

DIFE Multi Tertiary Building Extension, County Louth

Volume A.2.3 Electrical Specification

Part 3 of 4: Standard Clauses

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Y60 CONDUIT AND CABLE TRUNKING

1000 GENERAL

1010 STANDARDS:

Provide conduit and cable trunking in accordance with the relevant British Standards and in particular the requirements of BS 7671 Requirements for Electrical Installations (The IET Wiring Regulations).

2010B CONDUIT SYSTEMS METAL RIGID CLASS 4:

Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.

Material - Metal, steel.

Method of connection - Threadable.

Suitability for bending - Rigid, BS EN 61386-21.

Electrical characteristics - with electrical continuity.

Resistance against corrosive or polluting substances

Conduits with same protection outside and inside

High protection - Hot dip zinc coating. BS EN 61386-1 Table 10 Class 4.

2010D CONDUIT SYSTEMS - STEEL FLEXIBLE, LSF SHEATHED:

Provide conduit systems to BS EN 61386. Use conduit of each type from one manufacturer.

Material - Metal, steel.

Method of connection - Non-threadable.

Suitability for bending - Flexible, BS EN 61386-23.

Resistance to flame propagation

Non-flame propagating conduit.

Resistance against corrosive or polluting substances

Conduits with same protection outside and inside

Medium protection

Conduits with greater protection outside than inside -Medium/high

Stove enamel inside, LSF sheathed outside. BS EN 61386-1 Table 10 Class 2.

2020A RIGID CONDUIT SYSTEM - METALLIC CONDUIT

Use couplers to match conduit grade and finish.

Use solid couplers to join lengths of conduit unless inspection couplers are shown on the

drawings or schedules.

Conduit fittings and adaptable boxes

Material - Malleable iron adaptable boxes.

Do not use factory made bends, inspection bends or inspection couplers unless shown on drawings or schedules.

Ensure fittings are same class and finish as associated conduit system.

Supply covers for circular or adaptable boxes in the same material and finish as boxes.

Use steel dome or cheese headed screws to secure covers for Class 2 finish.

Use brass dome or cheese headed screws to secure covers for Class 4 finish.

Limit number of entry holes within loop-in boxes to four.

Adaptable box, minimum size - 100mm x 100mm x 50mm.

Connections

Use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes. Use solid couplers.

Conduit fixing saddles - Spacer bar.

Plugs - Hexagonal malleable iron.

Locknuts - Hexagonal steel.

2040A PLIABLE OR FLEXIBLE CONDUIT SYSTEMS - METALLIC:

Type of Packing - Unpacked.

Type of sheath - Low smoke and fume material.

Fittings material - Brass adaptors.

Connections

Use brass male adaptors to connect flexible conduit to motors and any other equipment having a threaded entry.

Use male adaptors, solid couplers, flanged couplers with washer and externally screwed brass bushes to connect flexible conduit to trunking and equipment not having a threaded entry.

2080A CABLE TRUNKING AND FITTINGS:

Comply with BS EN 50085. Use trunking of each type from one manufacturer.

2090B METAL SURFACE TRUNKING - ZINC FINISH:

Material

Steel trunking to BS EN 50085. Supply partitions and covers same material as trunking.

Gauge of metal - BS EN 50085.

Trunking type

Standard cable trunking with compartments.

Style

Use trunking manufactured with inward return edge flanges and fitted with flange couplers

which ensure that when the cover is removed a minimum of 80% of the nominal trunking or compartment width is available for access.

Protection to BS EN 50085

Electroplated zinc having a minimum thickness of zinc coating of 0.0012mm inside and outside.

Hot dip zinc coated steel to BS EN 10327 or BS EN 10143.

Finish - Manufacturer's standard, all surfaces.

Colour - Self Colour or Manufacturer's standard.

Fixings

Use purpose made brackets to fix to structural steel or suspension rods.

Provide external fixing lugs where specified protection for the installation is IP44 or greater.

Fittings

Use bends, tees and angles of similar gauge, type and finish as trunking body and supplied by same manufacturer.

Partitions and Covers

Ensure partitions are electrically continuous with the body of the trunking or provide a connector for a circuit protective conductor.

Ensure gap between partitions and lids maintains segregation of circuits.

Provide individual mounting plates for each accessory mounted on trunking covers.

Material - Same material as trunking.

Joints

Use purpose made jointing pieces fixed with screws into captive nuts. Ensure screws do not protrude through the nuts.

Ensure rigidity of trunking is maintained across joint.

Ensure external dimensions of trunking are maintained and not reduced by more than 4% across joints between trunking lengths and/or fittings.

Use purpose made fittings of the same manufacture where trunking connects to switchgear and distribution boards.

Provide flanges for connection of flush floor trunking to vertical trunking to maintain the cross sectional area of compartments with 50 mm minimum radius.

Maintain electrical continuity at each joint by a copper link, (tinned copper for galvanized trunking), fixed on outside of trunking, secured by screws, nuts and shake proof washers.

Screws must not project through the nut. Make provision for continuity to be achieved without need to remove paint from ferrous metal where trunking has a painted finish.

Screws, Nuts, Washers

Do not use self-tapping screws. Use cheese or round head screws except where provision is

made for the use of counter-sunk heads.

Material

Use steel zinc coated

- BS 7371-3 or BS 7371-6.

Cable supports

Provide horizontal trunking with removable cable retainers or bridges to retain cables in situ.

Provide vertical trunking with pin racks to support cables at 3000 mm maximum spacing.

Use insulated pins or insulation sleeved pins on pin racks.

2090E STEEL DADO TRUNKING:

Material steel - BS EN 50085.

Wall/dado trunking - three compartment.

Installation - surface.

Style.

Use trunking manufactured within ward return edge flanges and filled with flange couplers, which ensure that when the cover is removed a minimum of 80% of the nominal trunking or compartment width is available for access.

Colour - manufacturer's standard or BS 4800 shade to be approved.

2090F ALUMINIUM DADO TRUNKING:

Material extruded aluminium - BS EN 50085.

Wall/dado trunking - three compartment.

Installation - surface.

Style - extrusion as manufacturer's standard.

Colour - manufacturer's standard or BS 4800 shade to be approved.

2110A SERVICE OUTLET BOXES:

Provide service outlet boxes and junction boxes constructed from sheet steel with same finish as trunking.

Maintain continuity and segregation of compartments through boxes and fit flyovers where necessary.

Provide service outlet boxes with separate and segregated access to outlets associated with each wiring compartment. Fit cable guard or grommet to each section.

Incorporate spigots on boxes for connection to trunking.

Make frames adjustable on each corner, recess lids.

Manufacture frame and lids for service outlet boxes and junction boxes of cast metal, and

suitable to accept type of floor covering.

Outlet plates

Provide outlet plates for each low voltage compartment equipped with socket outlets.

Provide outlet plates for each extra low voltage compartment equipped with items.

Provide outlet plates for each information technology compartment that ensures the IT compartment and its outlet plate conform to the requirements of BS EN 50174 and of the IT system installer, equipped with suitable outlets.

Provide blank outlet plates for any unused compartments.

2120A POWER POLES:

Provide service poles complete with associated conduit or trunking fittings. Maintain continuity and segregation of circuits throughout. Provide outlet boxes with separate access to wiring compartments.

Standard - BS EN 50085-2-4.

Material - Extruded Aluminium.

Finish - Manufacturer's standard.

Fixings - Free standing or complete with fixing brackets at top.

2130C PVC DADO TRUNKING - GENERAL PURPOSE:

Trunking to BS 4678-4

Mechanical properties, trunking for medium mechanical stress.

Temperature tolerances - BS 4678-4, Table 1.

Electrical characteristics

Without electrical insulating characteristics.

Resistance against ingress of solid objects

Protected against solid objects greater than 1.0mm (IP4X).

Resistance to ingress of water

Protected against dripping water (IPX2).

Resistance against corrosive or polluting substances

Medium protection.

Fittings

Use fittings from same manufacturer as trunking. Use 'snap-on' covers. Use trunking fittings and accessories suitable for jointing by solvent welding.

Use proprietary cable retaining clips at 500mm maximum intervals on trunking that exceeds 1.8m in length. Where junctions occur ensure first clip is not more than 300mm from junctions.

2150A SEPARATE OR MULTI-COMPARTMENT TRUNKING:

Use separate trunking or multi-compartment trunking for segregation of services. Ensure steel

partitions have a provision for connecting a circuit protective conductor.
Provide separation of wiring for circuits as required by BS 7671.

2170 SUPPORTS AND FIXINGS:

Provide proprietary suspension systems comprising channel sections with return lips and compatible fixing accessories made of material to BS EN 10162, BS EN 10210 and/or slotted angles to BS 4345.

Ensure support components for Class 4 conduit have the same finishing method as the conduit carried out after manufacture. Ensure components in direct contact with conduit match profile of conduit.

Ensure all steel components such as studding, bolts and steel screws, bolts, nuts and washers are either cadmium plated and passivated or zinc electroplated to BS 7371 after manufacture. Do not use metal fixing components likely to deteriorate and/or cause damage through electrolytic action.

3010A GENERAL:

Ensure entire system is electrically and/or mechanically continuous, to BS 7671.

Fire barriers

Comply with the requirements of BS 7671 wherever the conduit or trunking passes through the perimeter of a fire compartment (wall, floor or ceiling).

Appearance

Arrange conduit, trunking and ducting to present neat appearance, parallel with other service runs and lines of building construction, except where in screed or in-situ concrete. Ensure plumb vertical runs.

Cable installation

Install cable in conduit, trunking or equipment enclosures only when completely erected throughout its length.

Do not use framework of partitions or similar unless indicated.

Building expansion and settlement

Make provision in conduit and trunking at expansion and settlement joints to allow for movement of building structure. Provide circular through or adaptable boxes no more than 300 mm either side of expansion or settlement joints for conduit crossing.

Join boxes with flexible steel conduit type C or conduits arranged to form a telescopic joint and cover overall with PVC sleeve to provide minimum degree of protection of IP44 or purpose made telescopic joint protected by a PVC sleeve to at least IP44.

Quality

Cut conduit clean and square with axis. Remove any burrs prior to erection.

Site form 90° in conduit wherever practical or use circular or adaptable boxes.

Construct bends and sets cold with a bending machine. Do not apply heat when forming sets or

bends.

Use bending tools complying with British Standards appropriate to conduit material.

Ensure no indentation or reduction in cross sectional area occurs during installation.

Use correct tools to assemble conduit. Ensure no tool marks or damage to components occurs.

3020 LAYOUT:

Ensure the maximum circuit lengths and groupings of cables indicated are not exceeded.

Conduit sizing

Where dimensions are not indicated select trunking and conduit sizes in accordance with Appendix A of Guidance Note I Selection and Erection published by the IEE (now IET).

3030 SPACING:

Install conduit, trunking and equipment clear of other services. Measure distance from external surface of any thermal insulation. Notify instances where minimum clearance cannot be achieved and bond items concerned. Minimum general spacing between conduits, trunking, equipment and insulated steam services - 300 mm.

Other services excluding steam - 150 mm.

Above central heating radiators - 1000 mm.

Ensure separation is in accordance with Appendix K of Guidance Note I Selection and Erection published by the IET and BS EN 50174.

3040 CONDENSATION PREVENTION:

Install conduit and trunking systems to ensure internal condensation does not affect operation of associated circuits. Provide drainage points in accordance with BS 7671.

Where conduit passes through external wall between two areas of different ambient temperatures or in other locations likely to cause condensation, install a conduit or adaptable box. After wiring fill box with inert, permanently plastic compound with high insulation value.

3050A PROTECTION AND REPAIR OF STEEL COMPONENTS:

Paint joints of conduit and minor damages to finish of conduit and trunking immediately after

erection or after damage occurs.

Use paint compatible with finish as follows

Galvanized finish, use two coats zinc rich paint.

Black enamelled finish, use two coats of good quality, air drying, black enamel paint.

Remove grease, oil, dirt and rust before applying protective paint.

Notify serious damage and repair or replace as instructed.

3060 EQUIPMENT CONNECTIONS:

Where surface mounted equipment is installed in conjunction with concealed conduit work, terminate concealed conduit at flush mounted conduit or adaptable box. Drill back of equipment, bush for back entry and mount equipment to conceal back box.

Connect to fixed equipment via conduit box located adjacent to termination point, using either solid or flexible conduit as indicated for final connection to equipment terminations.

Use conduit box as cable change point to facilitate changed wiring locally to adjacent equipment.

Connect trunking to equipment by specially fabricated connectors or by couplers and externally screwed brass bushes.

3070 CLEANING BEFORE WIRING:

Clean inside of conduits and trunking with swabs immediately before wiring.

Inspect all components and remove any foreign matter, fit temporary plugs to open ends of conduit and trunking to prevent ingress of water and solid material.

3080A WIRING:

Comply with BS 7671 when wiring installations.

Segregate circuits as indicated.

Ensure draw wires are left within empty conduits for use of specialist installers. Use draw wires comprising nylon tapes with fitted eyelets.

For concealed conduit ensure system is installed to enable re-wiring to be carried out from boxes for fittings or accessories only. Draw-in boxes will only be permitted with prior permission in writing.

Do not use tallow or any other substances to facilitate drawing-in of cables.

3090 BUILDERSWORK:

Ensure conduit is not concealed until work has been inspected and approved.

Obtain permission before horizontally chasing walls.

Ensure that conduit and fittings buried in concrete or behind plaster are protected against corrosion or electrolytic action prior to rendering.

Ensure conduit concealed in wall chases is covered by plaster and/or rendering to minimum

depth of 12 mm.

4010 DRAW-IN BOXES:

Provide draw-in boxes in conduit at maximum intervals of 10 metres or after bends and/or sets totalling 180 degrees.

4020 INSTALLATION OF CAST IN OR BURIED CONDUIT:

Ensure cast-in conduits are firmly secured to reinforcing steelwork and that accessory and/or conduit boxes are secured so they do not move during subsequent building operations.

Ensure there is no blockage immediately shuttering is removed.

Check there is no mechanical damage to conduit in floor screed prior to screeding. Fix securely before screed is poured. Provide temporary protection to conduits until screeds are laid.

Ensure minimum amount of cross-overs occur dependent upon screed depth. Do not install draw boxes in floors.

Do not install conduits in screeds in areas indicated.

Within site blinding.

In main structural slabs unless prior permission in writing is obtained.

4030 CONDUIT BOXES:

Ensure that wherever conduit boxes are cast in the face of the box is flush with the face of the concrete or plaster. Fit circular conduit boxes with extension rings to ensure a flush face with plaster or concrete or where terminal blocks are to be accommodated.

Ensure fixing holes are countersunk where material thickness allows or use round head screws to prevent damage to cables and remove burrs before cables are drawn in.

Use a minimum of two screw fixing for standard circular conduit boxes and four screws for large conduit boxes and adaptable boxes up to 150 mm x 100 mm.

Use back outlet boxes where surface conduits pass through walls, to outside accessories or lighting points.

Secure switch boxes and socket boxes using countersunk steel screws where provision is made for them or if not use round head screws. Use plug inserts and finally grout in position prior to plastering or screeding.

4040 FIXING CONDUIT:

Support conduit in accordance with Appendix I of Guidance Note I Selection and Erection published by the IEE.

Ensure conduit is not under mechanical stress. Fix conduit boxes independently of conduit.

Make allowance for any additional mechanical loading supported by conduit boxes.

Where protection is specified as IP44 or greater ensure fixings of conduit boxes are suitable to

maintain degree of protection.

Use following methods of fixing conduit:-

LOCATION	TYPE OF FIXING
Floor screeds.	Saddles or crampets.
Buried in plaster or render.	Crampets or saddles.
Above false ceilings.	Saddles.
Surface.	Saddles.

4050 FLEXIBLE AND PLIABLE CONDUIT:

Use flexible conduit for final connections to motors, other equipment subject to vibration or adjustment and to thermostats, motorised valves and similar items mounted in pipelines or ducts.

Use sufficient length between equipment and circular through box at end of conduit run (minimum 450 mm) to allow necessary full range of withdrawal, adjustment or movement.

Use solid type adapters to terminate flexible conduit.

Use PVC covered flexible conduit where installed externally, exposed to weather or in any position where ingress of moisture or condensation may occur.

4060 SCREWED STEEL CONDUIT:

Use materials clean and free from defects, rust, scale and oil. Obtain prior permission in writing for use of materials subject to remedial work before erection. Repair any damage caused by threading, bending or erection by painting with zinc rich paint before any rust occurs.

Ensure length of thread on conduit matches that in conduit couplers, fittings or equipment with no thread exposed after erection except at running couplers.

Ensure conduits butt inside couplers.

Use lubricant when cutting threads.

Use minimum number of running couplings

For running couplings in Class 2 conduit, use coupler and locknut. Paint exposed thread with zinc rich paint.

For running couplings in Class 4 conduit, use three piece conduit unions.

4080 UNDERGROUND INSTALLATION:

Where buried below ground, use Class 4 conduit. Do not use any buried conduit boxes unless prior permission in writing has been obtained. Wrap conduit with PVC self-adhesive tape, half lapped. Extend taping 150 mm beyond point where conduit leaves ground. Install circular through conduit boxes at the end of the tape. Fill conduit boxes after cable installation with inert, permanently plastic compound with high insulation value, and wrap in PVC self-adhesive

tape.

5020 ACCESS:

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

5030A FIXING TRUNKING:

Ensure trunking is independently fixed and supported from building fabric. Obtain approval for proposed fixings/supports.

Support trunking in accordance with the manufacturer's requirements and/or Guidance Note 1 Selection and Erection published by the IEE.

Use two fixings minimum per standard length.

5040A STEEL TRUNKING:

Install steel trunking in accordance with the manufacturer's requirements and those of BS 7671.

Use trunking to avoid multiple parallel conduit runs, subject to approval.

Cut trunking clean and square with axis, prepare ends and remove burrs and sharp edges.

Ensure inside of trunking is free from anything liable to damage cables either during installation or after covers are fitted.

When trunking is held in a vice, ensure surfaces remain undamaged and components are not warped.

Avoid tool marking or damage to trunking system components.

Do not site fabricate trunking tees, bends, flanges and other accessories. Use only factory made accessories.

Form circular holes over 6 mm diameter in trunking body using correctly sized punch sets. Use twist drill for holes up to 6 mm maximum diameter.

Use only factory formed openings for accessories.

Line unprotected apertures in trunking with PVC or nylon edging strip.

Fit ends of runs with removable blanking plates.

Ensure connections are not made to covers unless indicated or approval obtained.

Provide fixed section of cover projecting 25 mm either side of fabric where trunking passes through wall, floors or ceiling.

Fit cable retaining straps at 500 mm intervals except where cover is on top.

5050 UNDERFLOOR AND FLUSH FLOOR TRUNKING INSTALLATION:

Lay underfloor and flush floor trunking straight and level. Adjust height of services outlets, junction boxes and flush floor trunking to suit top of screed level. Ensure that spaces below trunking are free from voids and correctly packed. Prevent ingress of screed by masking where

necessary.

Ensure trunking levelling and alignment is carried out in co-operation with person(s) responsible for confirming location and finish of floor levels.

Immediately following installation of trunking fit temporary covers to service outlets, junction boxes and flush floor trunking. Fit temporary blanking plates over open connections to vertical trunking.

Retain temporary covers until permanent covers are installed.

Ensure underfloor trunking systems are fully re-wired to final circuit outlets.

Connect conduits only at inspection or other easy access points.

5060 TRUNKING OF INSULATING MATERIAL:

Comply with manufacturer's instructions. Do not install trunking where ambient temperature is below - 5°C or working temperature is above 60°C.

Use solvents recommended by trunking manufacturer when making solvent welded joints.

Remove excess solvent before surface damage occurs. Hold joints rigid and in position until welds set.

Use manufacturer's standard radiused bends, connector tees, off-sets, end plates and component parts of trunking system assembly.

Ensure no type of trunking other than that specified is installed without approval.

Trunking may be substituted for conduit at certain positions subject to approval.

Y61 HV/LV CABLES AND WIRING

1000 GENERAL

1010 CABLE MANUFACTURER:

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

1020 CABLE CERTIFICATION MARKING:

Mark all types of cables with CENELEC cable certification marking or if included in British Approvals Service for Cables (BASEC) in accordance with BASEC regulations.

1030 MEDIUM VOLTAGE CABLE RECORDS:

Keep records of MV cable drum numbers and supporting information, mark information on record drawings, indicating precise location of each length of cable, and submit copies of manufacturer's cable test certificate.

2005 LSOH SHEATHING:

Supply cables with Low Smoke Zero Halogen (LSOH) sheathing, tested in accordance with BS EN 50267 and BS EN 60332.

2010B STANDARD LSF FLEXIBLE WIRES - SINGLE COPPER CORE:

Standard - BS 7211, Tables 3(b) and 4(b).

2010C STANDARD HEAT RESISTING (110 DEGREES CENTIGRADE OR MORE) FLEXIBLE WIRES - SINGLE COPPER CORE:

Standard - BS 6007, Tables 5, 8, and 10.

2010E STANDARD HOFR FLEXIBLE CORDS - MULTI COPPER CORES:

Standard - BS 6500, Table 16.

2020E STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, LSF SHEATHED AND

ARMOURED:

Standard - BS 6724, Tables 4, 6, 8, and 10.

Mechanical protection - Armour.

2020G STANDARD CABLES FOR CONDUIT AND TRUNKING, COPPER CONDUCTORS, LSF

INSULATED:

Standard - BS 7211, Tables 3(a) and 4(a).

Mechanical protection - Conduit and trunking.

2050A PAIRED, UNSCREENED CONTROL CABLES WITH OR WITHOUT METALLIC PROTECTION:

Standard - BS EN 50288-7.

With or without metallic protection.

2050B PAIRED, SCREENED CONTROL CABLES WITH OR WITHOUT METALLIC PROTECTION:

Standard - BS EN 50288-7.

Paired, screened control cables, with or without metallic protection.

2050G MULTI-CORE UNARMoured LSF, SHEATHED AUXILIARY CABLES:

Standard - BS 7211, Table 6

Mechanical protection - Unarmoured.

2080A STANDARD COAXIAL CABLES, FOR BROADCAST RECEIVING:

Standard - BS EN 50117. CAI benchmark status, cable types CT 100, CT 125, CT 165.

2090A OPTICAL FIBRE CABLES:

Standard - BS EN 60794-2-11. Category of fibre to BS EN 60793-2-10 A1a or A1b.

3010A CABLES GLANDS - UNARMoured CABLES, INDOORS:

Cable type

Flexible; wiring and power; control and auxiliary; and communications.

Standard - BS EN 50262 non-metallic, cable retention, IP54; Type A1 as BS 6121-5 Annex A.

Environment - Indoor.

3010B CABLES GLANDS - UNARMoured CABLES, OUTDOORS:

Cable type

Flexible; wiring and power; control and auxiliary; and communications.

Standard - BS EN 50262 non-metallic, cable retention, IP54; Type A2 as BS 6121-5 Annex A.

Environment - Outdoor.

3010C CABLES GLANDS - ARMoured CABLES, DRY INDOORS:

Cable type

Wiring and power; and control and auxiliary.

Standard - BS EN 50262 metallic, cable retention Class A, protective connection to earth, IP54.

Type B as BS 6121-5 Annex A.

Environment - Dry indoors.

3010D CABLE GLANDS - ARMOURED CABLES, INDOORS:

Cable type

Wiring and power; and control and auxiliary.

Standard - BS EN 50262 metallic, cable retention Class A, protective connection to earth, IP54.

Type B as BS 6121-5 Annex A.

Environment - Indoor.

3010E CABLE GLANDS - ARMOURED CABLES, OUTDOORS:

Cable type

Wiring and power; and control and auxiliary.

Standard - BS EN 50262 metallic, cable retention Class A, protective connection to earth, IP54 with shroud. Type C as BS 6121-5 Annex A.

Environment - Outdoor.

3060A CABLE JOINTS AND TERMINATIONS:

Use only cable joints as supplied or recommended by cable manufacturer.

Cable type - Power or control and auxiliary.

Joint arrangement - Straight through or tee.

Joint type - BS 7888, cold pour or heat shrink.

Accessories - Armour bonds, BS 7197; filling compounds.

Environment - Underground.

3130A CABLE COVERS AND MARKERS:

Material - Recovered plastic, integral tape.

Marking - Electricity or telephone.

Plastic marker tape

Yellow, marked electricity or telephone.

4010 CABLE INSTALLATION - GENERAL:

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

practical drum size.

Handle, install and dispose of cables on wooden drums in accordance with BS 8512.

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

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

4020 CABLE INSTALLATION IN LOW TEMPERATURES:

Install cables at lower installation temperatures when authorised by manufacturer in a written statement.

4030 INSTALLATION OF LSF CABLE:

Install LSF cables in accordance with manufacturer's instructions. Ensure ambient temperature is above 5°C. Ensure oversheaths are not damaged by abrasion or scuffing.

4040 INSTALLATION OF UNARMoured CABLES:

Install and use unarmoured cable to BS 7540-1, BS 7540-2, BS 7540-3 or the manufacturer's written instructions.

4060 CABLE INSTALLATION IN TRENCHES:

Lay cables on newly prepared bedding. Ensure multiple layers of cable are separated vertically by a 50mm layer of hard rammed bedding material.

When using a power winch ensure tension on the cable is taken by element of the cable designed for that purpose, that is armour or conductor cores as appropriate and not plastic sheath, metal sheath or core insulation.

When hand pulling cable ensure no kinks are formed and that flaking, when used, is done in the correct direction.

Do not allow cable to twist during installation. Use swivels to connect pulling bond to cable stocking or equivalent fitting.

Check drum is suitable for jacking before commencing installation. If drum or reel is unsuitable for jacking, flake cable in correct direction in maximum size turns from drum or reel before commencing installation. Use skilled labour to supervise all unreeling, flaking or running of cable from a drum.

Lay cables in the formation shown, ensure spacing is not reduced below that indicated.

Bind trefoil groups at 1m intervals. Bind any associated earth or protective conductor to its cable or trefoil group at 1m intervals.

Space multiple cables in trenches in accordance with BS 7671.

Ensure installation radii and permanent bending radii are not less than those recommended by

the manufacturer.

Do not lay cables to BS 6007, BS 6500, BS 7211 or BS 7919 direct in the ground.

4080 CABLE INSTALLATION INTO DUCTS:

Install cables into newly proved and cleaned duct. Use lubricants, recommended by the cable manufacturer in writing, to assist drawing process.

Flake cable if drums or reels are not suitable for jacking. At intermediate draw pits with exit duct more than 15 degrees off line of entry duct, flake cable before entering or provide comprehensive system of corner plates, roller and blocks. Use maximum practical size of turns when flaking and ensure direction is correct.

Do not exceed manufacturer's installation tension on cable and ensure the pulling tension is taken on cable elements designed for that purpose, that is armour or conductor cores and not on other elements, such as plastic sheath or conductor insulation.

Do not allow cables being pulled into ducts to twist. Use appropriate swivel between pulling bond and cable stocking or similar appliance.

Bind trefoil groups of single core cables installed into a single duct at 1m intervals. Install earth or protective conductors into the same duct as the associated cable where practical, through manholes, draw pits and jointing chambers. Bind the two cables together. Pull all cables in one duct as a group. Ensure group does not twist or cross over. Report any damage to cable sheath during installation and carry out any instructed work to remedy the damage.

Seal between cable and duct ends after cable installation. Ensure cable ends in jointing chambers are temporarily sealed where required.

4090A CABLE INSTALLATION IN CONDUIT AND TRUNKING:

Install cables so that they are orderly and capable of being withdrawn.

Arrange single core wiring generally using the loop-in method.

Trunking

In vertical trunking provide pin racks at 3m intervals. Use ties at 2m intervals for all wires of the same circuit reference. Mark ties with circuit reference number at 10m intervals.

Conduit

Provide cable clamps in conduit boxes at 10m intervals in vertical conduit.

Allow for full range of movement at building construction movement joints. Make all joints to wiring at terminal blocks in conduit boxes.

4100 CABLE INSTALLATION ON TRAY AND RACK:

Place cables side by side or as indicated. Fix using cleats or cable ties so that any cable may be

individually removed. Use metallic ties on cables with specified fire performance.

4110A CABLE SURFACE INSTALLATION:

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

4120A CABLE EMBEDDED INSTALLATION:

Dress cables flat, free from twists, kinks and strain, and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection. Ensure plaster or screed over cable is a minimum of 12mm. Protect embedded cables with metal capping or PVC oval conduit.

4140 CABLE INSTALLATION - FLEXIBLE CORDS:

Grip cords securely at connections. Where they do not form an integral part of the connected accessory or equipment, provide separate proprietary cord grips.

4150A CABLE JOINTING AND TERMINATING GENERALLY:

Ensure all joints and terminations are made by appropriately qualified cable jointers, using jointing materials, components and workmanship recommended by the cable manufacturer and the jointing accessory manufacturer. Install cable glands in accordance with BS 6121-5.

Cold pour resin and heat shrink joints.

Cut all cable ends immediately prior to joints or terminating. Seal cables left unconnected for more than 24 hours to prevent the ingress of moisture. Seal plastic sheathed cables using proprietary shrink on end caps. Seal lead sheathed cables by a plumbed dressed lead cap with an airspace to allow conductor movement.

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

Clean armour thoroughly prior to jointing or terminating.

At connections to equipment and switchgear without integral cable clamping terminals, use compression or solder type lugs for bolted terminal connections, of correct bore.

Form all compression connections to components using tools that cannot be released unless the correct degree of compression has been achieved.

Install and inspect compression and mechanical connectors on conductors in accordance with

BS EN 60228 and BS 7609.

Bolt core terminations with lugs to equipment using washers or proprietary shakeproof devices. Do not bunch more than three cores at clamping terminals or bolted connections.

Mark cable conductor phasing, or other core identification, at each end of all cables, and at all joints, maintaining consistency of marking with any existing system.

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

4200A COMMUNICATIONS COAXIAL, OPTICAL FIBRE AND IT CABLE INSTALLATION, JOINTING AND TERMINATING:

Use methods approved by cable and accessory manufacturers.

Employ labour certified by acceptable body as qualified to install and make joints and terminations in the referenced cable. Obtain in writing approval of cable manufacturer for accessories not supplied by them.

Identify cables using structured numbering scheme.

Install communication, coaxial, optical fibre and IT cables in accordance with BS EN 50174-3.

Y61.3080Y CONNECTORS FOR COAXIAL CABLES:

- Standard
 - BS 3041-7 - Type C.
 - BS 3041-12 - Type UHF.
 - BS EN 60169 - Type SC-A.
 - BS EN 60169 - Type SC-B.
 - BS EN 61169-8 - Type BNC.
 - BS QC 221100 - Type SMA.
 - BS QC 221300 - Type SMB.
 - BS QC 221400 - Type SMC.
 - BS QC 222000 - Type TNC.
- BNC.
 - Sealed.
 - Unsealed.
- IEC 95 (Belling or TV connector)
- F.
- Connectors to match equipment.

Y63 SUPPORT COMPONENTS - CABLES

1000 GENERAL

1010 APPLICATION:

Cables referred to in this section are only those types that can be installed without further mechanical protection.

2010A CABLE SUPPORTS AND FINISHES:

Cable supports

Support all cables throughout their length using conduit; or trunking and enclosures; or cable tray; or cable racking; or special support systems; or cleat or clip fixing direct to building fabric as indicated on the drawings/schedules.

Ensure tray, racking and special support systems are continuous and firmly fixed to building fabric. Allow space for additional cables as indicated on the drawings/schedules.

Ensure cable support system allows for spacing in accordance with BS 7671 for the design current of the cable.

Fixings finishes

Ensure finish for all support components, fixings, hangers and accessories is as cable support system or manufacturer's standard.

2020A CABLE SUPPORT SYSTEM - PERFORATED TRAY:

Type - Flanged or return flanged.

Perforations

Admiralty pattern for light or medium duty; GD CD pattern standard 23; or manufacturer's standard pattern.

Thickness - Manufacturer's standard thickness for type.

Fittings

Use factory made fittings throughout of same material, type, pattern, finish and thickness as cable tray.

Use reducers, inside angles and outside angles as manufacturer's standard.

Use flat bends, equal tees, unequal tees and crosses with corners gusseted.

Join lengths of tray and fittings using manufacturer's standard shouldered ends, fish plates, or couplers, with galvanized or zinc plated slotted domed head 'roofing' bolts, nuts, washers and

shakeproof washers.

Material

Hot rolled steel galvanized after manufacture to BS EN 10327 or BS EN 10143.

Finish - Self colour galvanized.

2020B CABLE SUPPORT SYSTEM - CABLE RACK:

Proprietary system of channel sections with return lip and compatible jointing and fixing accessories

Fittings

Use factory made fittings throughout of same material finish and section as rack, for risers, bends, reducers, tees, crosses and drop outs.

Material

Hot rolled steel galvanized after manufacture to BS EN 10327 or BS EN 10143.

Finish - Self colour galvanized.

2025A CABLE SUPPORT SYSTEM - PROPRIETARY CABLE TIES:

Two piece cable tray pattern, on cable tray only. Wrap round self-locking non releasable pattern on everything except cable trays.

2025C CABLE SUPPORT SYSTEM - TWO WAY SADDLES:

Bright copper for unsheathed mineral insulated cables. PVC covered bright copper for sheathed mineral insulated cables.

2025D CABLE SUPPORT SYSTEM - CABLE BASKET:

Proprietary system of wire basket with compatible jointing and fixing accessories.

Fittings

Use factory made fittings throughout of same material finish as basket, for risers, bends, reducers, tees, crosses and drop outs.

3010 CABLE TRAY INSTALLATION:

Support from building fabric with minimum clearance behind of 20mm. Install fixings at regular intervals to prevent visible sagging when loaded, with maximum spacing 1.2m and 230mm from fittings.

Keep cutting of cable tray to a minimum. Cut along a line of unperforated metal. Make good finish with zinc rich paint, primer and top coat or two pack epoxy paste, as appropriate to tray material and finish.

Fit holes cut in tray for passage of cables with grommets, bushes or other lining.

Install all bolts, fixings and hangers with threaded portion away from cables. Cable routes to

cross at right angles or spacing to BS EN 50374.

3020A CABLE CLEATS, TIES, SADDLES AND CLIPS INSTALLATION:

For cables on horizontal tray use ties for each circuit. Use tie manufacturer's special tensioning tool where available. Crop off tie ends.

For cables on vertical tray use cleats bolted to tray for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. Use cleats sized to grip cables firmly without undue pressure or strain on cable, but preventing slipping.

For cables on vertical or horizontal rack use proprietary fixings to rack for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. On continuous flat surfaces of wood, plaster, brick etc.

Use polypropylene surface fixing clips with prefixed hardened steel pin for PVC insulated and sheathed cables and sheathed or bright mineral insulated cables. Use round or flat or flat twin pattern as appropriate, manufactured specifically for cable being fixed.

Use one hole 'P' clips or two way saddles of bright copper for unsheathed mineral insulated cable. Use PVC covered for sheathed mineral insulated cables.

Space cleats, ties, saddles and clips

As Appendix G of Guidance Notes 'Selection & Erection' published by the IET.

Y71 LV SWITCHGEAR AND DISTRIBUTION BOARDS

2010A CUBICLE SWITCHBOARD - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:

- Standard - BS EN 61439-1.
- External design - Cubicle type assembly.
- Usage - Switchboard.
- Conditions of installation - Indoors.
- Electrical characteristics
 - Rated operational voltage 400V +10% -6%
- Service conditions
 - Ambient air temperature and altitude as BS EN 61439.

2010B CUBICLE CONTROL PANEL - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:

- Standard - BS EN 61439-1.
- External design - Cubicle type assembly.
- Usage - Control panel.
- Conditions of installation - Indoors.
- Electrical characteristics
 - Rated operational voltage 400V +10% -6%
- Service conditions
 - Ambient air temperature and altitude as BS EN 61439.

2010C MULTI-BOX SWITCHBOARD - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:

Standard - BS EN 61439-1.
External design - Multi-box type assembly.
Usage - Switchboard.
Conditions of installation - Indoors.
Electrical characteristics
Rated operational voltage 400V +10% -6%
Service conditions
Ambient air temperature and altitude as BS EN 61439.

2010D MULTI-BOX CONTROL PANEL - LV SWITCHGEAR AND CONTROLGEAR ASSEMBLY:

Standard - BS EN 61439-1.
External design - Multi-box type assembly.
Usage - Control panel.
Conditions of installation - Indoors.
Electrical characteristics
Rated operational voltage 400V +10% -6%
Service conditions
Ambient air temperature and altitude as BS EN 61439.

2020A FLOOR STANDING ASSEMBLY CONSTRUCTION:

Enclosure standard - BS EN 62208.

Material of enclosure - Manufacturer's standard.

Terminals for external conductors, main power circuits

Accommodate cross-sectional area of copper cables in accordance with BS EN 61439-1.

Terminals for external conductor, control and auxiliary circuits

Terminal block. Mounting as manufacturer's standard.

Size of neutrals on three phase supplies - Full sized.

Degree of protection to BS EN 60529, IP31 for assembly.

Protection against direct and indirect contact

Manufacturer's standard.

Accessibility for inspection

Arrange for following operations to be performed when assembly is in service and under voltage

Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.

Adjusting and re-setting of relays, releases and electronic devices.

Replacement of fuselinks and indicating lamps.

Fault location by voltage and current measuring.

Accessibility for maintenance

Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.

Removable parts and with-drawable parts as manufacturer's standard.

Internal separation - Form 4.

Input voltage variations for electronic equipment supply - BS EN 60439.

Supply frequency deviation - BS EN 60439.

Mounting - Floor standing.

2020B WALL MOUNTED ASSEMBLY CONSTRUCTION:

Enclosure standard - BS EN 62208.

Material of enclosure - Manufacturer's standard.

Terminals for external conductors, main power circuits

Accommodate cross-sectional area of copper cables in accordance with BS EN 60439-1.

Terminals for external conductor, control and auxiliary circuits

Terminal block. Mounting as manufacturer's standard.

Size of neutrals on three phase supplies - Full sized.

Degree of protection to BS EN 60529, IP31 for assembly.

Protection against direct and indirect contact

Manufacturer's standard.

Accessibility for inspection

Arrange for following operations to be performed when assembly is in service and under

voltage

Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.

Adjusting and re-setting of relays, releases and electronic devices.

Replacement of fuselinks and indicating lamps.

Fault location by voltage and current measuring.

Accessibility for maintenance

Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.

Removable parts and withdrawable parts as manufacturer's standard.

Internal separation - Form 4.

Input voltage variations for electronic equipment supply - BS EN 60439.

Supply frequency deviation - BS EN 60439.

Mounting - Wall mounted.

2030A ENCLOSURE FINISH:

Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.

Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.

Finish - Manufacturer's standard.

Colour - Manufacturer's standard colour.

2060 SITE BUILT ASSEMBLIES:

Ensure that components of site assemblies are part of a proprietary system and type tested as appropriate.

Install assemblies in accordance with manufacturer's drawings and instructions.

2070 SITE MODIFICATION:

Do not make site alterations unless authorised. Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with type test certificate obtained for arrangement of components.

2090A UTILISATION A, WITHDRAWABLE AIR BREAK CIRCUIT BREAKERS:

Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated

operational voltage.

Standard - BS EN 60947-2

Details of equipment - Circuit breaker.

Characteristics of circuit breakers

a.c. Interrupting medium - Air.

Rated and limiting values for the main circuit.

Rated voltage (Volts) - operational, 400.

Rated frequency 50 Hertz.

Circuit breaker Utilisation category - A.

Enclosure degree of protection IP 31.

Circuit breakers and switches

Provide metal clad withdrawable isolating removable type circuit breakers with provision for safe maintenance.

Closing mechanism

Independent manual spring operated.

Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.

Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.

Provide moulded case circuit breakers with provision for safe maintenance.

2090B UTILISATION A, MCCB AIR BREAK CIRCUIT BREAKERS:

Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.

Standard - BS EN 60947-2

Details of equipment - Circuit breaker.

Characteristics of circuit breakers

a.c. Interrupting medium - Air.

Rated and limiting values for the main circuit.

Rated voltage (Volts) - operational, 400.

Rated frequency 50 Hertz.

Circuit breaker Utilisation category - A.

Enclosure degree of protection IP 31.

Circuit breakers and switches

Provide manual closing air-break circuit breakers, (MCCB).

Closing mechanism

Independent manual spring operated.

Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.

Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic

shutters covering live contacts when removed from housing.
Provide moulded case circuit breakers with provision for safe maintenance.

2090C UTILISATION B, WITHDRAWABLE AIR BREAK CIRCUIT BREAKERS:

Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated operational voltage.

Standard - BS EN 60947-2

Details of equipment - Circuit breaker.

Characteristics of circuit breakers

a.c. Interrupting medium - Air.

Rated and limiting values for the main circuit.

Rated voltage (Volts) - operational, 400.

Rated frequency 50 Hertz.

Circuit breaker Utilisation category - B.

Enclosure degree of protection IP 31.

Circuit breakers and switches

Provide metal clad withdrawable isolating removable type circuit breakers with provision for safe maintenance.

Closing mechanism

Independent manual spring operated.

Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.

Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.

Provide moulded case circuit breakers with provision for safe maintenance.

2090D UTILISATION B, MCCB AIR BREAK CIRCUIT BREAKERS:

Provide circuit breakers in accordance with BS EN 60947. Ensure that uninterrupted current rating indicated applies when unit is enclosed and in operating environment at rated

operational voltage.

Standard - BS EN 60947-2

Details of equipment - Circuit breaker.

Characteristics of circuit breakers

a.c. Interrupting medium - Air.

Rated and limiting values for the main circuit.

Rated voltage (Volts) - operational, 400.

Rated frequency 50 Hertz.

Circuit breaker Utilisation category - B.

Enclosure degree of protection IP 31.

Circuit breakers and switches

Provide manual closing air-break circuit breakers, (MCCB).

Closing mechanism

Independent manual spring operated.

Provide automatic shutters to cover all live contacts when circuit breaker is isolated, withdrawn or removed from housing.

Provide a padlock to lock circuit breaker in isolated/withdrawn position, and to lock automatic shutters covering live contacts when removed from housing.

Provide moulded case circuit breakers with provision for safe maintenance.

2100A SWITCH DISCONNECTORS:

Supply switch dis-connectors in accordance with BS EN 60947.

Standard - BS EN 60947-3

Details of equipment - Switch-dis-connector.

a.c. Interrupting medium - Air.

Rated and limiting values for the main circuit.

Rated voltage (Volts) 230/400.

Rated frequency 50 Hertz.

Utilisation category - AC 23A.

Enclosure degree of protection IP 65.

Fit each switch with facility to padlock in OFF position.

Provide switches with auxiliary contacts as indicated. Where switches isolate final connections between a starter and its motor, fit one set of contacts to open starter coil circuit when switch is

opened.

2100B FUSE COMBINATION UNITS:

Supply fuse combination units in accordance with BS EN 60269 (BS 88).

Standard - BS EN 60947-3.

Details of equipment - Fuse combination unit.

a.c. Interrupting medium - Air.

Rated and limiting values for the main circuit

Rated voltage (Volts) 230/400.

Rated frequency 50 Hertz.

Utilisation category - AC23A

Enclosure degree of protection IP 31.

Fit removable neutral link in switches controlling circuits with neutral conductor.

Fit solid links in isolating switches.

Fit each switch with facility to padlock in OFF position.

Ensure that withdrawable chassis isolating type switches are provided with fully shrouded fixed contacts or insulated cover plates, to prevent accidental contact with live parts.

Ensure that switches in individual enclosures have an earth terminal, meet the degree of protection for the switchboard and have operating mechanisms interlinked with access door.

Provide switches with auxiliary contacts as indicated. Where switches isolate final connections between a starter and its motor, fit one set of contacts to open starter coil circuit when switch is opened.

2110A AUTOMATIC RESET PROTECTION DEVICES INTERPOSING RELAYS AND INTER-TRIPPING RELAYS:

Standard - BS EN 61810.

Housing

Flush panel mounting type. House all protection relays, excluding motor protection relays, in draw out cases.

Reset type - Automatic reset type.

Overcurrent tripping device

Provide overcurrent tripping device with overcurrent characteristic similar to a BS 2692 high voltage cartridge fuse, sized to protect the equipment/load.

2110B MANUAL RESET PROTECTION DEVICES INTERPOSING RELAYS AND INTERTRIPPING RELAYS:

Standard - BS EN 61810.

Housing

Flush panel mounting type. House all protection relays, excluding motor protection relays, in

draw out cases.

Reset type - Manual reset type.

Overcurrent tripping device

Provide overcurrent tripping device with overcurrent characteristic similar to a BS 2692 high voltage cartridge fuse, sized to protect the equipment/load.

2120 VOLTAGE SENSING RELAYS:

Provide single phase inverse time under voltage type voltage sensing relays to monitor the voltage between respective phases of supply.

Mounting

Supply suitable for flush panel mounting with relay trip indication.

Voltage settings

50-90% in five equal steps with automatic resetting at 105% of voltage setting.

Relay Inverse time characteristics

When voltage increases from zero to rated voltage with time multiplier set at 1.0, set relay resetting times as follows:-

Relay setting %	50	60	70	80	90
Resetting time (secs)	2	4	5	10	12

2130 TRIP/CLOSE SWITCHES AND CONTROL SELECTOR SWITCHES:

Provide a panel mounted heavy duty, spring return trip/close switch on each circuit breaker fitted with solenoid or motorized spring closing mechanisms.

Ensure contacts have a continuous rating of 10A minimum at between 30V to 250V ac and dc, and make and break duty rating of 30A at 250V ac or dc for a minimum period of 3 secs.

Where remote trip/close control is indicated, supply a panel mounted selector switch to select circuit breaker for local or remote closing. Ensure that selection of remote or local closing does not prevent circuit breaker tripping under operation of local or remote trip switch.

2140 CURRENT TRANSFORMERS:

Comply with BS EN 60044-1. Provide separate current transformers for each protection device and instrumentation. Ensure current transformers provide appropriate accuracy and are compatible with over current factors, characteristics, performance and VA rating required for satisfactory operation of protection devices, instruments and meters indicated.

Ensure that current transformers are capable of withstanding maximum short time withstand current of value and duration indicated for assembly.

Provide test links in secondary connections of all current transformers to facilitate testing of

instruments, meters and protection devices.

2150A INSTRUMENTS AND METERS:

Standards

Comply with BS 89 and BS EN 60051-1 for voltmeters, ammeters, watt meters, frequency indicators and power factor indicators.

Comply with BS 7856, BS EN 62053-11, BS EN 62053-22 or BS EN 62053-21 for kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters, and BS EN 62053-23 for KVAhr meters.

Protect wiring to voltmeters by separate fuses.

Protect potential coils of watt meters, frequency indicators, power factor indicators and kWh meters, kVA and kW maximum demand meters and polyphase reactive kVA meters by separate fuses.

Supply instruments and meters suitable for flush mounting and type, size and accuracy as indicated.

Ensure that indicating scales for all instruments comply with BS 3693.

Supply so that normal indication is 50% to 75% of full scale deflection.

Completely segregate all instruments in instrument compartments. Panel mount meters on front of instrument compartment.

2160A ELECTRICAL RECORDING INSTRUMENTS:

Provide electrical recording instruments.

Standard - BS EN 61143.

2170A INDICATOR LIGHTS:

Supply lamps of same type throughout. Provide indicator lamps with lamp test facility.

Lamps

Supply interchangeable indicators for respective units.

Protect wiring to indicator lamp units by separate cartridge fuses.

Lens Colour in accordance with BS EN 60073.

2180 LOW VOLTAGE COILS RATING:

Ensure coils for switching relays, contactors and other applications are capable of withstanding inherent voltage drop within system without armature or switching apparatus dropping out of

position.

2190A FRAMEWORK:

Construct framework for supporting electrical equipment from mild steel plate and strip, cold and hot rolled steel sections or slotted angles, in accordance with BS EN 10210 and BS 4345 respectively. Comply with BS EN 1011-2 for metal arc welding.

Finish

Frameworks mounted inside building manufacturer's standard finish.

Frameworks mounted outside building hot dip galvanized to BS EN ISO 1461.

Supply cadmium or zinc electroplated bolts, nuts, washers and screws.

2200A FUSES:

Supply cartridge fuse links including fuse carrier, bases and associated components that comply with BS EN 60269 (BS 88), fusing factor category gG, unless otherwise indicated.

2210A DISTRIBUTION BOARDS:

Comply with BS EN 60439-3 as appropriate. Make internal separation Form 1 unless otherwise indicated. Make fuse boards fully shrouded. Fit each distribution board with an isolating switch. Install busbars in same position relative to their fuse carriers or miniature circuit-breakers (MCBs) for each pole. In TPN distribution boards supply neutral busbars with one outgoing terminal for each outgoing circuit.

Provide a multi-terminal earth bar for circuit protective conductors for both insulated and metal-cased boards, with one terminal for each outgoing circuit. Connect directly to earth terminal without dependence on exposed conductive parts of enclosure.

Identify each fuseway and MCB way by numbering. Identify each terminal on neutral busbar and earthing bar with its respective fuseway or MCB way.

Where specific ratings are indicated incorporate fuses or MCBs, otherwise leave ways blank for future additions.

Enclosures finish

Finish - Manufacturer's standard.

Colour - Manufacturer's standard colour.

2230A MINIATURE CIRCUIT BREAKERS:

Standard - BS EN 60898-1.

Supply miniature circuit-breakers with voltage and current ratings, type according to instantaneous tripping current, energy limiting class, category of duty and frequency in

accordance with BS EN 60898-1.

2240A RESIDUAL CURRENT DEVICE:

Comply with BS EN 61008. Supply residual current devices (RCCDs) with rated voltage, rated current, rated tripping current, rated tripping time and rated breaking capacity as indicated.

DC component

Ensure dc component does not affect operation.

Overcurrent protection

Fit RCDs with integral overcurrent protection.

2250 CABLE TERMINATIONS:

Ensure that switchgear and distribution boards are provided with facilities to terminate size, number and type of cable indicated. Where necessary use fabricated steel extension boxes for glanding large and multiple cables.

Provide non-ferrous metal glanding plates for single core cable terminations.

2280A HARMONIC FILTER:

Unit - Filter conditioning to meet G5/4.

Mounting - Floor mounting. Built-in type.

Cubicle

Incorporating IGBTs, capacitors, reactors, block contactors and control gear.

Cable termination chamber

Mount cable termination chamber on side of cubicle with access through removable plates.

3010 FIXING:

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

3020 MOUNTING HEIGHT:

Mount single items of equipment 1450mm above finished floor level to centre of equipment, unless otherwise indicated.

Arrange groups of equipment, other than floor mounted assemblies, so that all parts of equipment requiring access for operation or maintenance are at least 500mm and no more than

2000mm above finished floor level, unless otherwise indicated.

3030 ACCESS:

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

3040A MARKING AND DRAWING:

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

3050 CABLE TERMINATIONS:

Terminate paper-insulated cable by means of switchboard manufacturer's standard compound filled cable boxes.

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

3060A INSTALLATION AND COMMISSIONING:

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

Y71.1010Y CO-ORDINATION STUDY:

Carry out a complete protection grading and setting calculation of the complete electrical distribution system, including all connected equipment. Engage an independent Chartered Electrical Engineer to:

Authenticate the calculation.

Provide fault (short circuit) calculations for the distribution system as indicated on the drawings and a protective device co-ordination study to ensure that all protective devices are co-ordinated. Base the study on the actual devices and cable lengths installed.

Prepare the fault calculations and protective device study with a network analyser, digital computer or by written calculations, include complete fault calculations for each proposed

source and combinations thereof including motor and generator contributions.

Present the fault calculations including the following:

General description of calculations methods, assumptions and base per unit quantities selected.

One line diagrams, source impedance data including X/R ratio and source system characteristics.

Impedance diagrams, typical calculations, tabulations of calculation quantities and results, conclusions and recommendations.

Calculation of three phase symmetrical fault currents at each switchboard, motor control centre and distribution board.

Calculation of earth fault currents including the associated zero sequence impedance diagram.

Tabulations which include fault impedance, X/R ratios, asymmetry factors, motor contributions,

Carry out the protective device co-ordination study including the following:

Time-current co-ordination curves graphically indicating the proposed co-ordination for the system on log-log graph transparencies. Include on each sheet, a complete title and one line diagram identifying the specific portion of the system covered.

A detailed description of each protective device identifying its type, function, manufacturer and time current characteristics and tabulation of recommended settings.

Include on the curve sheets, system HV equipment relay characteristics, pertinent transformer, motor and generator characteristics including up to the largest outgoing LV circuit breaker/fuse for each distribution board. Indicate manufacturing tolerances clearly showing the final grading

margin.

Submit the calculation:

As a bound report for approval by the CA Semple & McKillop Ltd.

Upon approval by the CA, submit copies of the approved report

Carry out adjustments of the protection settings to conform with the requirements of the report.

Ensure that discrimination is achieved throughout the network and select protective devices and settings accordingly.

Y71.1020Y ELECTRICITY SUPPLY:

Ensure all electrical equipment supplied and installed is suitable for power supply indicated to BS 7697.

Y71.2040Y TYPE TESTS:

- Provide certificates of verification of
 - temperature rise limits.
 - dielectric properties.
 - short-circuit strength to BS EN 60439.
 - continuity of protective circuit.
 - clearances and creepage distances.
 - mechanical operation.
 - degree of protection.
- Temperature rise limits

Y71.2050Y ROUTINE TEST:

- Carry out test on-site.
- Repeat test on-site.

Y72 CONTACTORS AND STARTERS

1000 GENERAL

1010A 3 PHASE SUPPLY:

Ensure all electrical equipment supplied and installed is suitable for 3 phase power supply to BS 7697.

1010B SINGLE PHASE ELECTRICAL SUPPLY:

Ensure all electrical equipment supplied and installed is suitable for single phase power supply to BS 7697.

1020A MANUFACTURER FITTED SURGE SUPPRESSORS:

Supply surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts. Fitted by Manufacturer.

1020B INSTALLER FITTED SURGE SUPPRESSORS:

Supply surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts. Fitted by installer.

1030A MANUFACTURER FITTED TRANSIENT SUPPRESSORS:

Supply transient suppressors in the form of resistor and capacitor networks across the starter contactor coils. Fitted by Manufacturer.

1030B INSTALLER FITTED TRANSIENT SUPPRESSORS:

Supply transient suppressors in the form of resistor and capacitor networks across the starter

contactor coils. Fitted by installer.

2010A CONTROLGEAR ASSEMBLY:

Standard - BS EN 60439-1.

External design - Cubicle type assembly.

Usage - Control panel, motor control centre or single starter enclosure.

Conditions of installation - Indoors.

Electrical characteristics

Rated operational voltage, 400 V. Rated short-time withstand current, 20 times rated current.

Service conditions - Ambient air temperature and altitude as BS EN 60439.

2020A ASSEMBLY CONSTRUCTION:

Enclosure standard - BS EN 62208.

Material of enclosure - Manufacturer's standard.

Terminals for external conductors, main power circuits

Accommodate cross-sectional area of copper cables in accordance with BS EN 60439-1, Appendix A.

Terminals for external conductor, control and auxiliary circuits

Terminal block. Mounting - top hat rails (35mm) to BS 5584 (EN 50022).

Size of neutrals on three phase supplies

Full current-carrying capacity of phase conductor.

Degree of protection to BS EN 60529

IP 31 for units installed inside buildings excluding boiler rooms and pump rooms.

IP 55 for units installed in boiler rooms, pump rooms and outside buildings.

Protection against direct and indirect contact as Manufacturer's standard.

Accessibility for inspection

Arrange for following operations to be performed when assembly is in service and under voltage.

Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.

Adjusting and re-setting of relays, releases and electronic devices.

Replacement of fuse links and indicating lamps.

Fault location by voltage and current measuring.

Accessibility for maintenance

Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.

Use barrier protected sub-sections for each functional unit or group.

Use compartments for each functional unit or group.

Removable parts and withdrawable parts

Degree of protection of assembly after removal or withdrawal of part as manufacturer's

standard.

Internal separation - Manufacturer's standard.

Input voltage variations for electronic equipment supply - BS EN 60439, Section 7.9.1.

Supply frequency deviation - BS EN 60439, Section 7.9.4.

Mounting - Floor standing or wall mounted.

2030A ENCLOSURE FINISH:

Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.

Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.

Finish - Manufacturer's standard.

Colour - Manufacturer's standard colour.

2040 SITE MODIFICATION:

Do not make site alterations unless authorised. Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with type test certificate obtained for arrangement of components.

2050A EIGHT HOURLY LV CONTACTORS AND MOTOR STARTERS:

Standard - BS EN 60947-4-1 or BS EN 60947-4-2.

Type of equipment - A.C. mechanical contactor. Interrupting medium air.

Operating condition.

Method of operation - Electromagnetic.

Method of control - Automatic. rated and limiting values for the main circuit.

Rated voltage (Volts) - Operational, 400.

Rated duty - Eight-hour.

Operational performance.

One rotation direction, with motor stopping between operations.

Control circuits

Electrical - ac; rated frequency (Hertz), 50; rated voltage (Volts), 230.

Co-ordination with short-circuit protective devices - Type 1

Enclosure degree of protection to BS EN 60529, IP 31.

Minimum mechanical and electrical endurance

Mechanical 0.3 million; electrical 15,000.

Provide mechanical and electrical interlocks to prevent simultaneous closure of paired

contactors.

2050B UNINTERRUPTED LV CONTACTORS AND MOTOR STARTERS:

Standard - BS EN 60947-4-1 or BS EN 60947-4-2.

Type of equipment - A.C. mechanical contactor. Interrupting medium air.

Operating condition.

Method of operation - Electromagnetic.

Method of control - Automatic.

Rated and limiting values for the main circuit.

Rated voltage (Volts) - Operational, 400.

Rated duty - Uninterrupted.

Operational performance.

One rotation direction, with motor stopping between operations.

Control circuits

Electrical - ac; rated frequency (Hertz), 50; rated voltage (Volts), 230.

Co-ordination with short-circuit protective devices - Type1

Enclosure degree of protection to BS EN 60529, IP 31.

Minimum mechanical and electrical endurance

Mechanical 0.3 million; electrical 15,000.

Provide mechanical and electrical interlocks to prevent simultaneous closure of paired contactors.

2050C CONTINUOUS LV CONTACTORS AND MOTOR STARTERS:

Standard - BS EN 60947-4-1 or BS EN 60947-4-2.

Type of equipment - A.C. mechanical contactor. Interrupting medium air.

Operating condition.

Method of operation - Electromagnetic.

Method of control - Automatic.

Rated and limiting values for the main circuit.

Rated voltage (Volts) - Operational, 400.

Rated duty - Continuous.

Operational performance.

One rotation direction, with motor stopping between operations.

Control circuits

Electrical - ac; rated frequency (Hertz), 50; rated voltage (Volts), 230.

Co-ordination with short-circuit protective devices - Type1

Enclosure degree of protection to BS EN 60529, IP 31.

Minimum mechanical and electrical endurance

Mechanical 0.3 million; electrical 15,000.

Provide mechanical and electrical interlocks to prevent simultaneous closure of paired

contactors.

2060A CONTROL CIRCUIT DEVICES:

Standard - BS EN 60947-5-1

Type of equipment.

a.c. control circuit device

Manual control switches; emergency stop; control relays; pilot switches; position switches; associated equipment; auxiliary contacts and indicating lamps.

Interrupting medium, Air.

Operating condition.

Method of operation - electromagnetic.

Method of control - automatic.

Rated and limiting values for the main circuit.

Rated voltage (Volts) - operational, 230.

Rated frequency (Hertz), 50.

Contact element classification.

Enclosure degree of protection IP 31.

2070A ISOLATING SWITCHES:

Standard - BS EN 60947-3.

Provide independent manual operation type isolating switches with rated duty, rated operational current and utilization category compatible with contactor.

2080A CONTROL SELECTOR SWITCHES:

Standard - BS EN 60947-5-1

Provide panel mounting independent manual operation rotary type switch to select local/off/remote control.

Ensure switch rated thermal current, rated operational current, and utilization category are compatible with contactor control circuit characteristics and circuit protection device.

2090A IN-BUILT PUSH BUTTONS:

Provide panel mounting type push buttons with actuator colours to BS EN 60073.

Standard- BS EN 60947-5-1.

Pattern

Supply flush button type start/on and reset push buttons. Supply mushroom actuator type stop/off push buttons released by turning the actuator.

Ensure rated thermal current, rated operational current and utilization category of push button contacts are compatible with contactor control circuit characteristics and circuit protection

device.

2100A INDICATOR LIGHTS:

Supply lamps of same type throughout. Provide indicator lamps with lamp test facility.

Standard - BS EN 842 and BS EN 60947-5-1.

Details

Supply interchangeable indicators for respective units. Provide neon indicators. Provide 230V indicator circuits and lamps.

Protect wiring to indicator lamp units by separate cartridge fuses.

Lens colour - In accordance with BS EN 60073.

2110A CONTACTOR CONTROL RELAYS:

Standard BS EN 60947-5-1, install relays in contactor enclosure.

Relay enclosure protection to BS EN 60529

Compatible with contactor enclosure.

2120A CONTROL AND INDICATOR LIGHT CIRCUIT FUSES:

Provide in contactor enclosure separate low voltage fuse bases, fuse carriers and cartridge fuses for protection of control circuits and indicator light circuits.

Fuses

Fully shrouded impact resistant moulded plastic fuse bases and carriers in accordance with BS EN 60269 (BS 88).

2130A MOTOR STARTERS - MOTORS BELOW 0.37 KW:

Provide fuses or circuit breakers for motors below 0.37 kW.

2130B MOTOR STARTERS - MOTORS OF 0.37KW AND ABOVE:

Provide starters incorporating overcurrent protection for motors of 0.37kW and above.

Provide starter with manual reset, adjustable, inverse time delay, and ambient temperature compensated thermal overcurrent release to BS EN 60947-4-1. Ensure overcurrent release is compatible with starting, accelerating and running characteristics of motor, starter and driven

machine combination. Use phase unbalance protection on three phase equipment.

2150 DIRECT-ON-LINE MOTOR STARTERS:

Use direct-on-line starter to BS EN 60947-4-1, with single phase motors and three phase motors.

2160 STAR DELTA MOTOR STARTERS:

Use star delta starter to BS EN 60947-4-1 with three phase motors.

Incorporate adjustable time delay contactor relays, to control star delta changeover, ensuring electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

2200 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY - SINGLE POWER SUPPLY:

Fit a control switch to starter enclosure arranged to select either motor for "run" or "standby" duty. Indicate selection of respective motor by illumination of indicator lights on starter enclosure.

Provide facilities for connection of remote indicator lights to indicate selection/operation of system and for connection of a system malfunction audible alarm where indicated.

Arrange for selected "run" duty motor to operate in response to system controls, and in event of operation of duty motor starter overcurrent trip, for automatic changeover to "standby" motor.

Control power supply to starter by an air break isolating switch interlocked with starter enclosure access door.

2210 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY - DUAL POWER SUPPLY:

Fit a control switch to starter enclosure arranged to select either motor for "run" or "standby" duty.

Indicate selection of respective motor and availability of the two power supplies by illumination of indicator lights on starter enclosure.

Provide facilities for connection of remote indicator lights to indicate selection/operation of system and for connection of a system malfunction audible alarm where indicated.

Arrange for selected "run" duty motor to operate in response to system controls, and on loss of power supply to "run" duty motor or operation of motor starter overcurrent trip, for automatic changeover to "standby" motor.

Control the two power supplies by a single air break multiple isolating switch interlocked with

starter enclosure access door.

2220 CONTROL CIRCUIT TRANSFORMERS:

Provide control circuit transformers to supply power at voltages to suit control components.

Standard

Use transformers in accordance with BS EN 61558-2-9 or BS EN 61558-1 and provide an external label of approved type and size.

Protection - Primary and secondary fuses.

2230A SWITCHING AND INDICATION:

Provide switches, indicating lamps, instruments and controls of uniform appearance and physically protected.

Switches and indicators

Fit on panel or access doors Stop/Start/Reset push buttons; Auto/Off/Manual control selector switch; run and trip indicator lights.

2240 AUDIBLE ALARMS:

Ensure that operation of any starter trip lamp, safety circuit lamp or alarm lamp operates a common audible alarm with mute and test facilities and terminals for remote alarm signal.

When an alarm condition has had the audible alarm muted, ensure that terminals for a remote "alarm accepted" light are energised. The audible alarm circuit and terminals for remote alarm signal must still be capable of indicating another fault occurring even though original fault has not been cleared. The test facilities are to test momentarily both the audible alarm and all alarm indicator lamps, whilst the push button is depressed.

Use alarms that interface with a sensor or controller to sense set-point and measured value.

Provide adjustable upper and lower limits on face of unit. Provide unit with indicating lamps to show which limit has been exceeded. Provide each unit with connections for remote alarm.

2250A PROGRAMMABLE LOGIC CONTROLLERS:

Provide programmable logic controllers in accordance with the manufacturer's recommendations and the specified control requirements.

Standard - BS EN 61131.

Provide fuse and isolator for the Programmable Logic Controller. Install PLC with control

components.

Programming language standard - BS EN 61131-3

2260A STARTER AND CONTROL PANEL INTERNAL WIRING:

Standard - BS 6231.

Wiring coding - Random colours and CPC green/yellow.

Control wiring

Segregate control wiring from power circuits. Contain control wiring in ventilated plastic trunking. Identify each end of each wire with a unique number.

Power wiring

Take account of thermal effects of grouping when routing power wiring. Identify each end of each wire with a unique number.

2270A COMPONENT MOUNTING:

Mount all components of the switchgear and control gear in accordance with the manufacturer's instructions.

Mount control components on top hat rails (35mm) to BS 5584 (EN 50022).

2280A CONTROL SYSTEM FUNCTION CHARTS:

Prepare function charts for the control system in accordance with BS EN 60848. Obtain approval of function chart before design of system hardware or writing control software.

Function chart format - Combined function chart/circuit diagram.

3010 INSTALLATION:

Install control panels, motor control centres, contactors and starters in accordance with BS EN 60947 and manufacturer's recommendations.

Y73 LUMINAIRES AND LAMPS

1000 GENERAL

2010A LUMINAIRES - GENERAL PURPOSE:

Standards

Supply luminaires with photometric data in accordance with BS EN 13032-1.

Supply luminaires in accordance with BS EN 60598).

Classification - To BS EN 60598-1.

Safety Support for Components

Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.

Photometric performance

Ensure luminaires of similar type have same photometric performance as published data within the tolerances defined by BS EN 13032-1.

Electromagnetic compatibility

Ensure luminaires comply with BS EN 61547 for EMC immunity.

2010B LUMINAIRES - GENERAL PURPOSE WITH SAFETY GLASS:

Standards

Supply luminaires with photometric data in accordance with BS EN 13032-1.

Supply luminaires in accordance with BS EN 60598).

Classification - To BS EN 60598-1.

Safety

Fit luminaire with cover glass to protect against ultra-violet emission and risk from explosion of lamps.

Safety Support for Components

Provide secondary support for translucent covers, diffusers and gear trays so they are prevented from falling when their primary fixing is released.

Photometric performance

Ensure luminaires of similar type have same photometric performance as published data within

the tolerances defined by BS EN 13032-1.

Electromagnetic compatibility

Ensure luminaires comply with BS EN 61547 for EMC immunity.

2010C LUMINAIRES - SPECIAL APPLICATIONS:

Standards

Supply luminaires with photometric data in accordance with BS EN 13032-1.

Supply luminaires in accordance with BS EN 60598).

Classification - To BS EN 60598-1.

Electromagnetic compatibility

Ensure luminaires comply with BS EN 61547 for EMC immunity.

2020A EMERGENCY LIGHTING LUMINAIRES:

Comply with BS EN 60598-2-22.

Comply with ICEL:1001. Ensure emergency lighting luminaires are marked with ICEL certification

label.

2040A HAZARDOUS AREA LUMINAIRES:

BS EN 60079-15 or BS EN 60079-25 as appropriate.

2060A LAMPHOLDERS - GENERALLY:

Lamp caps - BS EN 60061-1.

Lamp holders - BS EN 60061-2.

Lamp holders with enhanced safety features - BS 7895.

Bayonet lamp holders - BS EN 61184.

Lamp holders for tubular fluorescent lamps and starter holders - BS EN 60400.

Edison screw lamp holders - BS EN 60238.

Interchangeability

Ensure lamp holders in luminaires of similar type and rating are identical.

Earthing

Ensure metal lamp holders incorporate an earth terminal.

2070 LAMPHOLDERS - TUNGSTEN FITTINGS:

Use following lamp holders for tungsten filament lamps unless indicated otherwise.

Lamp	Lamp holder
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up to 150 W	bayonet B22d
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200 W edison screw E27 2A	
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300 W edison screw 16A	
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Shade rings

Provide a shade carrier ring for separately mounted lamp holders for GLS tungsten filament

lamps.

Polarity of Edison Screw Lamp holders

Ensure phase conductor is connected to centre contact.

2080A LAMPHOLDERS - MOUNTING:

Securely mount lamp holder in luminaire when it is sole support for lamp.

Cord grip

Provide integral cord grip type when lamp holders are suspended by cord.

Conduit Mounted

When mounted directly to conduit system use back plate lamp holder for conduit box.

2090A CONTROL GEAR AND COMPONENTS:

Compatibility

Ensure control gear and components are suitable for lamp type, wattage and starting characteristics. Obtain from manufacturers written confirmation of compatibility.

2100A FLUORESCENT LAMP BALLASTS AND STARTERS:

Ballasts

BS EN 61347-2-8 and BS EN 60921.

BS EN 61347-2-3, BS EN 61347-2-7 and BS EN 60925 for d.c.supplied electronic ballasts.

BS EN 60081 and BS EN 60901.

Supply thermal protectors for ballasts for tubular fluorescent lamps to BS EN 60730-2-3.

Starters - BS EN 61347-2-1 and BS EN 60927.

Use low distortion type.

2110A DISCHARGE LAMP BALLASTS AND STARTERS:

Ballasts - BS EN 61347-2-9 and BS EN 60923.

Starters - BS EN 61347-2-1 and BS EN 60927.

2120A CAPACITORS:

Use capacitors in accordance with BS EN 61048 and BS EN 61049 in tubular fluorescent, high pressure mercury and low pressure sodium vapour discharge lamp circuits.

2130 SUPPLY TERMINALS:

Use screw terminals for supply cables and circuit protective conductors, sized to terminate up to three 2.5mm² conductors. Provide separate terminal blocks for each incoming circuit, with

marking to identify each circuit.

2140 FUSE:

Include a fuse holder and BS 1362 fuse in each incoming circuit phase connection.

2160 REMOTE GEAR:

Locate control gear in separate lockable cabinet of sheet steel with same degree of protection and finish specified for luminaire. Comply with manufacturer's recommendations for maximum cable length between gear and lamp.

2165 TYPES OF HIGH EFFICIENCY LAMP FOR NON-DAYLIT AREAS:

Light Source	Type
High pressure sodium	All ratings above 70W
Metal halide	All ratings above 70W
Tubular fluorescent	All 26mm diameter (T) lamps and 16mm (T5) lamps rated above 11W, provided with low loss or high frequency control gear. 38mm diameter (T12) linear fluorescent lamps 2400mm in length
Compact fluorescent	All ratings above 26W

2170A TUNGSTEN FILAMENT LAMPS:

Comply with BS EN 60064, BS EN 60432-1 and BS EN 60630. Supply electronic step-down converters for filament lamps to BS EN 61047 and BS EN 61347-2-2. Comply with BS EN 61549

for double capped and ELV lamps.

2180A FLUORESCENT LAMPS:

Internationally specified tubular fluorescent lamps to BS EN 60081.

UK tubular fluorescent lamps to BS 1853-2.

Single capped fluorescent lamps to BS EN 60901 and BS EN 61199.

Double capped fluorescent lamps to BS EN 60081 and BS EN 61195.

Self ballasted lamps to BS EN 60968.

2185A TUNGSTEN HALOGEN LAMPS:

Comply with BS EN 60432-2 or BS EN 60357.

2190 HIGH PRESSURE MERCURY VAPOUR LAMPS:

Comply with BS EN 60188 and BS EN 62035.

2215A LED LAMPS:

Comply with BS EN 62031, DD IEC/PAS 62612, BS EN 62386-207 and BS EN 61347-2-13.

2240A SUPPORT SYSTEM - CONDUIT:

Use not less than 20mm conduit of same type as main conduit system.

Material - steel.

2250A SUPPORT SYSTEM - ROD:

Use continuously threaded rods with matching washers and nuts.

Diameter - 6mm.

Material - Cadmium plated steel.

2260A SUPPORT SYSTEM - CHAIN:

Use cadmium plated steel chain with load carrying capacity of not less than twice weight of complete luminaire.

2270A SUPPORT SYSTEM - FLEXIBLE CORD:

Use size and type as indicated.

Confirm temperature rating is suitable for operating temperature of luminaire or lampholder.

Confirm that cord is adequate for mass to be supported.

~~2280# SUPPORT SYSTEM - WALL BRACKETS:~~

2280A SUPPORT SYSTEM - WALL BRACKETS:

Provide wall brackets. Confirm wall brackets are suitable for supporting luminaire.

2295 SUPPORT SYSTEM - WIRE ROPE:

Provide wire rope support system. Confirm wire rope is suitable for supporting luminaires.

2300A STEEL COLUMNS AND BOLLARDS:

Standards - BS EN 40-2 and BS EN 40-5.

Material - Steel.

Bracket - Match column.

Earthing

Include earthing terminal fixed within service compartment.

Column base plate - Standard.

2300C ALUMINIUM COLUMNS AND BOLLARDS:

Standards - BS EN 40-2 and BS EN 40-6.

Material - Aluminium.

Bracket - Match column.

Earthing

Include earthing terminal fixed within service compartment.

Column base plate - Standard.

3010A TRACK LIGHTING:

Where indicated provide track for fixing fittings in accordance with BS EN 60570.

4060 MATERIAL OF SUPPORTING SURFACE:

Ensure classification of luminaires is appropriate. Do not mount luminaires on readily flammable surfaces.

4080 LUMINAIRES IN AREAS WITH INFRA-RED CONTROL SYSTEM:

Install luminaires in areas with infra-red control systems or data bearers so as to cause

minimum disturbance to the infra-red transmission system in accordance with BS 7693.

4100 INSTALLATION OF EXTRA LOW VOLTAGE TUNGSTEN HALOGEN LAMPS:

Use same wattage lamp on luminaires fed from common transformer. Supply each luminaire on common transformer by separate cable of same cross-sectional area.

4110 SUPPORT

Ensure support is adequate for weight of luminaires.

Number

- Provide the following minimum number of supports for each luminaire longer than 600mm.

Luminaire width (mm)	Minimum number of supports
Up to and including 300	2
Over 300	4

-

4120 SUPPORT FROM CONDUIT:

Where luminaire is supported from conduit provide a conduit box forming an integral part of conduit system at each point of suspension. Ensure suspensions are vertical.

Where conduit enters luminaire use back-nuts and washers to secure luminaire body to conduit support. Provide tube with corrosion resistance equal to conduit system.

Do not support luminaires directly from conduit boxes made from non-metal or heat sensitive materials, where the temperature of the material may exceed 60°C or the mass suspended exceeds 3kg.

4130 SUPPORT FROM TRUNKING:

Where luminaire is supported from trunking use proprietary clamps or brackets appropriate to the luminaire and trunking.

Do not support luminaires directly from trunking made from non-metal or heat sensitive materials, where the temperature of the material may exceed 60°C or the mass suspended

exceeds 3kg.

4140A SUPPORT BY DIRECT FIXING:

Refer to fixing methods, use luminaire supporting coupler to follow manufacturer's recommendations.

~~4150# SUPPORT IN SUSPENDED CEILING:~~

4160 SUSPENSION:

Suspend luminaires at height indicated. Ensure suspensions hang vertically unless otherwise indicated.

4170 SUSPENSION BY ROD:

Use washers, nut and lock-nut at top and bottom of rod. Paint cut ends with calcium plumbate primer or zinc rich paint.

4180 SUSPENSION BY CHAIN:

Use hook cover for suspension from circular conduit box. For connection to luminaires use luminaire manufacturer's own chain hook, but if not available use hook with standard screw threaded body to be secured to luminaire body with nuts and washers. Where indicated use captive hooks.

4210A COLUMNS AND BOLLARDS:

Location - Confirm location before excavation.

Bases - Install bases in accordance with bollard or column manufacturer's instructions.

Mounting

Mount column or bollard on base as recommended by manufacturer.

Ensure columns and bollards are vertical unless otherwise indicated.

Earthing

Install circuit protective conductor to connect luminaire to earthing terminal in service compartment; size circuit protective conductor same as live conductors. Bond accessible metal

parts of column or bollard to earthing terminal.

4220 CONNECTIONS TO LUMINAIRES

Cable Protection

Use appropriate size of grommet where cables enter through hole in luminaire body.

Earthing

Ensure that the earthing terminal of Class 1 luminaires is connected to the conduit protective conductor of the supply circuit.

Loose Wiring

Clip or tie back with suitable proprietary devices loose wiring within luminaire, at 300mm intervals.

4230A CONNECTIONS TO LUMINAIRES - DIRECT TO CONDUIT - TERMINAL BOX:

Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cord from terminal block to luminaire.

4230B CONNECTIONS TO LUMINAIRES - DIRECT TO CONDUIT - AT LUMINAIRE:

Terminate circuit wiring at supply terminals of luminaire. Take all conductors through same cable entry into luminaire.

4240A CONNECTIONS TO LUMINAIRES - DIRECT TO TRUNKING - TERMINAL BOX:

Terminate circuit wiring in terminal block in an adaptable box located on side of trunking. Use flexible cord from terminal block to luminaire.

4240B CONNECTIONS TO LUMINAIRES - DIRECT TO TRUNKING - AT LUMINAIRE:

Terminate circuit wiring at supply terminals of luminaire. Take all conductors through same cable entry into luminaire.

4250 CONNECTIONS TO LUMINAIRES - SUSPENDED FROM TRUNKING:

Where luminaires are suspended from trunking, secure plug and socket to BS 546, adjacent to, or on side of, trunking. Terminate circuit wiring at socket. Take flexible cord from plug of ceiling rose to supply terminals of luminaire.

4260A CONNECTIONS TO LUMINAIRES - RECESSED FITTINGS - PLUG AND SOCKET:

Where luminaires are recessed in a suspended ceiling, terminate circuit wiring at plug and socket to BS 546, located not more than 500mm from the access through the ceiling. Use

flexible cord from plug of ceiling rose to supply terminals of luminaire.

4270 CONNECTIONS TO LUMINAIRES - CONDUIT SUSPENSION:

Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cable from terminal block to luminaire, installed within tube.

4280 CONNECTIONS TO LUMINAIRES - ROD OR CHAIN SUSPENSION:

Terminate circuit wiring in terminal block within supporting conduit box. Use flexible cord from terminal block to luminaire and clip cable to one of the rods or chains, do not weave cable through links of the chain.

4290 CONNECTIONS TO LUMINAIRES - MICS CABLE:

Fix cable gland to luminaire and continue conductors to supply terminals of luminaire.

4300A SEPARATE LIGHTING SWITCHES ON DIFFERENT PHASES:

Install lighting switches on different phases at least 2m apart.

4300B PHASE BARRIER LIGHTING SWITCHES ON DIFFERENT PHASES:

When lighting switches on different phases are in a common box, use phase barrier switches in accordance with BS 7671.

Y73.4040Y INSTALLATION OF SEMI-RECESSED FITTINGS:

- Install luminaires as manufacturer's detail.

Y74 ACCESSORIES FOR ELECTRICAL SERVICES

2010A ACCESSORIES COMMON REQUIREMENTS - WHITE PLASTIC PLATES GRID, FLUSH INSTALLATION:

Area of installation - Interior.

Enclosure pattern - Flush.

Accessory mounting

Adjustable steel grid for grid switches or direct to enclosure for all other accessories.

Enclosure material- Pressed steel.

Enclosure finish - Galvanized.

Cover plate finish, all accessories to match

Moulded plastic, colour - white.

Cover plate pattern - Overlapping; with architrave where indicated.

Ancillaries

Earthing terminal integral within switch box.

Neon indicator with red lens, illuminated in "ON" position, for connection units.

Switch rocker bar colour - white.

Operating keys for key operated switches, minimum number 2.

Fuses to BS 1362.

Blank inserts for spare ways on grid switches.

Marking

Method - engraving. Mark front plate to indicate equipment served on connection units.

Conduit and cable entries

Knockouts side, top and rear.

Cable termination - Manufacturer's standard.

2010B ACCESSORIES COMMON REQUIREMENTS - MATT CHROME FINISH METAL PLATES, FLUSH

INSTALLATION:

Area of installation - Interior.

Enclosure pattern - Flush.

Accessory mounting

Adjustable steel grid for grid switches or direct to enclosure for all other accessories.

Enclosure material - Pressed steel.

Enclosure finish - Galvanized.

Cover plate finish, all accessories to match

Brass with matt chrome surface.

Cover plate pattern - Overlapping; with architrave where indicated.

Ancillaries

Earthing terminal integral within switch box.

Neon indicator with red lens, illuminated in "ON" position, for connection units.

Switch rocker bar colour as indicated.

Operating keys for key operated switches, minimum number 2.

Fuses to BS 1362.

Blank inserts for spare ways on grid switches.

Marking

Method - engraving. Mark front plate to indicate equipment served on connection units.

Conduit and cable entries

Knockouts side, top and rear.

Cable termination - Manufacturer's standard.

2010D ACCESSORIES COMMON REQUIREMENTS - METAL CLAD PLATES, SURFACE STEEL

CONDUIT INSTALLATION:

Area of installation - Interior.

Enclosure pattern - Surface.

Accessory mounting - Direct to enclosure.

Enclosure material

Pressed steel or cast iron.

Enclosure finish

As conduit system or galvanized.

Cover plate finish, all accessories to match

Metal clad.

Cover plate pattern - Surface type.

Ancillaries

Earthing terminal integral within switch box.

Neon indicator with red lens, illuminated in "ON" position, for connection units.

Switch rocker bar colour as indicated.

Operating keys for key operated switches, minimum number 2.

Fuses to BS 1362.

Marking

Method - engraving. Mark front plate to indicate equipment served on connection units.

Conduit and cable entries

Threaded entries, top, bottom or side to suit conduit system.

Cable termination - Manufacturer's standard.

2010E ACCESSORIES COMMON REQUIREMENTS - SURFACE, STEEL CONDUIT, WEATHERPROOF

INSTALLATION:

Area of installation - Exterior.

Enclosure pattern - Surface and weatherproof.

Accessory mounting - Direct to enclosure.

Enclosure material - Cast iron.

Enclosure finish - As conduit system or galvanized.

Cover plate finish, all accessories to match

As enclosure.

Cover plate pattern - Surface type.

Ancillaries

Earthing terminal integral within switch box.

Neon indicator with red lens, illuminated in "ON" position, for connection units.

Screwed weathering cap and chain for socket outlets.

Operating keys for key operated switches, minimum number 2.

Fuses to BS 1362.

Marking

Method - engraving. Mark front plate to indicate equipment served on connection units.

Conduit and cable entries

Threaded entries, top, bottom or side to suit conduit system.

Cable termination - Manufacturer's standard.

2010F ACCESSORIES COMMON REQUIREMENTS - SURFACE, PLASTIC, WEATHERPROOF

INSTALLATION:

Area of installation - Exterior.

Enclosure degree of protection to BS EN 60529, IP 54.

Enclosure pattern - Surface and weatherproof.

Accessory mounting - Direct to enclosure.

Enclosure material - Impact resistant plastic.

Enclosure finish - Natural or self coloured.

Coverplate finish, all accessories to match

Moulded plastic, colour as indicated.

Coverplate pattern - Surface type.

Ancillaries

Earthing terminal integral within switch box.

Neon indicator with red lens, illuminated in "ON" position, for connection units.

Protective shrouds to rocker bars.

Screwed weathering cap and chain for socket outlets.

Switch rocker bar colour as indicated.

Operating keys for key operated switches, minimum number 2.

Fuses to BS 1362.

Conduit and cable entries

Threaded entries to suit cable/conduit system.

Cable termination - Manufacturer's standard.

2020A INTERIOR LIGHTING SWITCHES - GENERAL PURPOSE MOULDED PLASTIC:

Standard - BS EN 60669-1, enclosure box to BS 4662.

Switch type - Rocker bar - moulded plastic.

Rating - 6A.

Gangs as indicated.

Switch mechanism - Snap action microgap.

Pole configurations

Single pole, double pole, 2 way or intermediate as indicated.

2020B INTERIOR LIGHTING SWITCHES - GRID MOULDED PLASTIC:

Standard - BS EN 60669-1, enclosure box to BS 4662.

Switch type - Rocker bar - moulded plastic.

Rating - 6A.

Switch mechanism - Snap action microgap.

Pole configurations

Single pole, 1 way, 2 way or intermediate as indicated.

2020C INTERIOR LIGHTING SWITCHES - PULL CORD:

Standard - BS EN 60669-1, enclosure box to BS 4662.

Switch type - Cord to BS EN 61058-2-1.

Rating - 6A. Pole configurations - Single pole.

2020D INTERIOR LIGHTING SWITCHES - GENERAL PURPOSE SECRET KEY:

Standard - BS EN 60669-1, enclosure box to BS 4662.

Switch type - Rocker bar - secret key.

Rating - 6A.

Gangs as indicated.

Switch mechanism - Snap action microgap.

Pole configurations - Single pole, double pole, 2 way or intermediate as indicated.

2020E INTERIOR LIGHTING SWITCHES - GENERAL PURPOSE DIMMER:

Standard - BS EN 60669-1, enclosure box to BS 4662.

Switch type - Rocker bar - dimmer.

Rating - 6A.

Gangs as indicated.

Switch mechanism - Snap action microgap.

Pole configurations - Single pole, double pole, 2 way or intermediate as indicated.

2020F INTERIOR LIGHTING SWITCHES - GRID SECRET KEY:

Standard - BS EN 60669-1, enclosure box to BS 4662.

Switch type - Rocker bar - secret key.

Rating - 6A.

Switch mechanism - Snap action microgap.

Pole configurations - Single pole, 1 way, 2 way or intermediate as indicated.

2030A EXTERIOR LIGHTING SWITCHES - METAL CLAD ROTARY:

Standard - BS EN 60669-1, enclosure box to BS 4662.

Switch type - Rotary disc or lever operating through sealing gland.

Rating - 6A.

Gangs as indicated.

Action - Two position.

Pole configurations as indicated.

2030B EXTERIOR LIGHTING SWITCHES - SEALED ROCKER BAR:

Standard - BS EN 60669-1, enclosure box to BS 4662.

Switch type - Rocker bar with sealed in plastic membrane.

Rating - 6A.
Gangs as indicated.
Action - Two position.
Pole configurations as indicated.

2040A TIME SWITCHES - 24 HOUR:

Wire timer and switch circuits to separate terminals.
Standard - BS EN 60730-2-7.
Time switch type - Quartz stabilized solid state 50 hour nickel cadmium battery backup.
Contacts duty - Inductive.
Contacts rating - 15A.
Special programme facilities
Number of 'ON' and 'OFF' operations - 4
Programme repeat cycle - 24 hour.

2040B TIME SWITCHES - 7 DAY:

Wire timer and switch circuits to separate terminals.
Standard - BS EN 60730-2-7.
Time switch type
Quartz stabilized solid state 50 hour nickel cadmium battery backup.
Contacts duty - Inductive.
Contacts rating - 15A.
Special programme facilities
Number of "ON" and "OFF" operations - 4
Programme repeat cycle - 7 day.

2050A LUMINAIRE CONNECTORS - GENERAL AND EMERGENCY LIGHTING:

Rating - 2A.
Connector type
Fixed terminal strip, screw cover and cord grip to BS 67.
Load carrying capacity to match selected luminaire.

2050B LUMINAIRE CONNECTORS - GENERAL LIGHTING:

Rating - 2A.
Connector type
3 pin plug/socket to BS 546.
Load carrying capacity to match selected luminaire.

2050C LUMINAIRE CONNECTORS - CORD GRIP GENERAL AND EMERGENCY LIGHTING:

Rating - 2A.

Connector type

Cord grip type plug/socket and screw on retaining cover to BS 5733 3 pin or 4 pin.

Load carrying capacity to match selected luminaire.

2060A LAMPHOLDERS - BC TYPE:

Standard - BS EN 61184.

Lamp holder type - Bayonet clip - B22.

Fixing - Bracket - straight or angle, or suspension as indicated.

Finish - Manufacturer's standard.

Material - Heat resistant moulded plastic.

Ancillaries

Cord grip, lampshade ring or protective lampshade ring as indicated.

2060B LAMPHOLDERS - ES TYPE:

Standard - BS EN 60238.

Lamp holder type - Edison screw - E27.

Fixing - Bracket - straight or angle, or suspension as indicated.

Finish - Manufacturer's standard.

Material - Heat resistant moulded plastic.

Ancillaries

Cord grip, lampshade ring or protective lampshade ring as indicated.

2070A ISOLATING SWITCHES - BS EN 60669-1:

Provide isolating switches for fixed appliances.

Utilization category as indicated.

Making capacity as indicated.

Standard - BS EN 60669-1, enclosure box to BS 4662.

Switch type - Rocker bar.

Rating as indicated on schedule.

Pole configuration - DP, three pole or TPN as indicated.

2070B ISOLATING SWITCHES - BS EN 60947-3:

Provide isolating switches for fixed appliances.

Utilization category as indicated on schedule.

Making capacity as indicated.

Standard - Enclosure box to BS 4662, BS EN 60947-3.

Switch type - Rocker bar.

Rating as indicated on schedule.

Pole configuration - DP, three pole or TPN as indicated.

2080A FUSE CONNECTION UNITS - SWITCHED:

Standard - BS 1363-4, enclosure box to BS 4662 and switched.

Unit type - Rocker bar - plastic.

Pole configuration - DP.

Ancillaries

Cord outlet or cord grip and fuse as indicated.

2080B FUSE CONNECTION UNITS - UNSWITCHED:

Standard - BS 1363-4, enclosure box to BS 4662 and unswitched.

Pole configuration - DP.

Ancillaries

Cord outlet or cord grip and fuse as indicated.

Lockable fuse carrier.

2090B SOCKET-OUTLETS - SINGLE WITH INTEGRAL RCD, SWITCHED:

Standard - Enclosure box to BS 4662, BS 7288.

Switching - Switched

Switch type - Rocker bar - plastic.

Rating - 13A.

Ancillaries

RCD, BS 7288. Mains failure trip, sensitivity 30mA. Plug tops 25% of number of sockets, fused as

indicated.

Gangs - 1

2090C SOCKET-OUTLETS - DOUBLE SWITCHED:

Standard - 13A socket-outlet to BS 1363, enclosure box to BS 4662.

Switching - Switched

Switch type - Rocker bar - plastic.

Rating - 13A.

Ancillaries

Plug tops 25% of number of sockets, fused as indicated.

Gangs - 2

2090D SOCKET-OUTLETS - SINGLE, UNSWITCHED:

Standard - 13A socket-outlet to BS 1363, enclosure box to BS 4662.

Switching - Unswitched.

Rating - 13A.

Gangs - 1

2100B COOKER CONTROL UNIT - WITHOUT SOCKET:

Standard - BS 4177, enclosure box to BS 4177.

Unit type - With pilot lamp.

Pole configuration - DP.

Rating - 45A.

2110A CORD OUTLETS - COOKER CONNECTION UNIT:

Standard - BS 5733, enclosure box to BS 4662.

Format - Cooker connection.

Rating - 45A

Pole configuration - DP&E.

2120A CABLE AND APPLIANCE COUPLERS - 16A, 240V SINGLE PHASE, GENERAL PURPOSE:

Standard - BS EN 60309-2.

Material - Polycarbonate male and female connectors.

Rating - Voltage 220 - 240V; Current 16A.

Configuration - 2PE.

Colour - 220 - 240V, Blue.

Ancillaries as indicated.

ON/OFF switch; gang combinations 1, 2, 3 and 4; RCD. BS 7288 sensitivity 30mA.

2130A TELEPHONE AND DATA OUTLET SOCKETS - GENERAL PURPOSE:

Standard

For jack socket to telephone service provider requirements and enclosure box to BS 4662.

Size - Standard.

Circuit configurations as indicated.

2140A TELEPHONE CORD OUTLETS - GENERAL PURPOSE:

Standard - BABT approved.

Circuit configurations - Single or twin as indicated.

~~2160# BNC SOCKETS:~~

2160A BNC SOCKETS - GENERAL PURPOSE:

Circuit configurations - Single or twin as indicated.

Impedance - 50 ohm.

Mounting - Insulated.

Ancillaries - Dust caps for sockets.

2170A AERIAL SOCKETS - TV AND DAB AERIALS:

Standard - BS 3041-2.

Circuit configurations - Dual TV and DAB.

Ancillaries

Safety isolation to CAI recommendations for communal aerial systems.

2170B AERIAL SOCKETS - SINGLE TV AERIALS:

Standard - BS 3041-2.

Circuit configurations - Single TV.

Ancillaries

Safety isolation to CAI recommendations for communal aerial systems.

2190A SHAVER POINTS - BATHROOM AND WASHROOM USE:

Provide shaver points, internally switched by plug insertion.

Standard

BS EN 61558-2-9, BS EN 61558-1 and BS EN 61558-2-23, enclosure box to BS 4662.

Rating - 20VA.

Components

Double wound single phase transformer 240/240V and 110V to BS EN 61558-2-9, BS EN 61558-1 and BS EN 61558-2-23.

Internal overload protection.

Marking - Input and output voltages and "SHAVERS ONLY".

2200A INDICATOR LAMPS - GENERAL PURPOSE LED:

Standard BS EN 62094-1.

Lamp - LED.

Lamp rating - 230V supply.

Lens cover - Moulded plastic.

Lens colour - BS EN 60073.

Lens retaining rings - Moulded plastic.

3010 EARTHING:

Ensure metal framework of equipment is bonded to main earth point. Ensure that cable CPC's are connected to earth bar.

Provide earth CPC between earth lug on metal box and accessory casing except where accessory is encased in plastic.

3020 PROTECTION:

Ensure there is no physical or electrical damage to accessories when they are removed from their packaging and during installation.

Provide masking covers for surface mounted accessories to protect surface from paint.

Where accessories are flush mounted install front plate after painting is finished.

3030 FIXING:

Align accessories horizontally and vertically. Where accessories are grouped, mount horizontally in line and parallel to each other and equidistant.

Fix cover plates to boxes with brass fixing screws.

3040 MEASURING MOUNTING HEIGHTS:

Take measurement for position of electrical accessories to the centre line of equipment from either finished floor or worktop. Where specified height coincides with top of tiling, leave a

clear gap of 50mm above tiling.

Mount equipment below a worktop 100mm below underside of worktop.

3050 STANDARD ACCESSORIES MOUNTING HEIGHTS:

Accessory	Location	Height (mm)
Lighting switch		1200
Socket outlet	General	450
	Kitchen	1000
	Above worktop	200
Shaver socket outlet		1000
Fused connection unit	General	450
	Above worktop	200
Fused connection unit controlling	Radiator heater, wall	1800
	Radiator heater, focal point	450
	Tubular heater	450
	Clock	1900
Cooker control unit	Above worktop	200
Cooker connection unit		600
Safety isolating transformer		1200
Room thermostat		1400
Telephone outlet		450
Radio/TV outlet		450
Push button		1200
Fire alarm manual call point		1200
Bell or buzzer		2000
Visible alarm indicator		2000

In car parks and garages comply with appropriate petroleum regulation for mounting heights of

socket outlets.

3070 ACCESSORIES MOUNTING HEIGHTS:

Provide switches and socket outlets for lighting and other equipment in habitable rooms at appropriate heights between 450mm and 1200mm from finished floor level, in accordance with Building Regulations Approved Document M and BS 8300.

Y80 EARTHING AND BONDING

1000 GENERAL

1010 MATERIALS GENERALLY:

Use materials and installations methods in accordance with BS EN 62305, BS 7671, BS 7430, Electricity Safety, Quality and Continuity Regulations and Local Electricity Supply Authority Requirements as appropriate.

2010A CONDUCTORS FOR LIGHTNING PROTECTION SYSTEMS - HORIZONTAL AIR

TERMINATIONS:

Use - Horizontal air termination or down conductor.

Minimum dimension - BS EN 50164-2 Table 1.

Form - Strip.

Material - Copper, annealed.

Coverings - None or PVC.

Accessories - Ridge Saddle; conductor clips - non-metallic; glazing bar holdfast; slate holdfast; back plate holdfast; all accessories sized to suit conductors.

2010B CONDUCTORS FOR LIGHTNING PROTECTION SYSTEMS - SELF SUPPORTING AIR

TERMINATIONS:

Use - Air termination, vertical.

Minimum dimension - BS EN 50164-2 Table 1.

Form - Rod.

Material - Copper, hard drawn.

Coverings - None.

Accessories - Terminal base; ridge saddle; rod brackets; rod to tape coupling.

2010C CONDUCTORS TO EARTHING SYSTEMS TO BS 7430:

Use - Earthing conductor.

Minimum dimension - BS 7430, current density $50\text{A}/\text{mm}^2$.

Form - Strip.

Material - Copper, annealed.

Coverings - None.

Accessories - Conductor clips, metallic.

2020A LIGHTNING PROTECTION CONDUCTOR JOINTS:

First Conductor

Form - strip; material - copper.

Dimensions - To BS EN 50164-2 Table 1 minimum for lightning protection system.

Second conductor

Form - rod; material - copper.

Dimensions - To BS EN 50164-2 Table 1 minimum for lightning protection system.

Solid joint - Brazed or welded, thermic.

Disconnecting test joint

Square clamp, oblong clamp, plate clamp or screw-down clamp.

2020B EARTHING SYSTEMS CONDUCTOR JOINTS:

First Conductor

Form - strip; material - copper.

Dimensions - For conductor current density $50\text{A}/\text{mm}^2$ earthing systems.

Second conductor

Form - rod; material - copper.

Dimensions - For conductor current density $50\text{A}/\text{mm}^2$ earthing systems.

Solid joint - Brazed or welded, thermic.

Disconnecting test joint

Square clamp, oblong clamp, plate clamp or screw-down clamp.

2030A TAPE FIXING DEVICES:

Secure bare conductor tape to structure with fixing devices which avoid piercing tape and ensure 3mm (minimum) clearance of tape from structure, at 450mm maximum, centres.

Material for lightning protection systems

Non-conducting.

Material for system earthing

Bronze.

2040A ROD EARTH ELECTRODES FOR LIGHTNING PROTECTION SYSTEMS:

Standard - BS EN 50164-2. Form - Roll threaded rod.

Dimensions

Rod Diameter - 15 mm - nominal.

Rod Length - 2.4m (2 x 1.2) minimum.

Earth electrode couplings

Use silicon bronze alloy or aluminium bronze alloy, counter bored to completely enclose rod threads. Ensure rods meet in centres of coupling.

Use high strength driving cap in contact with driven rod and couplings of compatible material fully enclosing the rod threads.

Interconnect electrodes using 25 x 3 mm bare copper tape.

Earth electrodes in draw pits

Provide concrete cover, permanently labelled, for electrodes installed through cable draw pit bases.

Material, minimum size as BS 7430 Table 4

Molecularly bonded copper clad steel rods to BS 7430 or BS EN 62305.

Accessories

Rod to tape clamp or U-bolt clamp. Accessories sized to suit earth rod and connector.

2040B ROD EARTH ELECTRODES FOR SYSTEM EARTHING:

Standard - BS 7430.

Form - rod with female thread each end.

Dimensions

Rod Diameter - 15 mm - nominal.

Rod Length - 2.4m (2 x 1.2) minimum.

Earth electrode couplings

Use high strength driving cap in contact with driven rod and couplings of compatible material fully enclosing the rod threads.

Interconnect electrodes using bare copper tape 25mm x 6mm.

Earth electrodes in draw pits

Provide concrete cover, permanently labelled, for electrodes installed through cable draw pit

bases.

Main earth conductor connection

Connect main earth conductor to first electrode using heavy duty purpose made silicon aluminium bronze body conductor clamp and high tensile phosphor bronze bolt.

Material, minimum size as BS 7430 Table 4 - Copper.

Accessories

Rod to tape clamp. Sized to suit earth rod and connector.

2040C BUILDING OR STRUCTURAL ELEMENT EARTH ELECTRODES FOR LIGHTNING PROTECTION SYSTEMS:

Standard - BS EN 62305.

Form - Building or structural element, as shown on the drawings.

Interconnect electrodes using 25 x 3 mm bare copper tape.

2040D BUILDING OR STRUCTURAL ELEMENT EARTH ELECTRODES FOR SYSTEM EARTHING:

Standard - BS 7430.

Form - Building or structural element, as shown on the drawings.

Interconnect electrodes using bare copper tape 25mm x 6mm.

2060A EARTH ELECTRODE CLAMPS:

Connect tape to electrode head using heavy duty purpose made silicon aluminium bronze body connector clamps or leaded gunmetal body connector clamps, and high tensile phosphor bronze bolts to BS EN 12163.

2070A EARTH ELECTRODE INSPECTION FACILITIES:

Provide enclosure for each connection between earth conductor and associated earth electrode system. Install so that top is flush with finished ground or floor level. Ensure enclosure provides

adequate access for testing purposes. Provide pit details for builders work.
Labelling - Wording, Earth.

2080A EARTH ELECTRODE TANK PENETRATION SEAL:

Dimensions

Screed depth (mm) 54 minimum.

Slab depth (mm) 158 maximum.

Flange area (m²) 0.125 minimum.

Form - Earth rod to tube seal by compression ring and seal.

Slab former - Standard earth rod pit.

2090A MAIN EQUIPOTENTIAL BONDS:

Provide main equipotential bonds in accordance with BS 7671.

Material - Insulated cable, single core to BS 6004.

Use no joints in main equipotential bonds.

2100A SUPPLEMENTARY EQUIPOTENTIAL BONDS:

Provide supplementary equipotential bonds to BS 7430, BS 7671 and BS EN 50310. Do not use joints in supplementing bonds.

Material - Insulated cable, single core to BS 6004.

2110A CIRCUIT PROTECTIVE CONDUCTORS:

Material

Insulated cable, single core to BS 6004 as indicated; metallic screwed conduits (excluding flexible); metallic trunking with tinned copper links; armouring and/or metallic sheathing of armoured cables or integral conductor of multi-core cable.

Size

Provide protective conductors sized in accordance with BS 7671 (IET Regulations) 543.1.4 and Table 54.7.

2120 EARTHING CLAMPS:

Use clamps complying with BS 951, for bonding pipes and earthing of conductors. For bonding

of lead sheathed cables use soldered or spring clamps.

2130A EARTH BUSBARS:

Material

Manufacture earth busbars from hard drawn, tinned, high conductivity copper bar.

Substation Earth busbar

75 x 13mm cross section 600mm minimum length.

Main Earth Terminal busbar

25 x 6 mm minimum for incoming live conductor not exceeding 50mm and 50 x 6 mm minimum for incoming live conductor over 50mm².

2140 TEST LINKS:

Provide two test links, in connections between main earth conductors and earth busbar.

Fabricate each from two additional sections of earth busbar. Mount one section on stand-off insulators matching earth busbar; use remaining section as removable test link. Secure 12mm high tensile brass studs to fixed sections of busbar and drill corresponding clearance holes in test links and provide brass washers, nuts and locking devices to secure frame/neutral earthing and test links.

2150 LUGS/TAGS:

Provide lugs or tags to enable connection of bonding conductors to equipment earth terminals.

2160 PROTECTIVE CABLE TERMINATIONS:

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

2170 PROTECTIVE CONDUCTOR WARNING NOTICES/LABELS:

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

2180 MAIN EARTH CONDUCTOR - WARNING TAPES:

Provide green/yellow PVC tapes labelled "EARTHING CONDUCTOR" over complete external

lengths of main earth conductors at 300mm depth below finished ground.

2190 EARTH BAR LABEL:

Label earth bar "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE" with wall mounted laminated plastic tablet engraved in 10mm high red letters on white ground.

3010 CLEAN EARTH DISTRIBUTION:

Install clean earth distribution in double insulated cables from earth electrodes to equipment points. Mount all busbars with insulators and separate from other earthing systems.

3020 DISSIMILAR METALS:

Ensure, where dissimilar metals are used for system, that purpose made jointing materials are used such that corrosion and deterioration of the electrical connection are not caused. Ensure bonding connections to other metal parts of building are electrolytically compatible with those metal parts. Use the guidance given in BS 7430 Table 8 when bonding dissimilar materials.

3030A COPPER TAPE JOINTS:

Provide waterproof protection at joints subject to moisture.

Joint copper tapes by brazing, using zinc-free brazing metal with melting point at least 600°C or thermic welding.

3030B ALUMINIUM TAPE JOINTS:

Provide waterproof protection at joints subject to moisture.

Joint aluminium tapes by welding to BS EN 1011-4.

3040 STRANDED CONDUCTOR JOINTS:

Provide waterproof protection at joints subject to moisture.

Joint copper stranded conductors with compression joints to BS EN 61284.

3050A PROTECTIVE CABLE TERMINATIONS:

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

Make connections between tape and equipment using high tensile grade brass bolts with brass nuts, washers and locking devices. Use phosphor bronze bolts, nuts and washers where

connections are liable to corrosion.

3060A EARTH ELECTRODES:

Location

Locate electrodes not less than 2m distant from building/structure protected, and away from telecommunication and pilot cables and metallic fences.

Driving

Drive rods vertically into ground with purpose designed electric hammer. (Where impenetrable strata encountered at shallow depth, drive at 30° to horizontal).

Depth of rod

2.4m minimum below finished ground surface.

Depth of Electrode heads

Locate electrode heads just below ground level.

Spacing

Where electrodes are installed in a group ensure minimum distance between electrodes is twice depth of rods. Where rods for clean earth are installed ensure distance from any other system rods is six times depth of clean rods.

Tape Depth

Install interconnecting or electrode tape 750mm below finished ground level, rising vertically at each electrode.

Connect groups of electrodes to main earth conductor via bolted link in inspection pit as BS 7430 for test purposes.

Y81 TESTING AND COMMISSIONING OF ELECTRICAL SERVICES

1000 GENERAL

2010A INCORPORATED EQUIPMENT CHARACTERISTICS:

Obtain and use information from manufacturers of equipment provided.

Use information provided, for equipment supplied by others and incorporated into installation.

2020A PROSPECTIVE SHORT CIRCUIT CURRENT:

Determine values of I_p by measurement, unless other means are indicated. Determine I_p at all necessary points within installation to confirm correct equipment selections.

Obtain from supply undertaker written confirmation of maximum and minimum values of I_p at origin of installation. Adjust subsequent measured values of I_p accordingly.

2030A INITIAL VERIFICATION:

Carry out detailed inspection to verify the requirements of BS 7671, Section 611 in the order given in clause 611.3.

2040A TEST EQUIPMENT AND CONSUMABLES:

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

Test equipment quality assurance requirements to BS EN ISO 10012.

2050A TESTING

Carry out in the same order as published the tests required by BS 7671, Section 612 for New Installation or Altered or Added Installation as appropriate.

2070A EARTH FAULT LOOP IMPEDANCE:

Use 25 A test current. Measure and record source impedance (Z_E).

If alternative LV supply arrangements are available, measure Z_S when using supply with highest impedance.

Measure Z_S with main equipotential bonding conductors connected. Do not summate values of

several parts of each loop.

2080 SETTINGS AND ADJUSTMENTS:

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

2090A STANDBY GENERATORS:

Perform works tests on standby generators and provide test certificates. Comply with BS 5000-3 and BS 5000-11 or BS EN 60034-3 as appropriate.

2100A HV AND LV SWITCHGEAR:

Perform works tests on HV and LV switchgear in accordance with BS EN 62271-200 and BS EN 61439-1, as appropriate, and provide test certificates.

2110A HV POWER TRANSFORMERS:

Perform works tests on HV power transformers in accordance with BS EN 60076-3, BS EN 60076-4 and BS EN 60076-5. Provide test certificates.
Perform all routine tests.

2120A FIRE DETECTION AND ALARM INSTALLATIONS:

Carry out site testing and inspection and provide test certificates for fire detection and alarm systems in accordance with BS 5839-1.

2120B LIGHTNING PROTECTION INSTALLATIONS:

Carry out site testing and inspection and provide test certificates for lightning protection installations in accordance with BS EN 62305.

2120C FIRE PROTECTION OF ELECTRONIC DATA PROCESSING INSTALLATIONS:

Carry out site testing and inspection and provide test certificates for fire protection of electronic data processing installations in accordance with BS 6266.

2120E EMERGENCY LIGHTING INSTALLATIONS:

Carry out site testing and inspection and provide test certificates for emergency lighting

installations in accordance with BS EN 50172.

2130 CALIBRATION:

Provide current certificates of calibration for all instruments used during test procedures.

Record particular instrument identity on record sheets.

2140A CERTIFICATION AND REPORTING:

Complete and hand over to the Client a Completion and Inspection Certificate to BS 7671

Appendix 6 for New Installation or Altered or Added Installation as appropriate.

2150A INSTALLATION CERTIFICATES:

Provide installation certificates for electrical installations in accordance with BS 7671 (IET Regulations).

Record details of departures from BS 7671 (IET Wiring Regulations) on certificate.

Provide copies of calculations justifying departure from BS 7671 (IET Wiring Regulations) and attach to certificates.

2160 RECORDS:

Record all results and instrument readings on approved Record Sheets and hand over to the client two copies for each inspection and test.

Hand over copies of complete Record Sheets to

- Client.

Provide copies of Record Sheets

- 2.

3010 CONDUCTIVE PARTS:

Test conductive parts simultaneously accessible with exposed conductive parts of extraneous conductive parts. Establish that they are either not an extraneous conductive part, or that they are reliably connected by metal to main equipotential bonding.

Confirm conductive parts which are not extraneous conductive parts are separated from earth by an impedance greater than 50,000 ohms. Confirm other conductive parts are bonded to equipotential zone earthbar by an impedance not exceeding 0.1 ohms.

3030A HIGH VOLTAGE TESTS:

Conduct high voltage tests for equipment indicated. Comply with BS 923-1, BS EN 61180 and BS

EN 60060-2. Comply with BS EN 61180.

3040A LV BURIED CABLES:

Test continuity and insulation of buried cables immediately after back-filling. Test continuity and insulation of buried cables prior to handover.

Y82 IDENTIFICATION - ELECTRICAL

1000 GENERAL

2010A LABELS AND NOTICES:

Apply identification labels and notices in accordance with BS 7671 (IET Wiring Regulations), section 514 to all electrical cables plant and equipment including components of mechanical systems.

Identification of protective devices.

Diagrams, charts or tables to comply with Clauses 514.9 and 560.7.9.

Warning notices, voltages in excess of 250 volts.

Periodic inspection and test notices.

Residual current device notices.

Earth electrode safety electrical connection label.

Bonding conductor connector point to extraneous conductive parts label.

Earth free local equipotential bonding areas warning notice.

Electrical separation areas warning notice.

Outdoor equipment socket outlet notice.

2020A MATERIALS:

Use materials for labels and notices with a predicted life equal to or greater than the design life of the electrical cables, plant, equipment or installation to which it refers.

External

Sign written, or stencil in paint compatible with surface.

Colour - Background, plant standard finish. Lettering, white.

Internal

Engraved thermosetting plastic laminate.

Colour - Background, white or red. Lettering, red or white.

2030A FIXING - INTERNAL:

Fix labels and notices using materials compatible with label or notice and surface to which it is fixed by screws into tapped hole or bolted complete with washer nut and locking device.

2040A ARRANGEMENT:

Obtain approval prior to manufacture, with regard to style, colour, lettering, size and position of

all labels and notices.

Provide sample showing style, colour, lettering and size, for approval.

2050A LETTERING AND SIZE OF LABELS AND NOTICES:

Ensure that all lettering and symbols comply with the requirements laid out in BS 5499-1 for height of lettering where not otherwise indicated. Ensure labels and notices of adequate size for the lettering required, and allow a minimum margin around all lettering of one line space vertically and two letter spacing horizontally.

Font - Helvetica Medium.

Size - BS 5499-1 or 5mm minimum high letters.

2060A CONDUCTOR ARRANGEMENT:

Arrange circuit polarity so that phases read in phase rotation order followed by the neutral, if any, from top to bottom in horizontal conductor layouts and left to right in vertical conductor layouts. Ensure flat horizontal arrays have leading phase to the left and neutral to the right from left to right when viewed from supply point. Arrange phase or live pole of two wire apparatus at top or left hand and neutral and earth both at bottom or right hand side. In all cases, ensure conductor arrangements defined are when viewed from front face of all equipment and terminating facilities. Apply identification markers in accordance with BS 7671 (IET Wiring Regulations), section 514 to all conductor termination points.

2070A SAFETY SIGNS:

Label all electrical plant and equipment using safety sign 8.A.0044 of BS 5499-5 where voltages above ELV exist.

Provide supplementary or text signs complying with BS 5499-5 with each safety sign 8.A.0044 as indicated.

Label all electrical plant and equipment with the labels specified in the appropriate British Standards for that plant or equipment.

Identify each substation and main switch room with safety sign 8.A.0044 to BS 5499-5 for any fire extinguishing system and notice giving details of,

Name of the Substation or switch room

The presence of Medium and Low Voltages.

Administrative instructions for access.

Location and method of contacting controlling authority.

Actions to be taken in an emergency.

2080A PLANT AND EQUIPMENT LABELS:

Fit labels on all items of plant, equipment, switches, etc., include the following information: service controlled, circuit reference, voltage, type of supply and phase etc., circuit protection

type and rating.

2085 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:
Graphical symbols for use on equipment to be created and applied in accordance with BS EN 80416-1, BS EN 80416-2, BS EN 80416-3.

2090 MAINTENANCE NOTICES:

Fix notices giving warning of, and instructions on, any special maintenance procedures to plant and equipment.

2100 COLOUR CORRECTED LIGHT FITTINGS:

Fix a warning or identification disc to light fittings containing colour corrected fluorescent tubes or other colour corrected light sources to ensure that maintenance staff install the correct lamps.

2110A MOTORS AND STARTERS LABELS:

Fit identification labels to all motors, starters and starter panels. Ensure positive identification of respective motors and starters. Provide motors with non-corrodible labels attached adjacent to each bearing giving details of the lubricant to be used. Mark direction of normal rotation on motor casing. Provide labels to identify motor equipment fitted with surge suppressors and thermistors stating that insulation test voltages must not be applied to thermistors and thermistor control units. Ensure labelling is compatible with schematic and wiring diagrams, and complies with BS EN 60034-8.

2120A LABELLED ACCESSORY PLATES - ENGRAVED:

Label accessory plates, including lighting switches, socket outlets and connection units to indicate their use. Label by engraving, lettering 6mm high colour red.

2130A SWITCHGEAR:

Fit labels on switchgear as required by BS EN 60439 to indicate duty of unit, its voltage, phase and current rating, protective device rating size of conductor involved, and all other necessary details.

Use an agreed serial coding system, provide at the switch a key to the coding system.

2140 DISTRIBUTION BOARDS:

On each distribution board identify every outgoing way with a renewable circuit chart in a

transparent plastic envelope permanently fitted inside distribution board cover. Clearly indicate in typed script, circuit identification number, cable size, fuse or circuit breaker rating and a description of item supplied and area supplied by circuit.

2150A SCHEMATIC DIAGRAMS:

Provide a purpose made schematic diagram permanently fixed showing the connections of the equipment and plant.

Locations and materials as indicated in contract preliminaries.

2160A SPECIAL PURPOSE EARTHING:

Fit labels to special purpose earthing conductors and connection points, describing their purposes and any instructions necessary for their operation and maintenance.

IT equipment "Clean Earths".

Telecommunications functional earths as BS 6701.

2170A INDICATOR LAMPS AND PUSH BUTTONS FOR POWER SYSTEMS:

Use indicator lamp and push button colours in accordance with BS EN 60073.

Indicator lamp

Red, danger or alarm; yellow, caution; green, safety.

Push buttons

Red, emergency action; red, stop or off; yellow, intervention; green, start or on.

Illuminated push buttons - Type a.

2180A CONDUIT AND TRUNKING COLOUR CODING:

In areas of mechanical plant or voids accommodating mechanical services, or where otherwise indicated, identify electrical conduits and ducts in accordance with BS 1710. Apply colour orange to BS 4800 by painting on service as a band over 150mm or applying an adhesive tape type wrap around services over a length of 150mm.

Place identification colours at bulkheads, wall penetrations and any other place where identification is necessary.

2190A CABLE IDENTIFICATION:

Provide all cables, other than final sub-circuit wiring enclosed in conduits or trunking, with labels fixed at each end of cable either side of wall and floor penetrations at approximately 12m intervals at convenient inspection points by means of non-releasable plastic straps, minimum

width 4mm.

Ensure labels show the reference number of cable.

2200A TERMINAL MARKING AND CONDUCTOR IDENTIFICATION:

Provide for switchgear and control gear elements whose terminals are marked in accordance with BS 5472 (EN 50005) and BS 6272 (EN 50042). Use a unique reference to identify each element in the switchgear or control gear. Mark on or adjacent to each element its reference. Identify each terminal for connection to external wiring or cabling using a reference system complying with BS EN 60445 based on the element reference and the appropriate element terminal reference.

Adjacent to terminals.

Use lettered or numbered ferrules or sleeves to BS 3858 to mark each auxiliary conductor or control cable core with the identity of the terminal to which it is connected and the reference of plant or equipment to which it is connected and the identity of the terminal at the remote end. Ensure that main circuit conductors are identified in accordance with BS 7671 (IET Wiring Regulations) section 514. Ensure that all identification of terminals and conductors is recorded and included on record drawings and in operation and maintenance documentation.

2210A UNDERGROUND CABLE IDENTIFICATION:

Identify external underground cable routes by means of approved markers along their length at distances not exceeding 50m and where a change of direction occurs on such routes. Provide cables markers with a brass plate or impress concrete to clearly indicate the reference of group of cables or reference number of cable and operating voltage of cable. Provide key to any reference system used at switchgear. Mark and protect direct buried cables with plastic tape yellow printed black "DANGER ELECTRIC CABLES" elsewhere.

2220A CABLE CONDUCTOR COLOUR CODING:

Identify cable conductors in accordance with BS 7671 (IET Wiring Regulations) section 514 and Appendix 7, note that a lighting sub-circuit switch wire is a phase conductor in a single phase circuit.

2230 CABLE JOINTING AND TERMINATION:

Connect all cables in the installation so that the correct sequence of phase rotation is maintained throughout. Where straight through joints are approved joint medium voltage conductors as they lie, ensuring their complete length is phased out on completion. Ensure connections at terminations of MV cables are made in the correct phase rotation and ensure cable conductor termination marking if any, complies with this phase sequence. Where straight through joints are approved on low voltage cables, whether power cables or control or auxiliary cables, joint conductors strictly in accordance with their colour or numeric coding. Where such joints are approved on mineral insulated or other non-coded conductor cables, identify each

core at the joint and make the joint core to core.

2240A CABLE SHEATH IDENTIFICATION - INTERNAL:

Use to identify coloured cables sheaths for various services as follows.

Fire alarm, red;

Clock circuits, brown;

Telecommunications, grey;

Data as system suppliers requirements;

Control, black;

LV, black;

LV mineral insulated, orange;

MV red.

Code cables for various services using alpha numeric symbols as follows.

Code letters preceding cable reference.

Fire alarm, FA.

Clock, CL.

Telecommunications, T.

Data, D.

Control, C.

Low voltage, LV.

Extra low voltage, ELV.

LV Essential circuits EM.

Medium voltage, HV.

2250A CABLE SHEATH IDENTIFICATION - EXTERNAL:

Identify cable sheaths for various services in accordance with NJUG Guidelines on the Positioning and Colour Coding of Utilities' Apparatus, as follows.

MV Red; LV Black; telecommunications and data, Grey.

2260A ADDITIONAL SAFETY SIGNS:

Provide at locations shown or as appropriate safety signs to BS 5499-1.

Application

For main switch and electrical plant room access doors. BS 5499-5, complete with supplementary signs as shown.

6.C.0019. 6.A.002, with supplementary sign "Authorised persons only".

7.A.022

Application

For use with permit to work systems, BS 5499-5, complete with supplementary signs as shown.

6.C.0021. Printed on rigid plastic, with hanging loop, with supplementary wording "Do not

operate. Work in progress".

Application

For use at each emergency stop. BS 5499-5, complete with supplementary signs as shown.

9.B.0097. With supplementary sign "Emergency stop push-button".

Y90 FIXING TO BUILDING FABRIC

1000 GENERAL

1010 PREPARATION:

Mark-out, set-out and firmly fix all equipment, components and necessary brackets and supports.

1020 MANUFACTURER'S DRAWINGS:

Use manufacturer's drawings and templates for purposes of marking and setting out.

1030 FIXINGS:

Ensure structure and fixings are suitable for items to be fixed.

1040 LOADING DETAILS:

Provide loading details for all fixing types.

1050 BUILDING-IN BY OTHERS:

Provide all necessary assistance to enable any item of building-in type to be built in by others.

1060 SIZE OF FIXING:

Use largest size of bolt, screw or other fixing permitted by diameter of hole in item to be fixed.

1070 GREASING OF FIXINGS:

Ensure all bolts, screws or other fixings used are greased or lubricated in accordance with manufacturer's instructions.

2010 STANDARDS:

Ensure that fixings such as expanding anchors are tested for tensile loading in accordance with BS 5080-1.

2020 PLUGS:

Use plugs of suitable size and length for fixings. Use plastic, fibrous or soft metal non-deteriorating plugs to suit application. Do not use wood plugs.

Ensure that when screw is in place, threaded length is in plug. Ensure plugs used for screw fixing are set-in to correct depth prior to final tightening.

2030 SCREWS:

Use screws to BS 1210. Generally use sherardized steel wood screws for fixing to concrete,

brickwork or blockwork.

In damp or exposed situations use greased brass wood screws.

2080 NON-PENETRATIVE SUPPORT SYSTEMS FOR ROOF MOUNTED EQUIPMENT:

Obtain approval prior to using non-penetrative support systems for roof mounted equipment.

3010 DRILLING:

Drill holes squarely. Use drills of requisite size and depth, and appropriate to fabric. Do not flame-cut holes in metal work.

3050 FIXING TO TIMBER RAILS:

Fix equipment, brackets and supports by drilling hole through timber rail and fixing with bolt, back plate, washer and loose nut.

3060A FIXING TO HOLLOW STUD/TILE/BLOCK WALLS:

Fix equipment, brackets and supports where there is access at rear of wall, by drilling hole through wall and fixing with bolt, back-plate, washer and loose nut.

Fix equipment, brackets and supports where there is no access at rear of wall, drill hole and use screw anchor type fixing or gravity type toggle fixing.

3070A FIXING TO CONCRETE, BRICKWORK OR BLOCKWORK:

Fix equipment, brackets and supports using wood screws in plugs or, as appropriate, drill holes and fix using steel bolts of grouted bolt type or expanding bolt type fixing.

3080A FIXING TO METALWORK:

Fix equipment, brackets and supports by drilling holes and fixing using set screws or bolts complete with washers, shake proof washers and loose nuts.

3090A FIXING TO STRUCTURAL STEELWORK AND CONCRETE STRUCTURES:

Provide manufacturer's information on recommended fixing. Obtain approval for any fixing to structure steel work and concrete structures.

Generally use proprietary fixings to structural steelwork and concrete structures.

Obtain approval to cut holes in structural steelwork or concrete structures or weld to structural

steelwork.

Y90.3100Y NON-PENETRATIVE SUPPORT SYSTEMS FOR ROOF MOUNTED EQUIPMENT:

- Provide manufacturer's information on recommended support systems.
- Obtain the necessary approvals to use non-penetrative support systems as follows:
 - Ensure that the roof build-up is suitable for non-penetrative supports.
 - Ensure that necessary approval is given by
 - The Structural Engineer
 - The Architect
- Mounting positions
- Roof load management parameters (if known)
 - UDL deck loading kN/m^2
 - Maximum Point Loads kN
 - Maximum Base Pressures kN/m^2
- Components
- Provide support manufacturer's information on recommended free-standing systems
 - Support leg type
 - Support frame type
- Roof maintenance building clearance
 - Ensure that future roof maintenance access to roof finish is provided under each support system
 - Minimum building clearance
- Documentation required for Project Team approval:
 - CAD drawings of supports
 - Roof load management calculations
 - O&M documentation
 - Warranty information
- Manufacturer

Y91 PAINTING AND ANTI-CORROSION TREATMENTS

1000 GENERAL:

2010A PAINT MATERIALS:

Use the following materials as appropriate

Solvent borne priming paint to BS 7956 for bare woodwork.

Red Oxide priming paint for bare iron and steelwork.

Zinc Chromate priming paint for bare ferrous and non-ferrous metals.

Calcium Plumbate priming paint to BS 3698 for galvanized steel or composite wood/metal components.

Undercoating paint for previously primed or painted surfaces before the application of finishing coats.

Gloss finishing paint for previously primed or painted/undercoated surfaces.

Epoxy resin paint for specialist coatings requiring resistance to acids, alkalis, oils, solvents, abrasion or high humidity.

Aluminium paint to BS 388 for structural steelwork, storage vessels, heated metallic surfaces and similar applications where moisture and heat resistant properties are required.

Cold galvanizing paint for making good damage to previously galvanized surfaces and protection to galvanized materials modified during installation.

Zinc-rich metallic to BS 4652 for bare iron and steelwork where electrical conductivity has to be assured.

Black tar-based paint to BS 1070 for moisture resistant protection to metal surfaces where decorating appearance is not important.

Bitumen based coatings for cold application to BS 3416 protection to iron and steel, particularly pipelines and fittings for use in contact with potable water.

Bitumen based coatings for cold application to BS 6949 not to be used in contact with potable water.

2020 PAINT QUALITY:

Ensure paints used are of quality and type to suit application and that:-

Primers have good adhesion, covering power, rust-inhibiting and grain filling properties.

Gloss finishing paints are of machine finish grade having high adhesion and high resistance to solvents, mineral oils, cutting oils, detergents, chipping and impact damage.

3020 WEATHER AND OTHER CONDITIONS:

Do not apply paints where weather, temperature, humidity or other conditions may have a

damaging effect upon finish or paint.

3030A CLEANING AND PREPARING STEEL SURFACES FOR PAINTING:

Ensure metal surfaces are thoroughly cleaned, all mill and weld scale removed and finally degreased. Clean steel surfaces in accordance with BS EN ISO 8503 and prepare surfaces for painting in accordance with BS EN ISO 4618.

3030B CLEANING AND PREPARING SURFACES FOR PAINTING:

Ensure metal surfaces are thoroughly cleaned, all mill and weld scale removed and finally degreased.

Prepare surfaces for painting in accordance with BS EN ISO 4618.

3040 APPLICATION OFF-SITE:

Wherever possible ensure paint finishes applied by component manufacturers are spray applied.

3050 APPLICATION:

Apply paint evenly and ensure finish shows no excessive brush marks, grinning, runs, sagging, ropiness or other application defects.

3060 COLD GALVANIZING:

Repair damage to galvanized components due to installation process, i.e. following cutting, drilling or welding, by applying 2 no. substantial coats of cold galvanizing paint.

3070 PROTECTION OF BRIGHT MACHINE PARTS:

Apply a protective coating to all bright machined parts before despatch from works.

Do not remove protective coatings unless required for installation, testing or commissioning purposes and in such cases reinstate upon completion.

Repair any damaged protective coating or bright machined part, or where necessary replace damaged component.

Use and apply metal coatings in accordance with manufacturer's instructions.

Complete where possible all welding, drilling, bending and other work before metal coating.