.
3. Standards: To [BS EN 61439-1](#) and [BS EN 61439-5](#).
4. Third-party certification: [ASTA Type test certification](#).

5. Rated operational frequency: 50 Hz.
6. Number of phases: Single. Three.
7. Incoming device: As Circuit schedules.
8. Outgoing devices
 - 8.1. Type: [Pr_65_72_27_44 J-type feeder pillar fuses](#)
 - 8.2. Quantity: As Circuit schedules.
9. Busbars and connections
 - 9.1. Type: Fully shrouded.
 - 9.2. Rated operational current (Ie): 125A
 - 9.3. Rated short-time withstand current (Icw) for 1 s: 35 kA.
10. Neutral and earth bars: Individual terminal for each outgoing circuit.
11. Spare ways: As Circuit schedules. Fit with blank plates.
12. Identification: Label L, N and E cable terminations with push on plastic markers identifying circuit reference.
13. Spare outgoing devices:
14. Enclosure
 - 14.1. Ingress protection (minimum): To [BS EN 60529](#), IP65. To [BS EN 60529](#), IP65. To [BS EN 60529](#), IP65.
 - 14.2. Impact protection (minimum): To [BS EN 62262](#), IK10.
 - 14.3. Dimensions: Refer to drawings.
 - 14.4. Material: Steel. Glass reinforced plastics.
 - 14.5. Finish: Bitumen paint to root. Externally polyester powder coated. Hot dip galvanized.
 - 14.6. Colour: Manufacturers's standard.
 - 14.7. Doors: Double. Single. Flexible earthing conductor between main earth terminal and pillar door. Internally hinged with padlock loop. Two tri-head locks.
 - 14.8. Backboard: Include.
15. Accessories: Anti-condensation heater and thermostat. Internal lighting.
16. Execution: [Pr_60_70_22/665 Installing switchgear generally](#)

[Pr_60_70_22_19 Cubicle switchboards](#)

1. Manufacturer: Submit proposals in line with the information provided within this document.
2. Standards: To [BS EN 61439-1](#) and [BS EN 61439-2](#).
3. Third-party certification: [ASTA Type test certification](#).
4. External design type: Wall-mounted surface.
5. Rated operational voltage (Ue): 415 V a.c.
6. Incoming device: [Pr_65_72_27_02 Air circuit breakers](#); [Pr_60_70_48_44 Low voltage fuse-switch disconnectors](#); [Pr_65_72_27_53 Moulded case circuit breakers](#)
7. Outgoing devices
 - 7.1. Type: [Pr_65_72_27_53 Moulded case circuit breakers](#); [Pr_60_70_48_44 Low voltage fuse-switch disconnectors](#); [Pr_60_70_48_47 Low voltage switch disconnectors](#); [Pr_60_70_48_46 Low voltage switch-disconnector fuses](#)
 - 7.2. Quantity: As Circuit schedules.
8. Busbar and connections
 - 8.1. Rated operational current (Ie): As drawings.

- 8.2. Rated short-time withstand current (I_{cw}) for 1 s: Refer to description for details.
 - 35 kA.
 - 50 kA.
 - 63 kA.
 - 80 kA.
9. Terminals: Suitable for the connection of copper conductors.
10. Full length internal copper earth bar: Manufacturer's standard.
11. Spare ways: As Circuit schedules. Fit with blank plates.
12. Enclosure
 - 12.1. Dimensions: Manufacturer's standard.
 - 12.2. Ingress protection (minimum): To [BS EN 60529](#), IP31.
 - 12.3. Impact protection (minimum): To [BS EN 62262](#), IK10.
 - 12.4. Material: Steel.
 - 12.5. Finish: Externally polyester powder-coated.

Internal partitions, zinc-coated.
 - 12.6. Colour: Manufacturer's standard.
 - 12.7. Locking mechanism: Door-interlocked operating handles.
 - 12.8. Hardware: Corrosion-resistant lever type handles with latching mechanism.
 - 12.9. Locks: Cylinder type with a standardized key.
 - 12.10. Fixing of removable panels: Captive, corrosion resistant knurled thumb screws.
Captive, corrosion resistant bolts.
 - 12.11. Lifting bolts: Integral within reinforced top frame.
13. Internal separation: Refer to description for Form type details.
14. Cable entry: Suitable for front access cabling. Entry via gland plates facilitating either top and/or bottom entry.

Suitable for front or rear access cabling entry via top gland plates. Bottom gland plate.
15. Mounting arrangement for Electricity Distributor's metering equipment: Separate.
16. Accessories: Digital metering equipment. Low voltage safety matting. Padlocks and keys.
17. Execution: [Pr_60_70_22/665 Installing switchgear generally](#)

[Pr_60_70_22_22](#) Distribution boards

1. Manufacturer: Refer to drawings. Otherwise Contractor to submit proposals.
2. Standards: To [BS EN 61439-1](#) and [BS EN 61439-3](#).
3. Third-party certification: [ASTA Type test certification](#). [ASTA Type test certification](#).
4. Incoming device: [Pr_60_70_48_47 Low voltage switch disconnectors](#)
5. Outgoing devices
 - 5.1. Type: [Pr_65_72_27_52 Miniature circuit breakers](#); [Pr_65_72_27_73 Residual current circuit breakers with integral overcurrent protection](#)
 - 5.2. Quantity: As Circuit schedules.
6. Busbars and connections
 - 6.1. Type: Fully shrouded.
 - 6.2. Rated operational current (I_e): Refer to Description and drawings for detail.
 - 6.3. Rated short-time withstand current (I_{cw}) for 1 s: Refer to Description and drawings for detail.
7. Neutral and earth bars: Individual terminal for each outgoing circuit.
8. Neutral terminations: Match current carrying capacity of phase conductor.

9. Spare ways: As Circuit schedules. Fit with blank plates.
10. Enclosure
 - 10.1. Ingress protection (minimum): To [BS EN 60529](#), IP20.
 - 10.2. Material: Steel.
 - 10.3. Finish: Polyester powder coated.
 - 10.4. Colour: Manufacturer's standard.
 - 10.5. Locking mechanism: Cylinder locks with a standard key type.
11. Accessories: Digital metering equipment. Padlocks and keys.
12. Execution: [Pr_60_70_22/665 Installing switchgear generally](#)

[Pr_60_70_36_75 High-voltage safety matting](#)

1. Manufacturer: Contractor's choice.
2. Standard: To [BS EN 61111](#).
3. Class: Class 0 – 1000 V.
Class 1 – 7500 V.
Class 2 – 17 kV.
Class 3 – 26.5 kV.
Class 4 – 36 kV.
4. Width (minimum): 900mm.
5. Length (minimum): Match switchgear assembly.
6. Execution: [Pr_60_70_36/611 Installing electrical insulating matting](#)

See [Pr_60_70_48_05 Automatic transfer switching equipment \(TSE\)](#) in [Ss_70_10_30_70 Reciprocating internal combustion engine](#)

[Pr_60_70_48_44 Low voltage fuse-switch disconnectors](#)

1. Manufacturer: Refer to drawings. Otherwise submit proposals.
2. Standards: To [BS EN 60947-1](#) and [BS EN 60947-3](#).
3. Third-party certification: [ASTA Type test certification](#).
4. Rated operational voltage (Ue): 415 V.
5. Rated operational current (In): Refer to drawings.
6. Rated operational frequency: 50 Hz.
7. Switch arrangement: Refer to drawings.
8. Rated short-time withstand current (Icw) for 1 s: Not less than 12 times the maximum rated operational current.
9. Utilization category: AC-23A.
10. Terminals: Suitable for the connection of copper conductors.
11. Mechanical interlocking: Rotary handle capable of accepting up to three padlocks.
12. Enclosure
 - 12.1. Ingress protection (minimum): To [BS EN 60529](#), IP41.
 - 12.2. Impact protection (minimum): To [BS EN 62262](#), IK10.
 - 12.3. Material: Sheet steel.
 - 12.4. Finish: Powder coated.
 - 12.5. Colour: Manufacturer's standard.
 - 12.6. Gland plates: Fully removable to top and bottom faces. Pre-drilled cable knock-outs.
13. Fuses: [Pr_65_72_27_47 Low-voltage fuse links](#)

14. Execution: [Pr_60_70_22/665 Installing switchgear generally](#)

[Pr_60_70_48_46](#) Low voltage switch-disconnector fuses

1. Manufacturer: Refer to drawings.
2. Standards: To [BS EN 60947-1](#) and [BS EN 60947-3](#).
3. Third-party certification: [ASTA Type test certification](#).
4. Rated operational voltage (Ue): 250 V. 415 V.
5. Rated operational current (In): Refer to drawings.
6. Rated operational frequency: 50 Hz.
7. Switch arrangement: DP. SPSN. TPN. Refer to drawings.
8. Rated short-time withstand current (Icw) for 1 s: Not less than 12 times the maximum rated operational current.
9. Utilization category: AC-23A.
10. Terminals: Suitable for the connection of copper conductors.
11. Mechanical interlocking: Rotary handle capable of accepting up to three padlocks.
12. Enclosure
 - 12.1. Ingress protection (minimum): To [BS EN 60529](#), IP41.
 - 12.2. Impact protection (minimum): To [BS EN 62262](#), IK10.
 - 12.3. Material: Sheet steel.
 - 12.4. Finish: Powder coated.
 - 12.5. Colour: Manufacturer's standard.
 - 12.6. Gland plates: Fully removable to top and bottom faces. Pre-drilled cable knock-outs.
13. Fuses: [Pr_65_72_27_47 Low-voltage fuse links](#)
14. Execution: [Pr_60_70_22/665 Installing switchgear generally](#)

See [Pr_60_70_48_47 Low voltage switch disconnectors](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

[Pr_60_70_48_49](#) Low-voltage switchgear tripping units

1. Manufacturer: Submit proposals.
2. Input voltage: 230 V a.c.
3. Incoming supply protection: Miniature circuit breaker to [BS EN 60898-1](#).
4. Charger type: Electronic solid-state controller, constant voltage, current-limited. Automatic temperature compensation.
5. Battery recharge time: To 80% capacity within 12 hours and 100% capacity within 24 hours.
6. Operating temperature range: -10 to +45°C.
7. Battery type: Valve regulated lead-acid cells to [BS EN 60896-21](#) and [BS EN 60896-22](#).
Sealed nickel-cadmium cells to [BS EN 60622](#).
Vented nickel-cadmium cells to [BS EN 60623](#).
8. Output voltage: 24 V d.c..
50 V d.c..
110 V d.c..
9. Capacity (ampere hour): Submit proposals.
10. Vented battery safety labelling: Describe the treatment required following contact with the electrolyte, and warn of the explosion risk caused by naked flames.
11. Meters: Digital multi-meter providing indication of output voltage, charge and discharge current.

12. Indicator lamps: Mains supply healthy.
Float charge.
Boost charge.
Low electrolyte (vented cells only).
13. Alarm and fault indication: Battery low voltage.
Battery high voltage.
Charger fail. Mains supply fail.
Positive and negative earth fault.
14. Common fault relay contact: *Volt-free contacts for remote signalling.*
15. Enclosure
 - 15.1. Standard: To [BS EN 62208](#).
 - 15.2. Ingress protection (minimum): To [BS EN 60529](#), IP31.
 - 15.3. Impact protection (minimum): To [BS EN 62262](#), IK05.
 - 15.4. Material: Contractor's choice.
 - 15.5. Finish: Contractor's choice.
 - 15.6. Colour: Contractor's choice.
 - 15.7. Method of fixing: Floor standing.
Wall mounting.
 - 15.8. Lockable hinged door: Required.
 - 15.9. Cable entry: Removable gland plates for top entry cables.
Removable gland plates for bottom entry cables.

[Pr_65_70_11_09](#) Buried conduit

Shared by: [Ss_75_40_53_86](#) Surveillance CCTV systems and [Ss_70_30_80_35](#) Hard-wired voltage small power systems

1. Manufacturer: Contractor's choice.
2. Standards: To [BS EN 61386-1](#) and [BS EN 61386-24](#).
3. Mechanical properties
 - 3.1. Resistance to impact: Normal.
4. Resistance to bending: Rigid.
Pliable.
5. Resistance to external influences
 - 5.1. Protection against ingress of solid objects (minimum): To [BS EN 60529](#), IP3X.
 - 5.2. Protection against ingress of water (minimum): To [BS EN 60529](#), IPX0.
6. Resistance to corrosion: High protection, inside and outside.
7. Resistance to flame propagation: Non-flame propagating.
8. Sizes (OD): Contractor's choice.
9. Execution: [Pr_65_70_11/730](#) Installing conduit in concrete; [Pr_65_70_11/735](#) Installing conduit connections to equipment

[Pr_65_70_11_13](#) Cable cleats

Shared by: [Ss_70_30_80_35](#) Hard-wired voltage small power systems

1. Manufacturer: Contractor's choice.
2. Standard: To [BS EN 61914](#).
3. Environmental influences

- 3.1. Non-metallic and composite components: Resistant to ultraviolet light.

Pr_65_70_11_15 Cable ties

Shared by: [Ss_70_30_80_35 Hard-wired voltage small power systems](#)

1. Manufacturer: Contractor's choice.
2. Standard: To [BS EN IEC 62275](#).
3. Format: Wrap around self-locking releasable.
4. Contribution to fire : Non-flame propagating.
5. Environmental influences
 - 5.1. Non-metallic and composite components: Resistant to ultraviolet light.
 - 5.2. Metallic and composite components: Resistant to corrosion.

Pr_65_70_11_18 Cable trunking

Shared by: [Ss_75_40_02_11 Card access control systems](#) , [Ss_75_40_53_86 Surveillance CCTV systems](#) , [Ss_70_80_25_05 Amenity lighting systems](#) , [Ss_75_50_11_25 Emergency assistance call systems Type A](#) , [Ss_75_10_21_88 Telecommunications systems](#) , [Ss_75_50_11_57 Nurse call systems](#) , [Ss_70_80_33_35 Hard-wired general lighting systems](#) , [Ss_75_40_02_05 Audio intercom systems](#) , [Ss_75_40_75_40 Intruder detection and alarm systems](#) , [Ss_75_50_28_29 Fire detection and alarm systems](#) , [Ss_75_10_70_88 Television distribution systems](#) and [Ss_70_30_80_35 Hard-wired voltage small power systems](#)

1. Manufacturer: Contractor's choice.
2. Standards: To [BS EN 50085-1](#) and [BS EN 50085-2-1](#).
3. Installation position: Refer to drawings. Otherwise submit proposals.
4. Resistance to flame propagation: Non-flame propagating.
5. Electrical properties: With electrical continuity characteristics.
6. Protection by enclosure
 - 6.1. Protection against ingress of solid objects (minimum): To [BS EN 60529](#), IP4X.
 - 6.2. Protection against ingress of water (minimum): To [BS EN 60529](#), IPX1.
 - 6.3. Protection against access to hazardous parts (minimum): To [BS EN 60529](#), IPXXD.
7. Screening: Not required.
8. Sizes: Refer to drawings. Otherwise submit proposals.
9. Compartments: Refer to drawings. Otherwise submit proposals.
10. Accessories and fittings
 - 10.1. Generally: Factory made by the cable trunking or ducting manufacturer and of the same material type and finish as the cable trunking or ducting.
 - 10.2. Types: Galvanised to RAL colour to be determined by Architect.
11. Execution: [Pr_65_70_11/740 Installing trunking generally](#); [Pr_65_70_11/765 Conduit, trunking and ducting zones](#)

Pr_65_70_11_19 Channel cable supports

Shared by: [Ss_75_10_21_88 Telecommunications systems](#) and [Ss_70_30_80_35 Hard-wired voltage small power systems](#)

1. Manufacturer: Contractor's choice.
2. Standard: To [BS 6946](#).
3. Format: Contractor's choice.

4. Dimensions: Contractor's choice.
5. Material: Carbon steel.
6. Finish: Hot dip galvanized.
7. Accessories
 - 7.1. Manufacturer: As channel cable support.
 - 7.2. Type: Contractor's choice.
8. Execution: [Pr_65_70_11/610 Installing channel cable supports](#); [Pr_65_70_11/640 Installing cable supports on roofs](#); [Pr_65_70_11/650 Multiple cable runs](#)
[Pr_65_70_11/661 Cable support zones](#)

See [Pr_65_70_11_20 Conduit fittings](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

[Pr_65_70_11_62](#) Plastic ducts for buried electric cables

1. Manufacturer: Contractor's choice.
2. Standard: In accordance with [EN 50484](#).
3. Third party certification: [British Board of Agreement \(BBA\)](#) approved.
4. Arrangement: Coilable.
Non-coilable.
5. Material: Acrylonitrile Butadiene Styrene (ABS).
Polypropylene (PP).
Polyethylene (PE).
Unplasticized polyvinyl chloride (PVC-U).
6. Colours: Black.
Red.
7. Inside diameter (nominal): Refer to drawings. Otherwise submit proposals.
8. Jointing
 - 8.1. Arrangement: Butt fusion welding.
Push fit flexible joints.
Spigot and socket.
 - 8.2. Ingress protection (minimum): To [BS EN 60529](#), IP4X.
9. Execution: [Pr_65_52_61/720 Laying pipeducts](#); [Pr_65_52_61/740 Laying pipeducts near foundations](#)

[Pr_65_70_11_62](#) Plastic ducts for buried electric cables

1. Manufacturer: Contractor's choice.
2. Standard: In accordance with [EN 50484](#).
3. Third-party certification: [British Board of Agreement \(BBA\)](#) approved.
4. Arrangement: Contractor's choice. Coilable or Non-coilable.
5. Material: Acrylonitrile Butadiene Styrene (ABS). Polypropylene (PP). Polyethylene (PE).
Unplasticized polyvinyl chloride (PVC-U).
6. Colours: Black. Red.
7. Inside diameter (nominal): Refer to drawings.
8. Jointing
 - 8.1. Arrangement: Butt fusion welding. Push fit flexible joints. Spigot and socket.
 - 8.2. Ingress protection (minimum): To [BS EN 60529](#), IP4X.
9. Execution: [Pr_65_52_61/720 Laying pipeducts](#); [Pr_65_70_11/740 Laying pipeducts near foundations Type A](#)

See [Pr_65_70_11_71 Rigid conduit](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

[Pr_65_70_12_92](#) Underground concrete cable protection covers

Shared by: [Ss_70_80_25_05 Amenity lighting systems](#)

1. Manufacturer: Contractor's choice.
2. Standard: To [BS 2484](#).
3. Execution: [Pr_40_10_57/700 Installing warning devices for underground cables and pipelines Type A](#)

[Pr_65_70_48_13](#) Crosslinked EVA insulated single core non-sheathed cables

1. Manufacturer: Contractor's choice.
2. Standard: To [BS EN 50525-1](#) and [BS EN 50525-2-42](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified.
4. Cable type: Refer to drawings. Otherwise submit proposals.
5. Size: Refer to drawings. Otherwise submit proposals.
6. Reaction to fire class
 - 6.1. Fire behaviour: As per manufacturers standard requirements.
 - 6.2. Additional classification for smoke production: As per manufacturers standard requirements.
 - 6.3. Additional classification for flaming droplets and/ or particles: As per manufacturers standard requirements.
 - 6.4. Additional classification for acidity: As per manufacturers standard requirements.
7. Execution: [Pr_65_70_48/635 Installing low voltage cables](#); [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#)

[Pr_65_70_48_29](#) Fire resistant screened (LSHF) cables

Shared by: [Ss_75_50_28_29 Fire detection and alarm systems](#) and [Ss_75_50_28_22 Domestic premises fire detection and alarm systems](#)

1. Manufacturer: Contractor's choice.
2. Standard: To [BS 7629-1](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified. Loss Prevention Certification Board ([LPCB](#)) certified.
4. Size: Refer to drawings. Otherwise submit proposals.
5. Insulation: Manufacturer's standard.
6. Fire resistance category: STANDARD 30.
STANDARD 60.
ENHANCED 120.
Refer to drawings and description.
7. Screen: Manufacturer's standard.
8. Execution: [Pr_65_70_48/635 Installing low voltage cables](#); [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#); [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#)

[Pr_65_70_48_41](#) Heavy-duty mineral insulated cables

1. Manufacturer: Contractor's choice.
2. Standard: To [BS EN 60702-1](#).

3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified. Loss Prevention Certification Board ([LPCB](#)) certified.
4. Size: Refer to drawings. Otherwise submit proposals.
5. Metallic sheath: Manufacturer's standard.
6. Outer covering
 - 6.1. Material: LSHF.
 - 6.2. Colour: Manufacturer's standard.
7. Execution: [Pr_65_70_48/675](#) Installing mineral insulated copper sheathed cables; [Pr_65_70_48/660](#) Installing low voltage cables in conduit and trunking; [Pr_65_70_48/735](#) Cable installation on channel cable supports, cable tray, cable ladder and cable basket

[Pr_65_70_48_51](#) Mineral insulation cables

1. Manufacturer: Contractor's choice.
2. Standard: To [BS EN 60702-1](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified. Loss Prevention Certification Board ([LPCB](#)) certified.
4. Size: Refer to drawings. Otherwise submit proposals.
5. Metallic sheath: Manufacturer's standard.
6. Outer covering
 - 6.1. Material: LSHF.
 - 6.2. Colour: Manufacturer's standard.
7. Execution: [Pr_65_70_48/660](#) Installing low voltage cables in conduit and trunking; [Pr_65_70_48/675](#) Installing mineral insulated copper sheathed cables; [Pr_65_70_48/735](#) Cable installation on channel cable supports, cable tray, cable ladder and cable basket

[Pr_65_70_48_55](#) Multicore screened thermosetting insulated (LSHF) sheathed cables

Shared by: [Ss_70_30_80_35](#) Hard-wired voltage small power systems

1. Manufacturer: Contractor's choice.
2. Standard: To [BS 8436](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified.
4. Size: Refer to drawings. Otherwise submit proposals.
5. Sheath colour: Black.
White.
6. Reaction to fire class
 - 6.1. Fire behaviour: As per manufacturers standard requirements.
 - 6.2. Additional classification for smoke production: As per manufacturers standard requirements.
 - 6.3. Additional classification for flaming droplets and/ or particles: As per manufacturers standard requirements.
 - 6.4. Additional classification for acidity: As per manufacturers standard requirements.
7. Execution: [Pr_65_70_48/635](#) Installing low voltage cables; [Pr_65_70_48/660](#) Installing low voltage cables in conduit and trunking; [Pr_65_70_48/735](#) Cable installation on channel cable supports, cable tray, cable ladder and cable basket

[Pr_65_70_48_61](#) PVC insulated and sheathed cables

Shared by: [Ss_75_50_11_25](#) Emergency assistance call systems Type A

1. Manufacturer: Contractor's choice.
2. Standard: To [BS 6004](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified.
4. Cable type: 6181Y.
6192Y.
6193Y.
6241Y.
6242Y.
6243Y.
Refer to cable schedules.
5. Size: Refer to drawings. Otherwise submit proposals.
6. Sheath colour: Grey.
7. Reaction to fire class
 - 7.1. Fire behaviour: As per manufacturers standard requirements.
 - 7.2. Additional classification for smoke production: As per manufacturers standard requirements.
 - 7.3. Additional classification for flaming droplets and/ or particles: As per manufacturers standard requirements.
 - 7.4. Additional classification for acidity: As per manufacturers standard requirements.
8. Execution: [Pr_65_70_48/635 Installing low voltage cables](#); [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#); [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#)

[Pr_65_70_48_62](#) PVC insulated flexible single core cables for switchgear and controlgear wiring

1. Manufacturer: Contractor's choice.
2. Standard: To [BS 6231](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified.
4. Cable type: Submit proposals.
5. Size: Refer to drawings. Otherwise submit proposals.
6. Reaction to fire class
 - 6.1. Fire behaviour: As per manufacturers standard requirements.
 - 6.2. Additional classification for smoke production: As per manufacturers standard requirements.
 - 6.3. Additional classification for flaming droplets and/ or particles: As per manufacturers standard requirements.
 - 6.4. Additional classification for acidity: As per manufacturers standard requirements.
7. Execution: [Pr_65_70_48/635 Installing low voltage cables](#); [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#)

[Pr_65_70_48_63](#) PVC insulated single core non-sheathed cables

Shared by: [Ss_75_50_11_25 Emergency assistance call systems Type A](#)

1. Manufacturer: Contractor's choice.
2. Standards: To [BS EN 50525-1](#) and [BS EN 50525-2-31](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified.
4. Cable type: H05V-K.
H05V-R.
H05V-U.
H07V-K.

H07V-R.
H07V-U.

5. Size: Refer to drawings. Otherwise submit proposals.
6. Reaction to fire class
 - 6.1. Fire behaviour: As per manufacturers standard requirements.
 - 6.2. Additional classification for smoke production: As per manufacturers standard requirements.
 - 6.3. Additional classification for flaming droplets and/ or particles: As per manufacturers standard requirements.
 - 6.4. Additional classification for acidity: As per manufacturers standard requirements.
7. Execution: [Pr_65_70_48/635 Installing low voltage cables](#); [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#)

[Pr_65_70_48_74](#) Single core heat resistant non-sheathed thermoplastic PVC insulated cables

1. Manufacturer: Contractor's choice.
2. Standards: To [BS EN 50525-1](#) and [BS EN 50525-2-31](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified.
4. Cable type: H05V2-K.
H05V2-R.
H05V2-U.
H07V2-K.
H07V2-R.
H07V2-U.
5. Size: Refer to drawings. Otherwise submit proposals.
6. Reaction to fire class
 - 6.1. Fire behaviour: As per manufacturers standard requirements.
 - 6.2. Additional classification for smoke production: As per manufacturers standard requirements.
 - 6.3. Additional classification for flaming droplets and/ or particles: As per manufacturers standard requirements.
 - 6.4. Additional classification for acidity: As per manufacturers standard requirements.
7. Execution: [Pr_65_70_48/635 Installing low voltage cables](#); [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#)

See [Pr_65_70_48_75 Single core non-sheathed \(LHSF\) insulated cables in Ss_70_30_25_25 Earthing and bonding systems](#)

[Pr_65_70_48_79](#) Split concentric PVC insulated and sheathed cables

1. Manufacturer: Contractor's choice.
2. Cable type: Thermosetting insulated and LSHF sheathed, to [BS 4553-3](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified.
4. Conductors
 - 4.1. Material: Copper.
 - 4.2. Size: Refer to drawings. Otherwise submit proposals.
5. Reaction to fire class
 - 5.1. Fire behaviour: As per manufacturers standard requirements.
 - 5.2. Additional classification for smoke production: As per manufacturers standard requirements.

- 5.3. Additional classification for flaming droplets and/ or particles: As per manufacturers standard requirements.
- 5.4. Additional classification for acidity: As per manufacturers standard requirements.
6. Execution: [Pr_65_70_48/680 Installing low voltage armoured cables](#); [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#)

[Pr_65_70_48_88](#) Thermosetting insulated armoured fire resistant (LSHF) cables

Shared by: [Ss_75_50_28_29 Fire detection and alarm systems](#)

1. Manufacturer: Contractor's choice.
2. Standard: To [BS 7846](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified. Loss Prevention Certification Board ([LPCB](#)) certified.
4. Size: Refer to drawings. Otherwise submit proposals.
5. Insulation: Manufacturer's standard.
6. Fire resistance category: Refer to fire strategy.
7. Voltage rating category: A.
8. Oversheath colour: Black.
9. Execution: [Pr_65_70_48/680 Installing low voltage armoured cables](#); [Pr_65_70_48/715 Excavations](#); [Pr_65_70_48/720 Cables in ducts](#); [Pr_65_70_48/725 Cables in trenches](#); [Pr_65_70_48/730 Installing warning devices for underground cables](#); [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#); [Pr_65_70_48/740 Cables in vertical trunking and ducts](#)

[Pr_65_70_48_89](#) Thermosetting insulated and PVC sheathed armoured cables

1. Manufacturer: Contractor's choice.
2. Standard: To [BS 5467](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified.
4. Size: Refer to drawings. Otherwise submit proposals.
5. Insulation: Manufacturer's standard.
6. Sheath colour: Black.
7. Reaction to fire class
 - 7.1. Fire behaviour: As per manufacturers standard requirements.
 - 7.2. Additional classification for smoke production: As per manufacturers standard requirements.
 - 7.3. Additional classification for flaming droplets and/ or particles: As per manufacturers standard requirements.
 - 7.4. Additional classification for acidity: As per manufacturers standard requirements.
8. Execution: [Pr_65_70_48/680 Installing low voltage armoured cables](#); [Pr_65_70_48/715 Excavations](#); [Pr_65_70_48/720 Cables in ducts](#); [Pr_65_70_48/725 Cables in trenches](#); [Pr_65_70_48/730 Installing warning devices for underground cables](#); [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#); [Pr_65_70_48/740 Cables in vertical trunking and ducts](#)

See [Pr_65_70_48_90 Thermosetting insulated and thermoplastic sheathed \(LSHF\) armoured cables in Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

[Pr_65_70_48_91](#) Thermosetting insulated and thermoplastic sheathed (LSHF) cables

Shared by: [Ss_70_80_25_05 Amenity lighting systems](#) , [Ss_75_50_11_25 Emergency assistance call systems Type A](#) and [Ss_70_80_33_35 Hard-wired general lighting systems](#)

1. Manufacturer: Contractor's choice.
2. Standard: To [BS 7211](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified.
4. Cable type: 6181B.
6182B.
6183B.
6184B.
6185B.
6241B.
6242B.
Refer to schedules. Refer to drawings.
5. Size: Refer to drawings. Otherwise submit proposals.
6. Reaction to fire class
 - 6.1. Fire behaviour: As per manufacturers standard requirements.
 - 6.2. Additional classification for smoke production: As per manufacturers standard requirements.
 - 6.3. Additional classification for flaming droplets and/ or particles: As per manufacturers standard requirements.
 - 6.4. Additional classification for acidity: As per manufacturers standard requirements.
7. Execution: [Pr_65_70_48/635 Installing low voltage cables](#); [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#); [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket](#)

Pr_65_70_48_92 Thermosetting insulated non armoured PVC sheathed cables

1. Manufacturer: Contractor's choice.
2. Standard: To [BS 7889](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified.
4. Size: Refer to drawings. Otherwise submit proposals.
5. Sheath colour: Black.
6. Reaction to fire class
 - 6.1. Fire behaviour: As per manufacturers standard requirements.
 - 6.2. Additional classification for smoke production: As per manufacturers standard requirements.
 - 6.3. Additional classification for flaming droplets and/ or particles: As per manufacturers standard requirements.
 - 6.4. Additional classification for acidity: As per manufacturers standard requirements.
7. Execution: [Pr_65_70_48/635 Installing low voltage cables](#); [Pr_65_70_48/660 Installing low voltage cables in conduit and trunking](#)

Pr_65_72_27_02 Air circuit breakers

1. Manufacturer: Refer to drawings. Otherwise submit proposals.
2. Standards: To [BS EN 60947-1](#) and [BS EN 60947-2](#).
3. Third party certification: [ASTA Type test certification](#)
4. Rated operational current (In): Refer to drawings. Otherwise submit proposals.
5. Number of poles: Refer to drawings. Otherwise submit proposals.
6. Rated operational voltage (Ue): Submit proposals.
7. Rated insulation voltage (Ui): Submit proposals.
8. Rated impulse withstand voltage (Uimp) : Submit proposals.

9. Rated frequency: 50 Hz.
10. Rated ultimate short-circuit breaking capacity (Icu): Refer to drawings. Otherwise submit proposals.
11. Protection
 - 11.1. Type: Microprocessor.
 - 11.2. Characteristics: Interchangeable with fixed range of settings and adjustable parameters.
Interchangeable with programmable settings and adjustable parameters.
 - 11.3. Settings: Refer to description for details.
 - 11.4. Parameters: Refer to description for details. Refer to manufacturers details.
 - 11.5. Special features: Refer to description for details. Refer to manufacturers details.
12. Measurement: Refer to description for details. Refer to manufacturers details.
13. Visual indication: Refer to description for details. Refer to manufacturers details.
14. Adjustment: Refer to description for details. Refer to manufacturers details.
15. Communications
 - 15.1. Remote monitoring: Refer to description for details. Refer to manufacturers details.
 - 15.2. Displays: Refer to description for details. Refer to manufacturers details.
16. Charge mechanism: Refer to description for details. Refer to manufacturers details.
17. Mechanical interlocking: Captive key exchange type with square faced key and alphabetical or numerical coded operating face.
18. Suitable for isolation: Required.
19. Provision for maintenance: Maintainable.
20. Method of installation: Refer to description for details. Refer to manufacturers details.
21. Ingress protection (minimum): To [BS EN 60529](#), IP20.
22. Connections
 - 22.1. Position: Refer to manufacturers details.
 - 22.2. Configuration: Refer to manufacturers details.
 - 22.3. Orientation: Refer to manufacturers details.
23. Accessories: Refer to description for details. Refer to manufacturers details.

[Pr_65_72_27_11](#) Cartridge fuses

1. Standards: To [BS EN 60269-1](#) and [BS HD 60269-3](#).
2. Third party certification: [ASTA Type test certification](#).

[Pr_65_72_27_44](#) J-type feeder pillar fuses

1. Manufacturer: Refer to drawings. Otherwise submit proposals. Refer to drawings. Otherwise submit proposals.
2. Standards: To [BS EN 60269-1](#) and [BS HD 60269-2](#).
3. Third party certification: [ASTA Type test certification](#).
4. Rated operational current (In): Refer to drawings. Otherwise submit proposals.
5. Rated operational voltage (Ue): 400 V.
6. Rated breaking capacity: Refer to drawings. Otherwise submit proposals.

[Pr_65_72_27_47](#) Low-voltage fuse links

1. Manufacturer: Contractor's choice.

2. Standards: To [BS EN 60269-1](#) and [BS HD 60269-2](#).
To [BS EN 60269-1](#) and [BS EN 60269-4](#).
To [BS EN 60269-1](#) and [BS EN 60269-6](#).
3. Third party certification: [ASTA Type test certification](#).
4. Fuse type: System E.
System G.
System I.
5. Breaking range and utilization categories: gG.
6. Rated operational current (In): Refer to drawings. Otherwise submit proposals.
7. Rated operational voltage (Ue): 230 V a.c. 400 V a.c.
8. Rated breaking capacity: Refer to drawings. Otherwise submit proposals.

See [Pr_65_72_27_50 Mains power supply transient overvoltage suppression devices in Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

[Pr_65_72_27_52](#) Miniature circuit breakers

1. Manufacturer: As per associated Distribution Board / Consumer Unit.
2. Standards: To [BS EN 60898-1](#) and [BS EN 60898-2](#). To [BS EN 60947-1](#) and [BS EN 60947-2](#).
3. Third party certification: [ASTA Type test certification](#).
4. Rated operational current (In): Refer to drawings. Otherwise submit proposals. As Circuit schedules.
5. Rated operational voltage (Ue): 230 V a.c. 400 V a.c.
6. Rated impulse withstand voltage (Uimp) : 6 kV.
7. Rated frequency: 50 Hz.
8. Number of poles: As required.
9. Rated short-circuit capacity (Icn): Refer to manufacturers details.
10. Tripping characteristic: Refer to manufacturers details.
11. Pollution degree category: Refer to manufacturers details.
12. Features: Refer to manufacturers details.
13. Mounting method: Refer to manufacturers details.
14. Accessories: Refer to manufacturers details.

[Pr_65_72_27_53](#) Moulded case circuit breakers

1. Manufacturer: Refer to drawings and description.
2. Standards: To [BS EN 60947-1](#) and [BS EN 60947-2](#).
3. Third party certification: [ASTA Type test certification](#).
4. Rated operational current (In): Refer to drawings. Otherwise submit proposals. As Circuit schedules.
5. Number of poles: As required for each circuit.
6. Rated operational voltage (Ue): 230 V a.c. 400 V a.c.
7. Rated insulation voltage (Ui): 500 V a.c.
8. Rated impulse withstand voltage (Uimp) : 8 kV.
9. Rated frequency: 50 Hz.
10. Rated ultimate short-circuit breaking capacity (Icu): Refer to drawings and description.
11. Rated service short-circuit breaking capacity (Ics): Refer to drawings and description.
12. Utilization category: A. B.
13. Protection

- 13.1. Type: Refer to drawings and description.
- 13.2. Characteristics: Integral.
- 13.3. Settings: Refer to drawings and description.
- 13.4. Parameters: Refer to drawings and description.
- 13.5. Special features: Refer to drawings and description.
- 14. Measurement: Refer to manufacturers details.
- 15. Visual indication: Refer to manufacturers details.
- 16. Adjustment: Refer to manufacturers details.
- 17. Communications
 - 17.1. Remote monitoring: Refer to drawings and description.
 - 17.2. Displays: Refer to drawings and description.
- 18. Suitable for isolation: Refer to drawings and description.
- 19. Operating handle
 - 19.1. Manual: Refer to drawings and description.
 - 19.2. Electrical: Refer to drawings and description.
- 20. Mechanical interlocking: Refer to drawings and description.
- 21. Method of installation: Fixed.
- 22. Ingress protection (minimum): To [BS EN 60529](#), IP30.
- 23. Connections
 - 23.1. Position: Refer to manufacturers details.
 - 23.2. Configuration: Refer to manufacturers details.
- 24. Accessories: Refer to manufacturers details.

Pr_65_72_27_73 Residual current circuit breakers with integral overcurrent protection

- 1. Manufacturer: Refer to drawings and description.
- 2. Standards: To [BS EN 61009-1](#) and [BS EN 62423](#).
- 3. Operating characteristic: As per manufacturers standard requirements.
- 4. Tripping characteristic: As required for each circuit.
- 5. Rated operational current (In): As required for each circuit.
- 6. Rated operational voltage (Ue): 230 V a.c. 400 V a.c.
- 7. Rated impulse withstand voltage (Uimp) : 4 kV.
- 8. Rated frequency: 50 Hz.
- 9. Number of poles: As required for each circuit.
- 10. Rated short-circuit capacity (Icn): 6 kA for domestic use. 10 kA for all other uses.
- 11. Rated residual operating current: As required for each circuit.
- 12. Time delay: As required for each circuit.
- 13. Pollution degree category: 2.
- 14. Features: Refer to manufacturers details.
- 15. Mounting method: Refer to manufacturers details.
- 16. Accessories: Refer to manufacturers details.

Pr_65_72_27_74 Residual current monitors

1. Manufacturer: Refer to drawings and description.
2. Standard: To BS EN 62020.
3. Enclosure
 - 3.1. Ingress protection (minimum): To BS EN 60529, IP20.
 - 3.2. Material: Polycarbonate. Steel.
 - 3.3. Finish: As per manufacturers standard finish.
 - 3.4. Colour: To match distribution switchgear.
4. Mounting: DIN rail mounted.
5. Rated operational voltage (Ue): 230 V a.c.
6. Nominal frequency: 50 Hz.
7. Response differential current: As required for each circuit.
8. Discrimination threshold
 - 8.1. Main alarm: 80% of set differential current.
 - 8.2. Pre-alarm: Adjustable between 10–90% of main alarm threshold.
9. Response time: Adjustable between 0.1s–1s.
10. Output: Integral audible alarm. Integral visual indicator.
11. Execution: Pr_80_51_51/620 Installing electrical monitoring and metering equipment Type A;
Pr_80_51_51/620 Installing electrical monitoring and metering equipment Type A

Pr_65_72_43_01 Active electrical filters

1. Manufacturer: As per drawings and description.
2. Rating per filter: As required for each circuit.
3. Nominal voltage and frequency:
4. User-adjustable functions: Mitigation of individual, group, or full range of harmonics (2nd to 25th order). Compensation of phase displacement ($\cos \phi$). Compensation of true power factor.
5. Operation
 - 5.1. Harmonic analysis: Continuously monitoring 2nd to 25th order.
 - 5.2. Response to harmonic currents:
 - 5.3. Rated current: Capable of mitigating harmonic current in the neutral conductor three times greater than rated phase current.
 - 5.4. Total voltage harmonic distortion: Capable of reducing network voltage down to a specified level of fundamental voltage.
 - 5.5. Reduction factor (minimum): 10 at full load current.
 - 5.6. Mains failure: Automatic restart.
 - 5.7. Overload condition: Maintain mitigation up to rated current without affecting reliability of operation.
6. Controls: Solid state microprocessor based. Push button providing ON/OFF operation.
7. Illuminated display requirements: Total current distortion (load and source). Total rms current (load and source).
8. System status indication via individual coloured light emitting diodes (LEDs) showing: Normal operation condition. Current limiting mode. Filter shut down or alarm condition.
9. Current transformers
 - 9.1. Type: Cast resin split.

- 9.2. Sets required: As required to suit each circuit.
10. Enclosure
 - 10.1. Ingress protection (minimum): To [BS EN 60529](#), IP30.
 - 10.2. Colour: to match distribution switchgear.
11. Execution: [Pr_65_72_43/640 Installing harmonic filters](#); [Pr_65_72_43/650 Installing close coupled active filters](#); [Pr_65_72_43/660 Installing current transformers \(CTs\)](#)

[Pr_75_51_52_15](#) Control and protective switching devices

1. Manufacturer: Refer to drawings and description.
2. Standards: To [BS EN 60947-1](#) and [BS EN 60947-6-2](#).
3. Number of poles: Double. Four.
4. Method of operation: Electromagnetic. Manual.
5. Method of control: Automatic. Non-automatic.
6. Reset after overload: Local manual resetting.
7. Rearming after short-circuit: Manual via a circuit breaker.
8. Rated operational voltage (Ue): 400 V.
9. Rated operational current (Ie): As required for each circuit.
10. Rated operational frequency: 50 Hz.
11. Rated service breaking capacity (Ics): As required for each circuit.
12. Utilization category: As required for each circuit.
13. Tripping class: As required for each circuit.
14. Communication protocol: As required for each circuit.
15. Control functions: As required for each circuit.
16. Enclosure
 - 16.1. Ingress protection (minimum): To [BS EN 60529](#), IP31.
 - 16.2. Material: Sheet steel.
 - 16.3. Finish: Polyester powder coated.
17. Execution: [Pr_60_70_22/665 Installing switchgear generally](#)

[Pr_80_51_51_04](#) Analogue metering equipment

1. Manufacturer: Refer to drawings and Description.
2. Metering functions: Ammeters to [BS 89-2](#). Voltmeters to [BS 89-2](#). Frequency meters to [BS 89-4](#). Phase meters to [BS EN IEC 60051-5](#). Power factor meters to [BS EN IEC 60051-5](#). Wattmeters to [BS 89-3](#).
3. Mounting: Surface mounted. Recessed into switchgear assembly.
4. Execution:

[Pr_80_51_51_23](#) Digital multifunction metering equipment

1. Manufacturer: Refer to drawings and description.
2. Display type: Liquid crystal display (LCD).
3. Ingress protection (minimum): To [BS EN 60529](#), IP31.
4. Metering functions: Reactive power (kVA(r)). Voltage between phases (V). Active energy (kWh). Active power (kW). Apparent power (kVA). Frequency (Hz). Maximum active power demand (kW). Phase currents (A). Power factor. Pulsed output (kWh).
5. Mounting: Recessed into switchgear. Surface mounted.

6. Execution: [Pr_80_51_51/620 Installing electrical monitoring and metering equipment Type C](#)

[Pr_40_10_57/700 Installing warning devices for underground cables and pipelines](#)

1. Installation: Lay along the route of underground cables during backfilling of excavation, end-to-end of service with no gaps.
2. Marker position
 - 2.1. Cables: *Lay tape 150 mm below finished ground level.*

[Pr_40_10_57/700 Installing warning devices for underground cables and pipelines Type A](#)

1. Installation: Lay along the route of underground cables during backfilling of excavation, end-to-end of service with no gaps.
2. Marker position
 - 2.1. Cables: Lay tape 150mm above LV services. Lay tape 300mm above HV services. Lay tiles 100mm above HV services.
3. Location, depth, colour and markings: NJUG guidelines. DNO specific requirements.

[Pr_40_10_57/710 Installing above ground warning markers](#)

1. Position: Locate above cable joints. Where buried pipelines and cables cross roads, locate at either side of road crossing.
2. Method of installation: In accordance with manufacturer's recommendations.

See [Pr_60_70_22/665 Installing switchgear generally in Ss_70_10_30_70 Reciprocating internal combustion engine](#)

See [Pr_60_70_22/675 Labelling switchgear in Ss_70_10_30_70 Reciprocating internal combustion engine](#)

[Pr_60_70_36/611 Installing electrical insulating matting](#)

1. Front access equipment: Install electrical insulating matting in front of the equipment.
2. Rear access equipment: Install electrical insulating matting in front of and behind the equipment.
3. Installation: Fix securely to the floor.

[Pr_60_70_48/645 Installing feed units](#)

1. Generally: In accordance with [BS 7671](#).
2. Position: Refer to drawings.

[Pr_60_70_48/650 Installing fire barrier units](#)

1. Generally: In accordance with [BS 7671](#).
2. Position: At each location where electrical services penetrate a fire compartment.

[Pr_65_52_61/720 Laying pipeducts](#)

1. General: Lay straight to line, true to gradient or level, fully supported on an even continuous bed.
2. Standard: In accordance with [National Joint Utilities Group](#) guidelines volumes 1 to 6.
3. Depth to crown (minimum): In accordance with [National Joint Utilities Group](#) guidelines volumes 1 to 6.
4. Tolerance: ± 20 mm from any specified level.
5. Bedding

- 5.1. Material: Fine aggregate.
- 5.2. Thickness: 100 mm.
6. Clearance between pipeducts where they cross (minimum): 50 mm.
7. Draw lines
 - 7.1. Material: To the requirements of service undertakers. Heavy-gauge natural polypropylene. Light-gauge natural polypropylene.
 - 7.2. Requirements: During laying thread through pipeducts. Leave in place for future pulling through of services.
 - 7.3. Length: As specified by service undertaker.
8. Ends of pipeducts terminating inside buildings: Seal.
9. Protection: Protect from ingress of debris. During construction, temporarily seal exposed ends.

Pr_65_52_61/740 Laying pipeducts near foundations

1. Concrete surround: Where side of trench is less than 1 m from the side of the foundation and the bottom of the trench is below the bottom of the foundation, provide designated concrete GEN 3 surround, with the top level of the concrete not lower than the bottom of the foundation. Where side of trench is more than 1m from the side of the foundation and the bottom of the trench is below the bottom of the foundation, provide designated concrete GEN 3 surround, with the top level of the concrete not lower than D mm below bottom of foundation (where D mm is horizontal distance of trench from foundation, less 150 mm).

Pr_65_70_11/610 Installing channel cable supports

1. Standards: In accordance with [BS 7671](#), [IET Guidance Note 1](#) and [BEAMA Best practice guide to cable ladder and cable tray systems: Channel support systems and other associated supports](#).
2. Preparation
 - 2.1. Burrs and sharp edges: Make smooth.
 - 2.2. Cutting: Minimize and make good edges. Cuts to slotted channel cable supports 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 channel cable supports 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 supports: Maximize.
5. Fire barriers: Provide where required to maintain fire performance of fabric.
6. Changes of size and direction: Manufacturer's accessories of the same material type, pattern, finish and thickness as channel cable supports.
7. Support
 - 7.1. Fixing arrangement: Independently fix and support from building structure using threaded rod fixed into expanding anchors. Independently fix and support from building structure using threaded rod fixed into resin injection anchors.
 - 7.2. Clearance from building fabric (minimum): 20 mm.
8. Components: Avoid contact between dissimilar metals.
9. Routing of channel cable supports: Submit drawings showing the proposed routes.

Pr_65_70_48/675 Installing mineral insulated copper sheathed cables

1. General requirements:
2. Installation: In accordance with [BS EN 60702-3](#).
3. Bending: Do not corrugate sheath. Straighten and dress cables neatly.
4. Moisture damage to the insulation: Prevent.
5. Temporary seals: Provide for cables when cut.
6. Fastening to fabric
 - 6.1. Bare cables: Bare copper P-clips.
 - 6.2. Sheathed cables: Copper P-clips with covering material to match that of cable sheath.
7. Testing: Test each length immediately after fastening. Repeat test 24–48 h later.

See [Pr_65_70_48/680 Installing low voltage armoured cables in Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_65_70_48/685 Jointing and terminating low voltage armoured cables in Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_65_70_48/715 Excavations in Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_65_70_48/720 Cables in ducts in Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_65_70_48/725 Cables in trenches in Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_65_70_48/730 Installing warning devices for underground cables in Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_65_70_48/735 Cable installation on channel cable supports, cable tray, cable ladder and cable basket in Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_65_70_48/740 Cables in vertical trunking and ducts in Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_65_72_27/610 Installing surge protective devices for low voltage power supplies in Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

Pr_80_51_51/620 Installing electrical monitoring and metering equipment Type A

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

Pr_80_51_51/620 Installing electrical monitoring and metering equipment Type A

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

Pr_80_51_51/620 Installing electrical monitoring and metering equipment Type C

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

See [Pr_80_77_28/630 Installing padlock and key cabinets in Ss_70_10_30_70 Reciprocating internal combustion engine](#)

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.

Ss_70_30_45/626 Installing multi-box assemblies

1. General arrangement: As drawings.

Ss_70_30_45/631 Electrical property measurement of low voltage systems

1. Objectives: *To determine the current demand through each phase at incoming supply position to establish its spare capacity.*
2. Property values to be recorded: *To determine the level of existing harmonics within the electrical installation with a view to recommending suitable mitigation measures to comply with the [Energy Networks Association publication ER G5/5](#), or to recommend suitable mitigation measures to improve power factor correction and to reduce overloading of neutral conductors.*
3. Sampling
 - 3.1. Start date and time: Refer to Description.
 - 3.2. Period: Refer to Description.
 - 3.3. Interval: Refer to Description.
4. Connection to existing switchgear
 - 4.1. Method statement: Submit.
 - 4.2. Timing: Refer to Description.
5. Results
 - 5.1. Format: Refer to Description.
 - 5.2. Number of copies: Refer to Description.

Ss_70_30_45/641 Thermal video imaging surveys of low voltage distribution systems

1. Thermal imaging personnel: Specialist thermographer.
2. Plant to be surveyed: Refer to Description.
3. Sampling: Refer to Description.
4. Results
 - 4.1. Format: Refer to Description.
 - 4.2. Number of copies: Refer to Description.

Ss_70_30_45/650 Connection to the incoming supply

1. Customer's installation: Connect low voltage distribution to incoming supply at Electricity Distributor's metering equipment or at existing section board.

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: 7 days.
3. Switches and circuit breakers: Clean to remove all visible traces of dust.
4. Protective devices settings: Include in O & M Manual.
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 busbar joints with duct or resistance measurements. Check earth connections at compartments, switches and earth electrodes.

Check clearance of live parts from direct contact.

Check polarity and phase sequence of protective devices. Check operation of protective devices using secondary and primary current injection.

Manually operate protective devices.

Carry out earth fault protection simulation tests. Check functional operation of circuit breakers.

Check operation of switch tripping devices.

7. Testing and commissioning results: Submit one copy.
8. Certificates of calibration for meters and instruments: Submit.

Ss_70_30_45/812 Inspecting, testing and commissioning automatic power factor correction equipment

1. Standard: In accordance with [BS 7671](#).
2. Notice before testing and commissioning: 7 days.
3. Operation of instruments and displays: Check and confirm correct operation.
4. Controls: Commission and adjust for optimum power factor correction.
5. Testing and commissioning results: Submit one copy.

Ss_70_30_45/813 Inspecting, testing and commissioning harmonic filters

1. Standard: In accordance with [BS 7671](#).
2. Commissioning of filters: By manufacturer.
3. Notice before testing and commissioning: 7 days.
4. Operation of instruments and displays: Check and confirm correct operation of: Reactive compensation. Selection of harmonic orders for mitigation. Number of parallel connected filters. Alarm functions. Communication port function. Check and confirm correct display of: Supply current (rms) L1, L2, L3 and neutral current. Load current (rms) L1, L2, L3 and neutral current. Supply THD % L1, L2, L3. Load THD % L1, L2, L3.
5. Controls: Commission and adjust for optimum harmonic mitigation and reactive power compensation.
6. Inspecting, testing and commissioning results: Submit one copy.

Ss_70_30_45/814 Inspecting, testing and commissioning UPS equipment

1. Standards: In accordance with [BS 7671](#) and [BS EN 62040-3](#).
2. Method statement: Submit.
3. Phase rotation: Verify.
4. Emergency and safety circuits: Check.
5. Correct operation of alarms and controls: Confirm.
6. Insulation resistance tests: Test interconnecting cables. Test forced cooling fan motors.
7. Site tests: In accordance with [BS EN 62040-3](#).
8. Operational tests: a.c. input failure test. a.c. input return test. Acoustic noise test. Battery ripple current measurement. Current division test. Overload capability test. Rated restored energy time. Rated stored energy time test. Restart test. Short circuit test.
9. Output tests: Harmonic components measurement. Frequency variation test. Output over voltage test. Output frequency slew rate test. Periodic output voltage variation test. Radiofrequency interference and conducted noise test.
10. Load tests: Full load test.

11. Standby generator compatibility tests: Required.

Ss_70_30_45/821 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: Paper copy.
Electronic copy in PDF format.
 - 1.4. Number of copies: Three.
2. Record drawings
 - 2.1. Content: For all low voltage distribution circuits: the cable origin, circuit designation, route, loading, conductor material and c.s.a., insulation type and colour, number of cores per cable, number of cables in trunking and conduit. Whether cables are run on surface, concealed in walls, floors, above suspended ceilings or within roof spaces. 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: A1 paper print drawing. Electronic drawing. (PDF & .DWG)
 - 2.3. Number of copies: Three.
3. Submittal date: At handover.

Ss_70_30_45/831 Spares and consumables

1. Supply the following spares
 - 1.1. Fuses: Two of each type and rating used.
 - 1.2. Operating handles for circuit breakers and switches: One per device.

Ss_70_30_80_35 Hard-wired voltage small power systems

Systems

Ss_70_30_80_35 Hard-wired voltage small power systems

1. Description:

A hard-wired voltage small power system shall be supplied, installed, tested and commissioned for this installation.

The supplies to the three Heat pumps shall exit the boiler room at low level above ground level and run on heavy duty galvanised steel 150mm wide perforated cable tray, mounted on Unistrut supports on the concrete base installed for the heating pipework. Cable basket shall be installed to support the cables between the distribution board and the point of exit from the room.

A 32A SP radial circuit is to be installed to a new BMS control panel in the boiler room. The control panel will have an integral isolator.

2No 16A radial circuits are to be installed to feed metal clad connection units located adjacent to where the heating pipes pass to outside for trace heating. Exact location to be agreed with the trace heating installer.

The Contractor shall allow for final connections to the trace heating and the control panel. All three circuits shall be wired in single core LSHF cables in galvanised steel conduit.

All connections to the pumps etc in the boiler room will be carried out by the BMS specialist.

2. System performance: Ss_70_30_80/210 Design of low voltage small power systems; Ss_70_30_80/215 Low voltage small power cables generally; Ss_70_30_80/230 Multi-gang power outlets; Ss_70_30_80/220 Selection of conduit, trunking and ducting generally
3. Connection to low voltage supply: Refer to drawings. Refer to Description.
4. Final circuit cabling: Pr_65_70_48_90 Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables; Pr_65_70_48_75 Single core non-sheathed (LHSF) insulated cables; Pr_65_70_48_55 Multicore screened thermosetting insulated (LSHF) sheathed cables
5. Cable accessories: Pr_65_70_11_13 Cable cleats
Pr_65_70_11_15 Cable ties
6. Containment: Pr_65_70_11_12 Cable baskets
Pr_65_70_12_11 Cable capping
Pr_65_70_11_17 Cable trays
Pr_65_70_11_19 Channel cable supports
Pr_65_70_11_09 Buried conduit
Pr_65_70_11_30 Flexible conduit
Pr_65_70_11_63 Pliable conduit
Pr_65_70_11_71 Rigid conduit
Pr_65_70_11_31 Floor cable trunking and ducting
Pr_65_70_11_18 Cable trunking
7. Containment accessories: Pr_65_70_11_20 Conduit fittings
Pr_65_70_11_75 Service outlet boxes
Pr_65_70_11_76 Service outlet poles
Pr_20_29_03_17 Chemical anchor cartridges; Pr_20_29_03_16 Chemical anchor capsules
Pr_20_29_76_15 Coach screws
Pr_20_29_03_28 Expansion anchors
Pr_20_29_08_84 Stainless steel hexagon headed nuts and bolts; Pr_20_29_76_85 Stainless steel hexagon head screws; Pr_25_80_81_42 Intumescent linear gap seals

- Pr_25_80_81_44 Intumescent trunking pillows
 Pr_20_29_63_50 Masonry plugs; Pr_20_29_03_83 Stainless steel chemical anchor rods;
 Pr_20_29_03_84 Stainless steel chemical anchor sockets
8. Rewireable installation: **Required.**
 9. Concealed installation: **Required.**
 10. Partial installation: **Required.**
 11. Final connections: Pr_65_70_48_40 Heavy-duty heat-resistant LSHF insulated and sheathed flexible cables
 12. Power conditioning equipment: Pr_65_72_27_88 Transient overvoltage surge suppression devices; Pr_65_72_27_50 Mains power supply transient overvoltage suppression devices; Pr_60_70_64_93 Uninterruptible power supply (UPS) units; Pr_60_70_64_94 Uninterruptible power supply (UPS) remote alarm panels
 13. Electrical accessories and outlets: Pr_65_72_97_11 Cable couplers
 Pr_65_72_97_12 Cable outlet plates
 Pr_65_72_97_17 Ceiling power switches
 Pr_65_72_97_82 Specialist socket outlets
 Pr_65_72_97_21 Cooker connection units
 Pr_65_72_97_20 Cooker control units
 Pr_65_72_97_23 Double pole switches; Pr_65_72_97_29 Electric vehicle charging points
 Pr_65_72_97_30 Fan isolators
 Pr_65_72_97_31 Fused connection units
 Pr_60_70_48_11 Changeover switches
 Pr_65_72_97_52 Multi-gang power outlets; Pr_65_72_97_79 Single voltage shaver outlets
 Pr_65_72_97_78 Shaver supply units; Pr_70_75_94_60 Panel mounting indicator lights
 Pr_65_72_97_40 Industrial plugs
 Pr_65_72_97_41 Industrial socket outlets
 Pr_65_72_97_72 Round pin socket outlets; Pr_65_72_97_81 Socket outlet residual current devices (SRCD); Pr_65_72_97_83 Surface and concealed wiring enclosures; Pr_65_72_97_84 Standard socket outlets
 14. Controls and starters: Pr_75_51_52_01 Alternating current (a.c.) drives; Pr_75_51_52_02 Alternating current (a.c.) semiconductor motor controllers and starters; Pr_75_51_52_22 Direct-on-line starters
 Pr_75_51_52_82 Star delta starters
 Pr_75_51_52_26 Electromechanical contactors
 Pr_75_51_17_27 Emergency stop buttons
 Pr_75_51_17_78 Selector switches
 Pr_75_51_17_66 Push-button switches
 Pr_75_51_17_75 Safety limit switches
 15. Accessories: Pr_60_70_48_07 Busbar trunking feed units; Pr_60_70_48_08 Busbar trunking fire barrier units; Pr_60_70_48_09 Busbar trunking tap-off units
 Pr_65_72_27_32 Fuse links
 16. Electrical identification: Pr_40_10_27_24 Electrical diagrams; Pr_40_10_27_27 Electrical shock treatment signs; Pr_40_10_57_29 Equipment labels and warning notices
 17. Execution: Ss_70_30_80/630 Installing cabling to socket outlets; Ss_70_30_80/620 Small power installation; Ss_70_30_80/610 Removing small power systems; Ss_70_30_80/650 Partial installation
 18. System completion: Ss_70_30_80/820 Documentation
 Ss_70_30_80/830 Spares
 Ss_70_30_80/840 Maintenance

System performance

Ss_70_30_80/210 Design of low voltage small power systems

1. Provision of small power: For fixed and portable equipment requiring power.
2. Design: Complete for the low voltage small power systems.
3. Standards: In accordance with [BS 7671](#).
To [BS 8488](#).
4. Diversity: In accordance with [IET Guidance Note 1](#).
5. Spare capacity throughout the small power system: 20%.
6. Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

Ss_70_30_80/215 Low voltage small power cables generally

1. Standard: In accordance with [BS 7671](#).
2. Proposed selection of low voltage cables: Submit drawings, technical information, calculations and manufacturers' literature.
3. Conductor sizes (minimum): Refer to drawings and description.
4. Cable sizes not stated: Submit.
5. Format: Amtech. Hevacomp.

Ss_70_30_80/220 Selection of 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_80/230 Multi-gang power outlets

1. Quantity: Refer to drawings and description.

Products

See [Pr_20_29_03_16 Chemical anchor capsules](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_20_29_03_17 Chemical anchor cartridges](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_20_29_03_28 Expansion anchors](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_20_29_03_83 Stainless steel chemical anchor rods](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_20_29_03_84 Stainless steel chemical anchor sockets](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_20_29_08_84 Stainless steel hexagon headed nuts and bolts](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_20_29_63_50 Masonry plugs](#) in [Ss_70_30_45_45 Low voltage distribution systems](#)

See [Pr_20_29_76_15 Coach screws](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

See [Pr_20_29_76_85](#) Stainless steel hexagon head screws in [Ss_70_10_70_35](#) Grid-connected photovoltaic systems

See [Pr_25_80_81_42](#) Intumescent linear gap seals in [Ss_70_10_70_35](#) Grid-connected photovoltaic systems

See [Pr_25_80_81_44](#) Intumescent trunking pillows in [Ss_70_10_70_35](#) Grid-connected photovoltaic systems

See [Pr_40_10_27_24](#) Electrical diagrams in [Ss_70_10_30_70](#) Reciprocating internal combustion engine

See [Pr_40_10_27_27](#) Electrical shock treatment signs in [Ss_70_10_30_70](#) Reciprocating internal combustion engine

See [Pr_40_10_57_29](#) Equipment labels and warning notices in [Ss_70_10_30_70](#) Reciprocating internal combustion engine

See [Pr_60_70_48_07](#) Busbar trunking feed units in [Ss_70_30_45_45](#) Low voltage distribution systems

See [Pr_60_70_48_08](#) Busbar trunking fire barrier units in [Ss_70_30_45_45](#) Low voltage distribution systems

[Pr_65_70_12_11](#) Cable capping

Shared by: [Ss_70_80_33_35](#) Hard-wired general lighting systems

1. Manufacturer: Submit proposals.
2. Material: Galvanized steel. PVC-U.
3. Width (minimum): As required.

[Pr_65_70_48_40](#) Heavy-duty heat-resistant LSHF insulated and sheathed flexible cables

1. Manufacturer: Submit proposals.
2. Standards: To [BS EN 50525-1](#) and [BS EN 50525-3-21](#).
3. Third-party certification: British Approvals Service for Cables ([BASEC](#)) certified.
4. Cable type: H07ZZ-F.
5. Size: As required.
6. Sheath colour: As required to suit location and environment.
7. Reaction to fire class
 - 7.1. Fire behaviour: Manufacturers standard properties.
 - 7.2. Additional classification for smoke production: Manufacturers standard properties.
 - 7.3. Additional classification for flaming droplets and/ or particles: Manufacturers standard properties.
 - 7.4. Additional classification for acidity: Manufacturers standard properties.
8. Execution: [Pr_65_70_48/665](#) Installing flexible cables

See [Pr_65_70_48_55](#) Multicore screened thermosetting insulated (LSHF) sheathed cables in [Ss_70_30_45_45](#) Low voltage distribution systems

See [Pr_65_70_48_75](#) Single core non-sheathed (LHSF) insulated cables in [Ss_70_30_25_25](#) Earthing and bonding systems

See [Pr_65_70_48_90](#) Thermosetting insulated and thermoplastic sheathed (LSHF) armoured cables in [Ss_70_10_70_35](#) Grid-connected photovoltaic systems

Pr_65_72_27_32 Fuse links

1. Standard: To [BS 1362](#).
2. Rated operational current (In): As required.

See [Pr_65_72_27_50 Mains power supply transient overvoltage suppression devices](#) in [Ss_70_10_70_35 Grid-connected photovoltaic systems](#)

Pr_65_72_97_11 Cable couplers

1. Standards: To [BS 5733](#) and [BS 1363-1](#). To [BS 5733](#) and [BS 546](#). To [BS EN 60309-1](#) and [BS EN 60309-2](#).
2. Material: As required to suit the location and conditions.
3. Impact protection (minimum): To [BS EN 62262](#), IK09.
4. Ingress protection (minimum): To [BS EN 60529](#), IP 44.
5. Voltage rating: Manufacturers standard requirements.
6. Current rating: As required to suit each circuit.
7. Frequency rating: 50–60 Hz.
8. Pin configuration: As require to suit each connection.
9. Cable termination: Manufacturers standard requirements.
10. Execution: [Pr_65_72_97/610 Installing electrical accessories](#)

Pr_65_72_97_20 Cooker control units

1. Manufacturer: Refer to Clients ER's.
2. Standard: To [BS 4177](#).
3. Current rating: As required to suit the circuit.
4. Switched socket outlet: 13 A to [BS 1363-2](#).
5. Indicator lamp: Manufacturers standard.
6. Mounting: Flush. Surface.
7. Ingress protection (minimum): To [BS EN 60529](#), IP 20.
8. Cable termination: Screwed.
9. Plate
 - 9.1. Material: Refer to drawings and description.
 - 9.2. Finish: Refer to drawings and description.
10. Insert colour: Refer to drawings and description.
11. Execution: [Pr_65_72_97/610 Installing electrical accessories](#)

Pr_65_72_97_21 Cooker connection units

1. Standard: To [BS 5733](#).
2. Individual terminal block capacity (minimum): 10 mm² stranded cable.
3. Mounting: Flush.
4. Ingress protection (minimum): IP2XD
5. Cable termination: Screwed.
6. Plate
 - 6.1. Material: Refer to drawings and description.
 - 6.2. Finish: Refer to drawings and description.
7. Execution: [Pr_65_72_97/610 Installing electrical accessories](#)

Pr_65_72_97_23 Double pole switches

1. Manufacturer: Refer to drawings and description.
2. Standards: To [BS EN 60669-1](#) and [BS EN 60669-2-4](#).
3. Current rating: As required to suit each circuit.
4. Indicator lamp: Refer to drawings and description.
5. Mounting: Flush. Surface.
6. Ingress protection (minimum): To [BS EN 60529](#), IP 20.
7. Cable termination: Screwed.
8. Plate
 - 8.1. Material: Refer to drawings and description.
 - 8.2. Finish: Refer to drawings and description.
9. Insert colour: Refer to drawings and description.
10. Execution: [Pr_65_72_97/610 Installing electrical accessories](#)

Pr_65_72_97_29 Electric vehicle charging points

1. Manufacturer: Refer to clients ER's.
2. Standards: To [BS EN 62196-1](#). To [BS EN 62196-1](#). To [BS EN 62196-2](#). To [BS EN 62196-3](#).
3. Mode: Refer to drawings and description.
4. Input voltage: Refer to drawings and description.
5. Input current: Refer to drawings and description.
6. Rated frequency: 50 Hz.
7. Outlet type: Refer to drawings and description.
8. Power output: Refer to drawings and description.
9. Mounting: Refer to drawings and description.
10. Impact protection (minimum): Manufacturers standard specification.
11. Ingress protection (minimum): To [BS EN 60529](#), IP 54.
12. Circuit protection: Refer to drawings and description.
13. Accessories: Refer to drawings and description.

Pr_65_72_97_30 Fan isolators

1. Manufacturer: Refer to drawings and description.
2. Standards: To [BS EN 60669-1](#) and [BS EN 60669-2-4](#).
3. Current rating: 6 A minimum.
4. Poles: Triple pole.
5. Mounting: Refer to drawings and description.
6. Ingress protection (minimum): IP2XD
7. Cable termination: Screwed.
8. Plate
 - 8.1. Material: Refer to drawings and description.
 - 8.2. Finish: Refer to drawings and description.
9. Insert colour: Refer to drawings and description.
10. Execution: [Pr_65_72_97/610 Installing electrical accessories](#)

Pr_65_72_97_31 Fused connection units

1. Manufacturer: Refer to drawings and description.
2. Standard: To [BS 1363-4](#).
3. Control
 - 3.1. Type: Refer to drawings and description.
 - 3.2. Indicator lamp: Refer to drawings and description.
4. Mounting: Refer to drawings and description.
5. Flex outlet: Refer to drawings and description.
6. Ingress protection (minimum): To [BS EN 60529](#), IP 20.
7. Cable termination: Screwed.
8. Fuse carrier access: Screw. Tamper proof screw.
9. Plate
 - 9.1. Material: Refer to drawings and description.
 - 9.2. Finish: Refer to drawings and description.
10. Insert colour: Refer to drawings and description.
11. Execution: [Pr_65_72_97/610 Installing electrical accessories](#)

Pr_65_72_97_52 Multi-gang power outlets

1. Manufacturer: Refer to drawings and description.
2. Standard: To [BS 1363-2](#).
3. Current rating: Refer to drawings and description.
4. Fuse protection: To [BS 1362](#).
5. Outgoing ways
 - 5.1. Type: Refer to drawings and description.
 - 5.2. Quantity: Refer to drawings and description.
6. Cable length (minimum): As required.
7. Features: Main switch with integral neon indicating 'power on'.

Pr_65_72_97_78 Shaver/Mirror supply units

1. Manufacturer: Refer to clients ER's.
2. Standards: To [BS EN IEC 61558-1](#) and [BS EN 61558-2-5](#).
3. Rating: 20 V·A.
4. Output voltage: 115 V and 230 V.
5. Isolating transformer: Integral.
6. Mounting: Refer to drawings and description.
7. Ingress protection (minimum): IP2XD
8. Plate
 - 8.1. Material: Refer to drawings and description.
 - 8.2. Finish: Refer to drawings and description.
9. Execution: [Pr_65_72_97/610 Installing electrical accessories](#)

Pr_65_72_97_81 Socket outlet residual current devices (SRCD)

1. Manufacturer: Refer to drawings and description.

2. Standards: To [BS 1363-2](#) and [BS 7288](#).
3. Voltage rating: 230 V a.c.
4. Current rating: Refer to drawings and description.
5. Rated residual operating current: Refer to drawings and description.
6. Frequency rating: 50 Hz.
7. Number of poles: Double pole.
8. Arrangement: Refer to drawings and description.
9. Control
 - 9.1. Type: Refer to drawings and description.
 - 9.2. Switch position: Refer to drawings and description.
 - 9.3. Indicator lamp: Refer to drawings and description.
 - 9.4. Interlock: Three-pin equal pressure.
 - 9.5. Response to line voltage failure: Active.
10. Operating characteristic: A. AC.
11. Mounting: Refer to drawings and description.
12. Ingress protection (minimum): Refer to drawings and description.
13. Cable termination: Screwed.
14. Plate
 - 14.1. Material: Refer to drawings and description.
 - 14.2. Finish: Refer to drawings and description.
 - 14.3. Insert colour: Refer to drawings and description.
15. Execution: [Pr_65_72_97/610](#) [Installing electrical accessories](#)

[Pr_65_72_97_84](#) Standard socket outlets

1. Manufacturer: Refer to drawings.
2. Standard: To [BS 1363-2](#).
3. Arrangement: Refer to drawings.
4. Control
 - 4.1. Type: Refer to drawings.
 - 4.2. Switch position: Refer to drawings.
 - 4.3. Indicator lamp: Refer to drawings.
 - 4.4. Interlock: Refer to drawings.
5. Mounting: Refer to drawings.
6. Features: Refer to drawings.
7. Ingress protection (minimum): Refer to drawings.
8. Cable termination: Refer to drawings.
9. Plate
 - 9.1. Material: Refer to drawings.
 - 9.2. Finish: Refer to drawings.
10. Insert colour: Refer to drawings.
11. Execution: [Pr_65_72_97/610](#) [Installing electrical accessories](#)

Pr_65_72_97/610 Installing electrical accessories

1. Standard: In accordance with [BS 7671](#).
2. Accessory faceplates: Free from any traces of plaster, grout, paint or similar.
3. Positioning: Coordinate with other wall- or ceiling-mounted equipment.
4. Alignment: Align adjacent accessories on the same vertical or horizontal axis.
5. Fixing: Fix securely, plumb and level to vertical and horizontal axes.
6. Mounting heights
 - 6.1. Generally: Measure from finished floor level to centre line of accessory.
 - 6.2. Light switches: 1100mm.
 - 6.3. Single voltage shaver outlets: 1100mm.
 - 6.4. Shaver supply units: 1100mm.
 - 6.5. Socket outlets: 450mm where not mounted on trunking or above worktops. 200mm above worktop. Trunking 800mm to underside.
 - 6.6. Fan isolators: Adjacent fan.
 - 6.7. Cooker control units: 200mm above worktop.
 - 6.8. Cooker connection units: 600mm.
 - 6.9. Telecommunications and data outlets: 450mm where not mounted on trunking or above worktops. 200mm above worktop. Trunking 800mm to underside.
7. Separation distance between adjacent accessories (minimum): 10 mm.

See [Pr_75_51_17/610 Installing emergency stop buttons](#) in [Ss_70_10_30_70 Reciprocating internal combustion engine](#)

Ss_70_30_80/620 Small power installation

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

Ss_70_30_80/630 Installing cabling to socket outlets

1. General: Wire socket outlets in ring final circuits without spurs where hard wiring is employed. Wire socket outlets in radial circuits where prefabricated cable is employed.

Ss_70_30_80/650 Partial installation

1. Equipment to be installed only: Refer to drawings and description.
2. Equipment requiring power supplies and final connection only: Refer to drawings and description.
3. Containment
 - 3.1. Provide for the following systems: Refer to drawings and description.
 - 3.2. Draw cords: Required.

System completion

Ss_70_30_80/820 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: Paper copy. Electronic copy (PDF & Word)

- 1.4. Number of copies: Three.
2. Record drawings
 - 2.1. Content: For all low voltage final circuits, the cable origin, circuit designation, route, loading, conductor material and c.s.a, insulation type and colour, number of cores per cable, number of cables in trunking and conduit.
Whether cables are run on surface, concealed in walls, floors, above suspended ceilings or within roof spaces.
Location, route and depth of underground cables.
Location of LV switchgear including distribution boards.
Routes of trunking, conduit, cable tray and cable ladders.
Location of all electrical outlets, including isolators, starters, control equipment and electrical accessories Schematic drawings showing all low voltage final circuits, the cable origin, circuit designation, cable type, size, number of cores, size and type of overcurrent protective device.
 - 2.2. Format: A1 paper print drawing.
Electronic drawing. (PDF & .DWG)
 - 2.3. Number of copies: Three.
3. Submittal date: At handover.

Ss_70_30_80/830 Spares

1. Plugs: Supply two for each socket outlet type.
2. Fuse links: Supply ten of each rating.

Ω End of System

Ac_70_60_49/120

Low voltage electrical installation testing and inspecting

Activities

Ac_70_60_49/120 Low voltage electrical installation testing and inspecting

1. Description:

The Contractor shall include for the wholesale testing end to end of the new electrical installation, together with recording and submitting all measurements, all as per BS7671 (plus all and any amendments published at time of tender).

The Contractor shall include for carrying out all tests as required to provide a comprehensive set of results, using a set of forms as issued by the NICEIC, the ECA or based upon the model forms in Appendix 6 of BS7671.

All circuits forming part of the installation works shall be tested and all results recorded, including earth loop values, prospective short circuit current, insulation resistance, conductor continuity etc. as appropriate to the circuit in question.

Test certificates are to be provided for all systems and circuits.

Test certificates are to be typewritten handwritten results will not be accepted.

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_49/610 Test equipment calibration](#); [Ac_70_60_49/620 Inspection and testing electrical installations generally](#)

4. System completion: [Ac_70_60_49/870 Minor electrical installation works 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): 7 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.

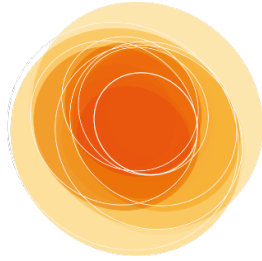
- 6.2. Other circuits less than or equal to 500 V (excluding SELV and PELV): 2 megohm when tested at 500 V d.c.
- 6.3. Circuits above 500 V: 2 megohm when tested at 1000 V d.c.
- 7. External earth fault loop impedance (Z_e): Direct measurement.
- 8. Connection of test equipment to existing switchgear: Any required shutdown to be agreed with Client.
- 9. Earth fault loop impedance (Z_s): By direct measurement.
- 10. Measurement locations: Origin, switchgear, fixed equipment and outlets, circuit extremities.
- 11. Prospective fault current
 - 11.1. Method: Direct measurement.
 - 11.2. Location: Origin, and at points where protective devices are required to operate under fault conditions.
- 12. Phase sequence: Verify.
- 13. Cable containment: Measure electrical continuity and insulating properties of containment. Submit results.

System completion

Ac_70_60_49/870 Minor electrical installation works certificates

- 1. Standard: In accordance with [BS 7671](#), Appendix 6.
To [National Inspection Council for Electrical Installation Contracting \(NICEIC\)](#) standard.
To [SELECT](#) standard. (Scotland only)
- 2. Format: Electronic, type written results.
- 3. Test equipment identity: Record on test certificates.
- 4. Certificates of calibration: Submit for each test instrument.
- 5. Schedule of test results: Submit two copies.

Ω End of Activity



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