

**C.L.A.W. ELECTRICAL SPECIFICATION PART EC GENERAL TECHNICAL
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EC.01.0 GENERAL

- EC.01.01 The whole of the work detailed in the Specification shall be carried out in compliance with the regulations as listed in Section EB of the Specification Document.
- EC.01.02 The Main Contractor will be responsible for the provision and safety of all temporary electrical services, for the payment of all accounts for the consumption of electrical energy during the progress of the work, and for the negotiations with the Supply Authority for the connection of all temporary services.

EC.02.0 VERIFICATION, INSPECTION & TESTING

- EC.02.01 In accordance with BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition tests shall be required as the installation progresses for insulation resistance, and continuity of conduit, cables, and circuit protective conductors to verify the installation is in compliance with the regulations. The Electrical Services Installer must ensure that the person who carries out such tests is fully competent to do so.
- EC.02.02 Notice shall be given to the Contract Administrator when tests are to be made.
- EC.02.03 The complete record of all of all ongoing tests shall be documented and copies given to the Contract Administrator and Main Contractor. The Electrical Services Installer must ensure that the instruments used for the tests are to BS EN 61010 -1 and have been recently calibrated to ensure their accuracy.
- EC.02.04 Prior to the performance of testing, inspection of the installation shall be carried out to ensure the constituent part of the installation is in a satisfactory condition to undertake the tests.
- EC.02.05 When the installation is complete, testing in accordance with BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition will be carried out.
- EC.02.06 The Contract Administrator reserves the right to call upon the Electrical Services Installer at any time to carry out tests which he may deem necessary. For the purpose of these tests, the Electrical Services Installer is to supply instruments, materials, labour and attendance that may be necessary in the presence of the Contract Administrator, without extra cost, before the expiry of the period of guarantee.

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EC.02.0 VERIFICATION, INSPECTION & TESTING (Cont'd)

- EC.02.07 If any part of the installation shall fail during or as a result of any test, or if the results obtained shall not, in the opinion of the Contract Administrator be satisfactory, the Electrical Services Installer shall forthwith, without any charge, make good any defects so occasioned, and shall submit the installation to further tests in the presence of the Contract Administrator.
- EC.02.08 On the satisfactory completion of the tests, the Electrical Services Installer shall provide a Completion Certificate and Inspection Certificate as described in BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition.
- EC.02.09 The Electrical Services Installer shall be responsible for all test notices, fees, etc., required by the Supply Authority and is to ensure that the necessary notices are submitted at the correct time to ensure no delay in the energising of the system.

EC.03.0 SWITCHGEAR

- EC.03.01 The Electrical Services Installer shall provide, connect and install all the main switchgear (Compliant with all current relevant British Standards) as detailed in Section EL of the Specification Document and on the Contract Drawings.
- EC.03.02 Free standing switchboards whether factory assembled or site assembled shall be mounted on a plinth of minimum height 100mm.
- EC.03.03 Where factory assembled switchboards are specified, duplicate copies of the manufacturer's test certificate and dimensioned general arrangement drawings shall be submitted to the Contract Administrator for approval before the equipment is delivered.
- EC.03.04 Where switchboards are site assembled, a test certificate shall be provided indicating that the equipment is capable of withstanding without breakdown or flashover, an applied voltage test equivalent to that specified in the British Standard for similar factory built equipment.
- EC.03.05 All switchboards shall be fitted with a metering facility on all incoming and outgoing circuits.
- EC.03.06 All switchboards shall include provision for Power Factor Correction and transient over-voltage protection.

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EC.03.0 SWITCHGEAR (Cont'd)

- EC.03.07 Busbar chambers and connections shall be in accordance with BS.EN 60439-2:2000. Busbars shall be readily extendable and the connections and wiring shall be marked in accordance with BS.EN 60439-2:2000.
- EC.03.08 Each distribution board/consumer unit shall be of the size type and rating as detailed in Section EL of the Specification and on the Contract Drawings, and shall fully comply with the relevant British Standards.
- EC.03.09 The distribution boards shall contain the maximum number of fuse or miniature circuit breaker ways irrespective of the number being used. All spare ways shall be fitted with fuse carriers and all spare MCB ways shall be blanked off using the appropriate manufacturers blanking plates.
- EC.03.10 All distribution boards shall be fitted with integral isolators.
- EC.03.11 All distribution boards shall be fitted with a locking facility.
- EC.03.12 All distribution boards supplied from a non metered source shall be fitted with a metering facility.
- EC.03.13 All miniature and moulded case circuit breakers shall be of the thermal and magnetic or magnetic hydraulic type, and fully comply with BS.EN 60898:1991, BS.EN 60898-2:2001, BS.EN 60898-2:2006 and BS.EN 60947-2:2006.
- EC.03.14 All circuits throughout shall be connected to the correct phase(s) exactly as indicated on the Contract Drawings and connected in the same sequence within their respective protective device and terminal blocks. Any change must be agreed with the Contract Administrator.
- EC.03.15 All distribution boards shall be fitted with engraved laminate labels which shall be brass screwed or riveted to the door. The label shall be engraved with 6mm black characters on white background illustrating the following information:
- Title and reference number of the distribution board
 - Supply source
 - Supply cable size
 - Rating of distribution board and isolator size
- EC.03.16 **ADHESIVE OR DYMOTAPE LABELS WILL NOT BE ACCEPTED.**

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EC.03.0 SWITCHGEAR (Cont'd)

EC.03.17 Included inside each distribution board shall be a neatly typed circuit schedule, enclosed in a plastic envelope, indicating the position, number of outlets/luminaires fed, approximate load and size of each fuse or circuit breaker.

EC.03.18 **HAND WRITTEN LABELS WILL NOT BE ACCEPTED**

EC.04.0 CABLES-GENERAL

EC.04.01 Any cables and flexible cords used in the installation shall carry the certifying marks of the British Approvals for Electric Cables (BASEC).

EC.04.02 All cables shall be installed strictly in accordance with BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition and the recommendations of the cable manufacturers.

EC.04.03 Cables shall be in continuous lengths without joints, terminating only at the terminals on the main switchgear and distribution equipment. Where the length required is in excess of the length obtainable in one piece from the cable manufacturer, the installation of a joint shall be sanctioned. The position of all joints shall be approved by the Contract Administrator. The cost of all such joints shall be included in the cable unit rate.

EC.04.04 Cables erected on walls or steel work shall be supported in accordance with the BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition.

EC.04.05 Drawings showing any special arrangements of multi-way racks shall be submitted to the Contract Administrator for approval before being fabricated.

EC.04.06 Any cables considered to be in a poor condition due to bad handling or fixing shall be rejected at the discretion of the Contract Administrator.

EC.04.07 Where any cables are installed in any location where it is liable to be covered by thermal installation the Electrical Installer shall take due cognisance of section 523 of BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition and ensure the current carrying capacities of the cables are suitable.

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EC.05.0 CABLES ABOVE SUSPENDED CEILINGS

- EC.05.01 To avoid deviating from BS 7671 regulation 522-8-01, i.e. avoid damage to the sheath and insulation of the cables during installation and subsequent use, all cables shall be installed as the ensuing clause of this section.
- EC.05.02 Cables shall not be supported on the grid framework.
- EC.05.03 All armoured or mineral insulated metal sheathed cables above suspended ceilings shall be adequately clipped / cleated to the soffit or traywork.
- EC.05.04 All non-armoured PVC sheathed cables above suspended ceilings shall be adequately clipped / cleated to the soffit or contained in basket / trunking which shall be supported from the soffit.
- EC.05.05 All single core PVC insulated cables above suspended ceilings shall be contained in conduit / trunking which shall be supported from the soffit
- EC.05.06 All data or telecom cables above suspended ceilings shall be contained in conduit / trunking / basket which shall be supported from the soffit
- EC.05.07 All cable drops to ceiling mounted accessories shall be as near vertical as possible and the Electrical Services Installer shall that the final fixing before the bends are so sited so as not to place the cable under undue strain
- EC.05.08 Final connections to luminaires shall be by Klik type plug and socket mounted on the trunking with a **maximum** of 3metres of flexible cord which shall be mechanically supported from the slab and shall **not** lie on the ceiling grid.
- EC.05.09 The Electrical Services Installer shall **not** use adhesive clips to perform this function

EC.06.0 CABLES BELOW SUSPENDED FLOORS

- EC.06.01 To avoid deviating from BS 7671 regulation 522-8-01, i.e. avoid damage to the sheath and insulation of the cables during installation and subsequent use, all cables shall be installed as the ensuing clause of this section.
- EC.06.02 Cables shall not be loosely installed below suspended floors.

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EC.06.0 CABLES BELOW SUSPENDED FLOORS (Cont'd)

- EC.06.03 All armoured or mineral insulated metal sheathed cables below suspended floors shall be adequately clipped / cleated to the concrete floor or traywork.
- EC.06.04 All non-armoured PVC sheathed cables below suspended floors shall be adequately clipped / cleated to the concrete floor or contained in basket / trunking which shall be fixed to the concrete floor.
- EC.06.05 All single core PVC insulated cables below suspended floors shall be contained in conduit / trunking which shall be fixed to the concrete floor.
- EC.06.06 All data or telecom cables below suspended floors shall be contained in conduit / trunking / basket which shall be fixed to the concrete floor.

EC.07.0 PVC/SWA/PVC CABLES

- EC.07.01 PVC/SWA/PVC cables shall be 600/1000volt grade manufactured in accordance with BS.6346: 1997.
- EC.05.02 Cables shall have shaped cores with phase and neutral conductors constructed of the same size and stranded copper.
- EC.07.03 Cable terminations shall be made by using controlled compression type glands complete with cone grip armour clamps manufactured in accordance with BS.6121: 2005 and BS EN 50262:1999, dust tight and oil tight as applicable.
- EC.07.04 Efficient earth continuity shall be ensured between cable armouring, glands and switchgear at both ends of cables unless of minimum conductor size 70mm² in accordance with BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition.
- EC.07.05 Cables shall be supported in accordance with the maximum spacing enumerated below using black polythene cleats or metal claw cleats, depending upon the size of cable:

Overall cable diameter (mm)	Horizontal (mm)	Vertical (mm)
Up to 9	250	400
10 to 15	300	400
16 to 20	350	450
21 to 40	400	550

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EC.07.0 PVC/SWA/PVC CABLES (Cont'd)

- EC.07.06 Where cable runs are at less than 30° from the vertical they shall be fixed in accordance with the vertical maximum spacings and where more than 30° from the vertical they shall be fixed in accordance with the horizontal maximum spacings.
- EC.07.07 All glands shall be fitted with black plastic shrouds, external or internal type as appropriate.
- EC.07.08 PVC cables can only be handled or installed when both the ambient and cable temperatures are above 5°C and have been so for the previous 24 hours, or where special precautions have been taken to maintain the cable above this temperature.
- EC.07.09 Where cable is employed for indoors usage the oversheath shall be of LSF (Low Smoke and Fume) compound.
- EC.07.10 No joints will be permitted unless with the expressed agreement, in writing, of the Contract Administrator. Straight-through and Tee joints where approved shall be made in standard joint boxes purpose made for armoured and sheathed cables and filled with a cold pouring sealing compound. Compression joints shall be made with the correct size of tool and pressure for the ferrules used.

EC.08.0 XLPE CABLES

- EC.08.01 XLPE Cables shall be 600/1000 volt grade manufacture in accordance with BS.5467:1997.
- EC.08.02 Cables shall have shaped cores with phase and neutral conductors constructed of the same size and stranded copper.
- EC.08.03 Cable terminations shall be made by using controlled compression type glands complete with cone grip armour clamps manufactured in accordance with BS.6121: 2005 and BS EN 50262:1999, dust tight and oil tight as applicable.
- EC.08.04 Efficient earth continuity shall be ensured between cable armouring, glands and switchgear at both ends of cables unless of minimum conductor size 70mm² in accordance with BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition.
- EC.08.05 Cables shall be supported in accordance with the maximum spacing enumerated below using black polythene cleats or metal claw cleats, depending upon the size of cable:

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EC.08.0 XLPE CABLES (Cont'd)

Overall cable diameter (mm)	Horizontal (mm)	Vertical (mm)
Up to 9	250	400
10 to 15	300	400
16 to 20	350	450
21 to 40	400	550

- EC.08.06 Where cable runs are at less than 30° from the vertical they shall be fixed in accordance with the vertical maximum spacings and where more than 30° from the vertical they shall be fixed in accordance with the horizontal maximum spacings.
- EC.08.07 All glands shall be fitted with black plastic shrouds external or internal type as appropriate.
- EC.08.08 If XLPE Cables contain PVC bedding or PVC oversheath it shall only be handled or installed when both the ambient and cable temperatures are above 5°C and have been so for the previous 24 hours, or where special precautions have been taken to maintain the cable above this temperature.
- EC.08.09 If XLPE Cables contain non-hygroscopic tape bedding and appropriate oversheath it can be handled and installed at temperatures not exceeding 10°C.
- EC.08.10 To take full advantage of the short circuit rating of XLPE insulated cables only compression type connectors are to be used. Soldered type connectors are not permitted.
- EC.08.11 Where XLPE cable is laid direct in the ground an appropriate de-rating factor should be employed due to the high operating temperature (90°C) of the cable, which could cause an increase in thermal resistance of the surrounding soil.
- EC.08.12 Where XLPE cable is employed for indoors usage the oversheath shall be of LSF (Low Smoke and Fume) compound.
- EC.08.13 No joints will be permitted unless with the expressed agreement, in writing, of the Contract Administrator. Straight-through and Tee joints where approved shall be made in standard joint boxes purpose made for armoured and sheathed cables and filled with a cold pouring sealing compound. Compression joints shall be made with the correct size of tool and pressure for the ferrules used.

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- EC.09.0 PVC INSULATED AND SHEATHED, ALUMINIUM STRIP ARMoured CABLES**
- EC.09.01 The cables shall be 600/1000 volt grade, unless otherwise stated. Conductors shall be solid aluminium insulated with PVC compound, the cores laid up with PVC fillers, PVC bedded, armoured with single layer aluminium strip armour and PVC served overall.
- EC.09.02 The clause dealing with the 'PVC Insulated and Sheathed Steel Wire Armoured Cables' shall apply to PVC insulated and Sheathed, Aluminium Strip Armoured Cables in so far as this would apply.
- EC.09.03 The cable shall be terminated and jointed in strict accordance with the Manufacturer's recommendations.
- EC.09.04 All cable terminations shall be made off with compression type cable glands, incorporating an armour clamp and making a watertight seal on the PVC cable's sheath. The cable termination shall be provided with a PVC shroud which when used in wet and damp situations shall be fitted with Denso paste.
- EC.09.05 All conductors are to be terminated in compression type lugs. The conductors must be cleaned prior to jointing. Denso jointing compound must be used on interface contact surfaces of all bimetallic joints i.e. joints between dissimilar metals.
- EC.09.06 Where it is necessary to solder aluminium conductors, care shall be taken to ensure that the correct flux and solder is used.
- EC.09.07 Any filling compound used in conjunction with PVC cables shall be of the epoxy resin or polyester resin type.
- EC.10.0 CABLE DUCTS AND TRENCHES ETC.**
- EC.10.01 Where cables enter a building pipe ducts with easy bends shall be supplied, laid and installed by the Main Contractor, and be complete with draw wire. The radius of the bends shall be a minimum of 8 times the diameter of the pipe duct.
- EC.10.02 Where cables are laid direct in the ground, trenches shall be excavated and backfilled by the Main Contractor, but the Electrical Services Installer will be responsible for the laying of the cables, necessary protection and ensuring that the backfilling material contains no matter that could cause damage to the cables.

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EC.10.0 CABLE DUCTS AND TRENCHES ETC. (Cont'd)

- EC.10.03 Cables shall be laid at a minimum depth of 500mm and their location clearly indicated on appropriate record drawings.
- EC.10.04 The trench bottom shall be of constant depth and free from sharp stones, bricks etc. All backfilling shall be carried out using granular pea gravel, 10mm single size aggregate to BS 882 (for pipes/ducts), or sand (for cables), with 150mm layers below and above the pipe/ducts/cables.
- EC.10.05 Final backfill shall be selected earth, compacted level with the surrounding area.
- EC.10.06 Directly on the sand cover the Electrical Installer shall supply and lay continuous plastic protective tiles 150mm wide together with a cable marking tape (Campbell or similar) labelled "ELECTRIC CABLE BELOW" 300mm from finished ground level. Tiles and tapes shall be laid such that the outer edges of the tile/tape are at least 75mm beyond the outer cable in the trench over its full length. All cable locations shall be clearly indicated on appropriate record drawings.
- EC.10.07 Cables run under roads or other prepared surfaces at a minimum depth of 750mm shall be installed in steel pipes suitably protected against corrosion and complete with draw wire, which shall be provided and laid by the Main Contractor.

EC.11.0 MIMS CABLES AND INSTALLATION

- EC.11.01 MIMS cables shall be in accordance with BS EN 60702-1:2002 and BS EN 60702-2:2002. 250 volt grade shall not be used except where specified in Section EL of the Specification Document.
- EC.11.02 The whole of the MIMS installation shall be carried out in accordance with the manufacturer's instructions, complete with supply and fixing of all seals, glands and connections etc., and the continuity resistance between the earth point and any other position in the completed installation shall not exceed the requirements of BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition.

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EC.11.0 MIMS CABLES AND INSTALLATION (Cont'd)

- EC.11.03 Cables shall be made off with ring type glands with screw on pot type seals utilising cold plastic compound and neoprene sleeving, all conforming to BS EN 60702-2:2002 and applied in the manner recommended by the manufacturer of the cable. Where ambient temperature is likely to exceed 150°C, medium temperature seals shall be used and complete with LSF (Low Smoke and Fume) shrouds and all fixing saddles shall be LSF (Low Smoke and Fume) coated or nylon throughout.
- EC.11.04 Where cables pass through wall and floors, they shall be protected by galvanised conduit bushed at both ends. Cables rising on external or exposed wall surfaces shall be protected by galvanised conduit to a height of 2 metres above ground level. The conduit shall be suitably bushed and sealed with MIMS sealing compound.
- EC.11.05 Where MIMS cables terminate into electric motors or similar equipment liable to vibration or movement, an expansion loop of a single coil of the cable shall be made before final connection.
- EC.11.06 Where cables do not terminated in a conduit box with spouts, they shall be fitted with a coupling and brass bush.
- EC.11.07 The cores of the cables shall be identified by means of coloured sleeves in accordance with BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition and BS.3858: 1992.
- EC.11.08 The whole of the system of cable and fittings shall provide both electrical and mechanical continuity and shall be efficiently earthed. Where the cable is cut, kinked, badly bent, shows signs of inferior workmanship, or an insulation reading less than 'infinity' is obtained, the Electrical Services Installer shall replace the defective cable or seals. All unmade ends of MIMS cables on site shall be sealed to prevent the ingress of moisture.
- EC.11.09 Wherever possible, the cable shall be covered with LSF (Low Smoke and Fume) oversheath.
- EC.11.10 The copper sheathing must not make casual contact with metal, gas or water pipes except when deliberately bonded to the latter by means of suitable earthing clips.

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EC.11.0 MIMS CABLES AND INSTALLATION (Cont'd)

EC.11.11 Cable trays shall be used to support cables where several are run together and shall be of the galvanised or coated type except that in dry non corrosive situations such as rising ducts the tray can be of the painted type.

EC.11.12 Cables shall be supported in accordance with the maximum spacing enumerated below using LSF (Low Smoke and Fume) coated fixing saddles, depending upon the size of cable:

Overall cable diameter (mm)	Horizontal (mm)	Vertical (mm)
Up to 9	600	800
10 to 15	900	1200
16 to 20	1500	2000
21 to 40	2000	3000

EC.11.13 Where cable runs are at less than 30° from the vertical they shall be fixed in accordance with the vertical maximum spacings and where more than 30° from the vertical they shall be fixed in accordance with the horizontal maximum spacings.

EC.11.14 Cables laid in the ground shall be protected with sand; interlocking tiles all and marker tape as for a paper and XLPE/SWA/LSF cable installation and shall be LSF oversheathed. Where ground subsidence may occur cable snakes shall be provided.

EC.12.0 PVC SINGLE CABLES

EC.12.01 All cables shall be LSF (Low Smoke and Fume) 600/1000 volt grade single core and shall comply with BS 6004:2000 and 6500:2000

EC.12.02 Cable colours shall conform to BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition.

EC.12.03 All single core PVC insulated cables shall be contained in conduit / trunking.

EC.12.04 All cables shall **only** be drawn in after the erection of the conduit and trunking systems complete with all outlet boxes etc. Cable runs between terminal points shall be installed without intermediate joints.

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EC.12.0 PVC SINGLE CABLES (Cont'd)

EC.12.05 Where it is necessary to make direct connection between the hard wiring and flexible cables, the wiring is to terminate in a circular conduit box behind the fitting which shall contain a porcelain shielded connector and heat resisting tails shall connect to the lampholder or luminaires.

EC.13.0 PVC INSULATED AND PVC SHEATHED CABLE INSTALLATION

EC.13.01 PVC/PVC cables shall be twin with earth continuity conductor and 600/1000 volt grade to BS.6004: 2000 and BS.6346: 1997.

EC.13.02 The wiring shall be carried out on the loop-in principle and no junction boxes will be permitted.

EC.13.03 Generally all cables shall be concealed in floor voids, in roof spaces and walls.

EC.13.04 All cables installed in walls shall be protected with earthed metal conduit.

EC.13.05 Cable routes are to be chosen so that the cables are kept away from water pipes, gas pipes, telephone and bell installations. They shall not be installed where ambient temperatures are likely to exceed 45°C.

EC.13.06 Cables run in roof spaces shall be secured at intervals not exceeding 200mm except that cable liable to mechanical stress shall be supported at all such places of stress.

EC.13.07 Where PVC/PVC cables are to be installed above suspended ceilings they shall be so supported in accordance with clause EC.05.

EC.13.08 Where a ceiling rose or ceiling mounted fluorescent luminaire is to be installed, the PVC fixed wiring cables shall terminate direct in the ceiling rose or luminaire.

EC.13.09 Where any other type of accessory or luminaire is to be installed e.g. batten holder, ceiling mounted tungsten or suspended tungsten, or fluorescent luminaire the PVC fixed wiring cables shall terminate in a fixed junction box within the ceiling void.

EC.13.10 Exceptionally where this method of termination is impracticable the PVC insulation is to be removed and the conductors fitted with insulating sleeves suitable for high temperature operation.

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**EC.13.0 PVC INSULATED AND PVC SHEATHED CABLE INSTALLATION
(Cont'd)**

- EC.13.11 In the case of fluorescent fittings the cable may be terminated at the manufacturers fitted terminals.
- EC.13.12 Where cables run through metalwork of switchgear, accessories or accessory boxes, all holes will be bushed before entry using nylon ring lock bushes.
- EC.13.13 No unsheathed portion of the cable is to be outside the box or equipment.

EC.14.0 FLEXIBLE CORDS

- EC.14.01 All flexible cords insulated with PVC, vulcanized rubber, butyl rubber, EP rubber or silicone rubber or glass fibre, shall be manufactured to BS 6007:2006 and BS.6500:2000.
- EC.14.02 The installation of flexible cords shall comply with BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition.
- EC.14.03 Flexible cords are to be 0.75mm² twin twisted round circular white finish and heatproof.
- EC.14.04 All flexible cables forming part of a luminaire are to be not less than 0.5mm² glass fibre insulated and all luminaires on site are to be pre-wired with this type of cable.
- EC.14.05 Multiple flex suspensions are to be wired with heatproof cables, white circular finish and provided with a steel suspension wire as part of the flexible. (It is to be noted that all luminaires specified for the installation are to comply with the above).
- EC.14.06 With regard to the usage of flexible cords, the Electrical Services Installer should, when ordering luminaires, ensure that the correct flexibles are provided with the fitting.
- EC.14.07 Connections from a ceiling box to the flexibles of a luminaire are to be by means of a mechanical connection, the connections being porcelain or other approved materials.
- EC.14.08 The connections are to be rated not less than the current rating of the cable so connected and under no circumstances are plastic type connectors to be used.

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EC.14.0 FLEXIBLE CORDS (Cont'd)

- EC.14.09 Wherever possible, use shall be made of 'plug-in' ceiling roses.
- EC.14.10 Flexible cables and cords shall have an earth conductor of sufficient length to ensure that no undue mechanical stress is placed on the conductor.
- EC.14.11 The length of flexible cables connecting to fixed equipment should not exceed 2000mm.

EC.15.0 CABLE MARKING AND IDENTIFICATION

- EC.15.01 All distribution boards and every outlet position (i.e. switches, T.S.S.O.'s, switched fused spur units, isolators and luminaires) shall have a plastic ferruled cable marking system at every termination indicating on each conductor:-
1. Distribution board reference (i.e.) DB/M as in distribution board Main.
 2. L-N-SW-E respectively with associated colours.
 3. Phase reference with respective colours.
 4. Circuit reference.

EC.16.0 SCREWED STEEL CONDUIT AND ACCESSORIES

- EC.16.01 The conduit and fitting used throughout the whole of the installation shall be in accordance with BS.4568 Parts 1:1970, AMD 1132:1973, AMD 5384:1987, BS EN 50086-1:1994, AMD 12052:2000, AMD 13548:2002 and BS EN 50086-2-1:1996, AMD 10513:2000, AMD 13547:2002 and shall not be less than 20mm in size.
- EC.16.02 A screwed conduit system must be mechanically and electrically continuous across all joints, so that the electrical resistance of the earthing lead, measured from the earth electrode or any other position, satisfies BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition.
- EC.16.03 Class 3 protection (Flocoat etc.) conduit shall be used throughout the installation except for external conduit runs and other areas where specified in Section L of the Specification, where Class 4 protection (galvanised internally and externally), shall be used.
- EC.16.04 No manufactured elbows, tees or purpose made bends will be permitted.

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EC.16.0 SCREWED STEEL CONDUIT AND ACCESSORIES (Cont'd)

- EC.16.05 Where conduits terminate in boxes which have no spout entry the connection of the conduit to the box shall be made by means of a hexagon smooth bore long reach brass male bush screwed from the inside of the box into a machine faced coupling on the end of the conduit, the whole to be screwed up tightly in such a manner that there are no exposed threads.
- EC.16.06 The smooth brass bushes shall be tightened with spanners and if any bushes become marked or mutilated they shall be replaced. No type of ring bush shall be used in the installation.
- EC.16.07 Conduit shall be mechanically and electrically continuous, tightly screwed between various lengths so that they butt together at the centre of the coupling joints, and against the shoulder provided in conduit boxes.
- EC.16.08 There shall be no exposed threads after erection of conduit, except at running joints use of which shall be kept to a minimum.
- EC.16.09 All exposed threads shall be painted using a zinc rich paint.
- EC.16.10 All conduit runs are to be kept as straight as possible and the conduit system shall be carefully planned and erected to avoid all unnecessary bends, sets or changes of direction.
- EC.16.11 The distance between draw in boxes shall not exceed two conduit lengths.
- EC.16.12 Conduit shall have no more than two right angle bends without the provision of a draw-in box.
- EC.16.13 Saddles shall be fixed at a maximum distance between saddles of 1.2 metres.
- EC.16.14 Conduit shall be cleaned of all lubricant and swarf internally and externally. Internal cleaning shall be achieved by use of a "draw-rag" pulled through its entire length.
- EC.16.15 The whole of the conduit system shall be swabbed clean before any cables are drawn in. The interior of conduit ends shall be reamed to ensure that the edge of the cut is smooth and free from defects. Where conduits ends have to be left open, stop ends shall be fixed to prevent the entry of rubbish. Wood plugs or rag will not be allowed.

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EC.16.0 SCREWED STEEL CONDUIT AND ACCESSORIES (Cont'd)

- EC.16.16 Where the finish has been chipped or damaged, the Electrical Services Installer shall apply a liberal coating of red oxide paint, followed by a top coat of appropriate colour.
- EC.16.17 Conduits shall be installed for a looped wiring and inspection system in such a manner that the wiring can be carried out from fittings or accessory boxes.
- EC.16.18 Ceiling boxes fitted whilst the building is in the course of erection shall be fixed as nearly flush with the surface of the ceiling as possible, collar extension rings being introduced when the runs are not within 7.5mm of the finished surface.
- EC.16.19 Break joint rings or flanges shall be fitted between boxes and ceiling roses and fitting back plates to make the surface joint.

EC.17.0 ALTERNATIVE METAL CONDUIT

- EC.17.01 The system shall consist of plain ended conduit tube located into special malleable iron or pressed steel fittings, which shall **fully** comply with BS.4568 Parts 1:1970, AMD 1132:1973, AMD 5384:1987, BS EN 50086-1:1994, AMD 12052:2000, AMD 13548:2002 and BS EN 50086-2-1:1996, AMD 10513:2000, AMD 13547:2002.
- EC.17.02 Both the malleable iron and pressed steel fittings shall be so constructed that where joints are formed between the plain ended conduit and appropriate fittings, a positive connection is made to ensure both mechanical rigidity and electrical continuity.
- EC.17.03 It is important that the above fixing method should not be fully tightened until the conduit installation has been completed and finalised to prevent any possibility of loose joints thereby destroying the mechanical stability and electrical continuity of the system.
- EC.17.04 The Electrical Services Installer is to ensure that all the required fixing between the plain ended conduit and fittings are correctly installed, and the electrical continuity of the system is to be tested.
- EC.17.05 Where this type of conduit system is employed, a separate circuit protective conductor shall be installed as indicated in Section EL of the Specification Document.
- EC.17.06 Any system used shall have the appropriate Assessment of New Techniques Certificate.

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EC.18.0 FLEXIBLE STEEL CONDUIT

- EC.18.01 Flexible steel conduit and adaptors shall conform to BS EN 50086-2-3:1996, AMD 10515:2000 and AMD 13549:2000 and shall be utilised at structural expansion joints and at equipment which is adjustable or liable to vibration.
- EC.18.02 All flexible conduit shall be LSF (Low Smoke and Fume) covered flexible steel.
- EC.18.03 The minimum size of flexible conduit shall be 20mm, and all fittings shall have a metric thread.
- EC.18.04 The maximum length of flexible conduit shall not exceed 2 metres.
- EC.18.05 The maximum distance between supports shall be 500mm.
- EC.18.06 In all cases a separate circuit protective conductor shall be installed and solid type adaptors, with a suitable hole and external lug for connection of the circuit protective conductor shall be used.

EC.19.0 PLASTIC CONDUIT AND ACCESSORIES

- EC.19.01 All plastic conduits shall be white finish, or as indicated in Section L of the Specification, heavy gauge super high impact rigid round PVC 20mm minimum diameter, plain entry unscrewed type and manufactured in accordance with BS EN 50086-1:1994, AMD 12052:2000, AMD 13548:2002 and BS EN 50086-2-1:1996, AMD 10513:2000, AMD 13547:2002.
- EC.19.02 All accessories shall be super high impact PVC manufactured in accordance with BS EN 50086-1:1994, AMD 12052:2000, AMD 13548:2002 and BS EN 50086-2-1:1996, AMD 10513:2000, AMD 13547:2002.
- EC.19.03 Rigid plastic conduit systems shall only be used where the ambient temperature is above -50°C and below 60°C and must not support a mass greater than 3kg.
- EC.19.04 Conduits up to 25mm may be bent cold using the correct size bending spring and those above 25mm must be bent using the hot bending method in strict accordance with the manufacturer's recommendations.
- EC.19.05 Conduit shall be cut with proprietary brand cutting tool.
- EC.19.06 Conduits shall be cleaned of all debris and adhesive after fixing.

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EC.19.0 PLASTIC CONDUIT AND ACCESSORIES (Cont'd)

- EC.19.07 The distance between draw in boxes shall not exceed two conduit lengths.
- EC.19.08 Conduit shall have no more than two right angle bends without the provision of a draw-in box.
- EC.19.09 Conduit shall be securely fixed to the fabric of the building at each conduit box and shall be further fixed using a proprietary brand space bar saddle.
- EC.19.10 Saddles shall be fixed at a maximum distance between saddles of 600 mm.
- EC.19.11 Joints between conduit fittings shall be affected using push fit couplings and accessories, and the correct solvent adhesive. In runs exceeding 6.0m in length, an expansion coupler shall be fitted and so arranged that it has an expansion gap of 12.00mm. At this position the couplers and conduit shall be sealed using mineral jelly, which will not set hard, and not a PVC solvent. Conduit ceiling boxes used for supporting luminaires shall include a situ steel inserts to provide additional support and to overcome the problems of heat conduction when using enclosed luminaires.

EC.20.0 FIXING OF CONDUIT AND ACCESSORY BOXES (ALL TYPES)

- EC.20.01 All conduits shall be installed at least 150mm clear of, and preferably under hot water pipes and 50mm clear of gas, water and other services. If it is necessary for the hot water services to pass within 50mm of the conduit then thermal insulation is to be provided between the conduit and hot water pipes.
- EC.20.02 The Electrical Services Installer shall pay particular attention to the method of fixing switchboxes, socket outlet boxes, etc., so that these will, when completed, be in an exact position relative to the finished wall surface to permit the cover plates to be fixed accurately.
- EC.20.03 The Electrical Services Installer shall ensure that any discrepancy between the face of the box and the finished wall surface is remedied by the use of an extension collar.
- EC.20.04 The Electrical Services Installer shall be held fully responsible for any faults or inaccuracies in this respect. Boxes shall be fitted by at least two screws of approved size and be round headed brass or electro zinc plated.

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EC.20.0 FIXING OF CONDUIT AND ACCESSORY BOXES (ALL TYPES)
(Cont'd)

- EC.20.05 Accessory boxes shall be suitable for flush or surface mounting, as indicated. Unless otherwise indicated, metal boxes for general use inside buildings shall be of steel with medium category of protection against corrosion; for use in plant rooms they shall be steel with heavy category of protection; and for use outside buildings and in other locations as indicated they shall be cast iron with heavy category of protection or of a corrosion proof material.
- EC.20.07 Accessory boxes shall be of adequate depth to accommodate the accessories without causing compression of the cables. Generally boxes shall be 35mm deep.
- EC.20.08 Earthing terminals shall be fixed inside each accessory box and on the grids of gridswitches. The earthing terminal of each grid shall be connected by a separate protective conductor to the earthing terminal of the box.
- EC.20.09 Front plates of accessories shall be of the material and finish as indicated, but generally the finish of various types of accessories in the same area shall match. For flush mounting the plates shall overlap the boxes; for surface mounting the plate shall match the profile of the box, without overlap.
- EC.20.10 Where indicator lamps are required they shall comprise a neon lamp with resistor and a red coloured lens, unless otherwise indicated.
- EC.20.11 Accessories with their boxes and front plates shall provide a minimum degree of protection of IP41 when used inside building and IP44 when used outside buildings or at other locations where indicated.
- EC.20.12 Conduit fixed on the surface of walls and ceilings etc. are to be secured by means of distance saddles, and the following fixing centres are not to be exceeded.

Conduit diameter (mm)	Horizontal (mm)	Vertical (mm)
20	1200	1500
25	1200	1500
32	1500	1750

- EC.20.13 Additional saddles shall be provided at not more than 300mm from joints, bends, accessory boxes and at the point of emergence from floor or ceilings.

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EC.20.0 FIXING OF CONDUIT AND ACCESSORY BOXES (ALL TYPES)
(Cont'd)

- EC.20.14 Drainage holes or 'Tee' boxes with short length spouts shall be installed at the discretion of Contract Administrator, at the lowest part of the installation to allow ventilation of wiring and drainage of moisture due to condensation.
- EC.20.15 In positions where the appearance of the conduit run is likely to be enhanced by the introduction of dummy lengths of conduits, and in all positions where a more secure fixing for the suspension of equipment, luminaires, etc. would be obtained, then the conduit will be extended beyond the normal terminations, by such dummy conduits and extensions.
- EC.20.16 Conduits throughout the installation shall be of sufficient diameter and so arranged with draw-in boxes to permit the easy draw-in or withdrawal of one or all cables. The number of cables contained in a conduit shall in no way exceed that as indicated in BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition.

EC.21.0 CABLE TRAYS

- EC.21.01 The Electrical Services Installer shall provide and install perforated mild steel cable trays above suspended ceilings and in ducts etc. as indicated in Section EL of the Specification.
- EC.21.02 The cable trays shall be constructed of 16 s.w.g. mild steel and galvanised finish. Cable tray bends and tees shall be purpose made and have a similar type and finish.
- EC.21.03 Cable tray shall be run continuously and all lengths of cable tray shall be inter-connected by means of purpose made couplers and bonded to ensure continuous earthing along all cable tray runs.
- EC.21.04 The cable tray shall be loaded in accordance with manufacturer's recommendations and shall be supported at intervals of no more than 2m utilizing trapeze / wall brackets to suit conditions and to the approval of the Contract Administrator.

EC.22.0 CABLE BASKET (STEEL WIRE CABLE TRAY)

- EC.22.01 The Electrical Services Installer shall provide and install cable baskets above suspended ceilings and in ducts etc. as indicated in Section EL of the Specification Document.

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EC.22.0 CABLE BASKET (STEEL WIRE CABLE TRAY) (Cont'd)

- EC.22.02 The cable baskets shall be manufactured from mild steel wires, of diameter 4.5mm –7mm (dependant on basket width) and galvanised finish. Bends and Tees shall be site constructed to manufacturer's recommendations and have a similar type and finish.
- EC.22.03 All lengths of cable basket shall be inter-connected by means of coupling clamps incorporating earthing terminals to ensure continuous earthing along all basket runs.
- EC.22.04 The cable baskets shall be loaded in accordance with manufacturer's recommendations and shall be supported at intervals of no more than 2m utilizing trapeze / wall brackets to suit conditions and to the approval of the Contract Administrator.
- EC.22.05 When formed the cable baskets shall be fitted with spacers to give separation to the different cabling systems installed in the basket. These separate compartments shall be fitted with ID Labels every 3M along it's length.

EC.23.0 STEEL CABLE TRUNKING

- EC.23.01 The trunking system shall be zinc coated mild steel dimensioned as shown in Section EL of the Specification Documentation and/or on the Contract Drawings. All bends, tees couplings and accessories shall be a standard pattern produced by the manufacturer.
- EC.23.02 Trunking and fittings shall comply with BS.4678 Part 1:1971, AMD 1125:1973, AMD 2679:1978, AMD 5485:1988 BS.4678 Part 2:1973. Generally trunking and fittings shall be protected in accordance with Class 2. Class 3 protection shall be used in damp situations.
- EC.23.03 Where conduit entries are made, the conduit shall terminate at the trunking by means of a hexagon smooth bore brass male bush screwed from the inside of the trunking into a machine faced coupling on the end of the conduit, the whole to be screwed up tightly in such a manner that there are no exposed threads.
- EC.23.04 Trunking shall have all sharp edges, burrs and swarf removed internally and externally.
- EC.23.05 The trunking shall be butted solidly into all fittings so as to ensure a continuous mechanical installation.

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EC.23.0 STEEL CABLE TRUNKING (Cont'd)

EC.23.06 Visible earth continuity links shall be fitted to each joint in the trunking system.

EC.23.07 Trunking shall be supported in accordance with the maximum spacing enumerated below using 'unistrut' type supports and with the lid fitted to underside:

Trunking Size (mm)	Horizontal (mm)	Vertical (mm)
Up to 25 x 25	750	1000
Up to 50 x 25	1250	1500
Up to 50 x 50	1750	2000
Up to 100 x 50	3000	3000

EC.23.08 Internal cable supports shall be provided every 500mm throughout the length of the trunking and cable supports (pin supports) shall be inserted every 1 metre in vertical runs.

EC.23.09 Where trunking passes through floors and partitions, which form fire barriers, internal fire barriers to the equivalent standard shall be fitted.

EC.24.0 PLASTIC CABLE TRUNKING

EC.24.01 Plastic cable trunking and accessories shall comply with BS.4678 Part 4:1982, AMD 4948:1985.

EC.24.02 Heavy duty or appropriate clip-on lid trunking shall be used for multiple circuitry as indicated in Section EL of the Specification Document.

EC.24.03 Expansion joints with gaps shall be incorporated in all runs, and external couplings shall have elongated slots and fixing holes should be drilled oversize to give freedom for linear movement.

EC.24.04 Where trunking is suspended, stirrup type supports should be at a maximum spacing enumerated below:

Trunking Size (mm)	Horizontal (mm)	Vertical (mm)
Up to 25 x 25	500	500
Up to 50 x 25	500	500
Up to 50 x 50	1250	1250
Up to 100 x 50	1750	2000

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EC.24.0 PLASTIC CABLE TRUNKING (Cont'd)

EC.24.05 In warm atmospheres or sunlight, supports shall be located at a maximum of 1 metre.

EC.24.06 In instances where trunking is to be suspended it shall be installed as follows:-

- i) A suitable sized metal tray or batten shall be firmly fixed to the fabric of the building by means of proprietary brand hangers and brackets.
- ii) The trunking shall be firmly fixed to the tray/batten using pan head screws, nuts and washers.

NOTE: The screw head shall be on the inside of the trunking.

EC.24.07 Where trunking is used as lighting trunking the support of luminaires should approximately coincide with trunking suspensions.

EC.24.08 The trunking shall be installed complete with manufacturers bends, bridges etc.

EC.24.09 Adhesive to be used shall be that recommended by the trunking manufacturer.

EC.24.10 The trunking shall be butted solidly and cemented (using the manufacturer's approved adhesive) into all fittings.

EC.24.11 PVC trunking shall only be used within areas where the ambient temperature is between -5°C and 60°C.

EC.24.12 Where trunking passes through the building structure, it shall be installed with a fixed section of lid. Such fixed sections shall be restricted to the absolute minimum length necessary.

EC.25.13 All trunking and accessories should be of one manufacturer.

EC.25.0 LIGHTING SWITCHES

EC.25.01 Wall mounted lighting switches are to be 'Gridswitch' 15/20 amp or 'Rockergrid' 20 amp or approved equivalent flush or surface pattern, dependent upon the type of installation compliant with BS EN 60669-1:2000, AMD 12098:2001.

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EC.25.0 LIGHTING SWITCHES (Cont'd)

- EC.25.02 One make of lighting switch and cover plate is to be used throughout the installation.
- EC.25.03 The coverplate finish is to be as detailed in Section EL of the Specification Document.
- EC.25.04 Ceiling light switches shall comply with BS EN 60669-1:2000, AMD 12098:2001 and be rated as detailed in Section EL of the Specification Document.

EC.26.0 SOCKET OUTLETS AND ACCESSORIES

- EC.26.01 Socket outlets and accessories shall conform to BS 1363-1:1995, and AMD 9541:1997, but shall be of the same manufacture and finish as the lighting switches, surface or flush dependent upon the type of installation.
- EC.26.02 Where ring circuits are specified no spurs will be allowed.
- EC.26.03 Where RCD sockets are specified they shall conform to BS 7288:1990
- EC.26.04 Plug tops correctly fused shall be connected to the flexible cords of the equipment detailed in Section L and/or on drawings provided that the equipment is delivered to site before the final completion of the installation. Plug tops and shall conform to BS 1363-1:1995, and AMD 9541:1997, and BS 1363-2:1995, and AMD 9542:1997

EC.27.0 SAFETY ISOLATING TRANSFORMERS

- EC.27.01 Safety isolating transformers shall be fixed type and their enclosures shall provide a minimum degree of protection of IP44. The nominal rated input voltage shall be 240 volts and tappings shall be provided on the input winding for alternative input voltages of 230 volts and 250 volts. The output windings shall be centre tapped and the tapping connected to earth.
- EC.27.02 Cartridge fuses or MCB's shall be provided to protect the input winding and both poles of each outgoing circuit.
- EC.27.03 Transformers supplying only hand lamps and bench lamps shall comply with Section E of BS 3535; they shall have an output voltage of 50 volts and a rated output of 100VA. One socket outlet shall be mounted on the transformer enclosure and terminals shall be provided within the enclosure for two other outgoing circuits.

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EC.27.0 SAFETY ISOLATING TRANSFORMERS (Cont'd)

- EC.27.04 Transformers supplying portable tools or other equipment shall comply with Section D of BS 3535; they shall have dual secondary windings with rated outputs of 400VA at 110 volts and 100VA at 50 volts. Two socket outlets shall be mounted on the transformer enclosure, one for each voltage; in addition, terminals shall be provided within the enclosure for two other outgoing circuits for each voltage.
- EC.27.05 Socket outlets for 50-volt circuits shall be rated at 5A and for 110-volt circuits they shall be rated at 16A.
- EC.27.06 A separate terminal shall be provided for each outgoing conductor; bunching of conductors in one terminal will not be accepted. Conduit entries shall be provided for input and output cables.
- EC.27.07 Transformers for bell or alarm circuits shall comply with Section B or C of BS3535, as appropriate, and shall be suitably rated for the connected load.

EC.28.0 ROOM THERMOSTATS

- EC.28.01 Room thermostats shall comply with BS 3955. Switches shall be single pole, single throw, and rated at 250 volts unless otherwise indicated; the rated current shall be as indicated.
- EC.28.02 Thermostats shall be adjustable and shall have a visible indicator and a calibrated temperature scale. Adjustment shall not require a special tool and fixed covers shall be provided to prevent tampering by unauthorised persons.
- EC.28.03 No provision for manual overriding of the thermal switching shall be included, unless otherwise indicated.
- EC.28.04 Thermostats shall be suitable for mounting direct on to a circular conduit box.

EC.29.0 TIME SWITCHES

- EC.29.01 Unless otherwise indicated, time switches shall be self-starting, self-winding, quartz motor or electronic type rated at 250 volts. The motor shall be protected by a fuse which shall be easily accessible. The rated current of the switch shall be 16A minimum.

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EC.29.0 TIME SWITCHES (Cont'd)

EC.29.02 Time switches shall be of the plug-in or din rail type as appropriate.

EC.29.03 Unless otherwise indicated, quartz time switches shall incorporate the following: not less than a 150-hour spring reserve; a 24-hour dial with a single pole, single throw, switch; a day-omitting device; an ON-OFF manual switch which does not disturb the normal dial settings.

EC.29.04 Unless otherwise specified electronic time switches shall be single channel, 24 hour/7 day switching programme, 1000 hour power reserve, day and time unit, summer/winter time change, manual override and at least 4 ON/OFF switching programmes per day.

EC.30.0 TERMINAL BLOCKS

EC.30.01 Terminal blocks shall comprise connectors contained within a moulded housing.

EC.30.02 Conductors shall be clamped between metal surfaces and no screws shall make direct contact with conductors. The design shall be such as to maintain sufficient contact pressure to ensure connections of negligible impedance at all times.

EC.30.03 Metal in contact with conductors shall be 85% copper alloy and any screws shall be of metal that is electrolytically compatible with the copper alloy. The moulded housing shall be of an insulating material suitable for the maximum operating temperature of the conductors.

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EC.31.0 MOUNTING HEIGHTS

EC.31.01 Mounting heights shall be in accordance with the Table below unless otherwise indicated.

Accessories or Equipment	Location or Function	Height mm AFFL
Lighting switch	General	1400
	Disabled	1000
Socket outlet	General	400
	Kitchens	1200
	Disabled facilities	1000
	Above worktops	200
	External	1000
	Above worktops	1400
	Car parks & garages	See Note 4
Shaver socket outlet		1400
Fused connection unit	General	To suit equipment served
	Above worktops	200
Cooker control unit		1400
Cooker connection outlet		600
Safety isolating transformer		1400
Room thermostat		1600
Telephone outlet		400
Radio/TV outlet		400
Pushbutton		1400
Bell or buzzer		2200

NOTES:

1. Heights are from finished floor level to the centre of the accessory or equipment, except in the case of worktops when the measurement shall be from the worktop surface.
2. If the specified height of an accessory coincides with the top of tiling, the accessory shall be mounted above the tiling, leaving a clear gap of 50mm.
3. Where apparatus is located underneath a worktop the accessory shall be mounted 100mm below the underside of the worktop.
4. In car parks and garages the heights shall comply with appropriate regulations relating to the presence of petroleum vapour.

EC.31.02 Where difficulty in locating accessories or equipment occurs the Contract Administrator shall be informed

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EC.32.0 LUMINAIRES- GENERAL

- EC.32.01 The Electrical Services Installer shall supply, install and connect luminaires as detailed in Section L of the Specification Document and/or on drawings complete with lamps/tubes whether separately specified or not. All luminaires shall conform to BS 4533-102:1990, BS 4533-102.22:1990 and BS EN 60598-2-22:1999.
- EC.32.02 Where lamps are not separately specified the Electrical Services Installer shall include for the provision of good quality low energy lamps/tubes to BS 1853-2:1995, BS EN 60064:1996, BS EN 60432-1:2000, BS EN 60432-2:2000, BS EN 60081:1998, BS EN 60901:1996, AMD 9782:1998 and AMD 12081:2001.
- EC.32.03 Unless otherwise agreed by the Main Contractor, no luminaires shall be erected until the decoration works have been finally completed

EC.33.0 LUMINAIRES- POINT POSITION

- EC.33.01 Luminaires shall be installed in the centre of the various rooms, unless dimensioned otherwise in Section EL of the Specification Document and/or on the Contract Drawings.
- EC.33.02 Where ceiling finish is to include ceiling tiles, particular care shall be taken in setting out to ensure that the luminaire points are symmetrically disposed in relation to the ceiling panels and except where specified in Section EL of the Specification Document and/or on the Contract Drawings, the centre of the luminaire points shall coincide with the centres of the ceiling panels.

EC.34.0 LUMINAIRES- FIXINGS

- EC.34.01 Surface mounted luminaires shall be securely fixed direct to conduit boxes, unless otherwise approved by the Contract Administrator. The fixing shall be made by means of brass machined screws inserted into the tapped holes in the box lugs.
- EC.34.02 Luminaires shall only be secured direct to a suspended ceiling if the luminaire forms an integral part of such a ceiling and then by purpose made fixings as recommended by the respective manufacturer.
- EC.34.03 The Electrical Services Installer shall include for all fixings whether separately specified or not and no additional claims shall be made for such fixings unless brought to the attention of the Contract Administrator at the time of tender submission.

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EC.34.0 LUMINAIRES- FIXINGS (Cont'd)

- EC.34.04 Under no circumstances shall a luminaire be secured to ceiling boards alone, but suitable wooden battens shall be fixed above the ceiling to take the weight of the luminaire.
- EC.34.05 Where suspended ceilings cannot support the weight of the luminaires these shall be suspended directly from the structural ceiling using the appropriate number of suspensions as recommended by the luminaire manufacturer to suit the particular luminaire.
- EC.34.06 A white break-joint ring shall be provided, where necessary, to enhance the appearance between the luminaire and outlet box.

EC.35.0 TUNGSTEN TYPE CLOSE CEILING MOUNTED LUMINAIRES

- EC.35.01 The Electrical Services Installer shall allow for a flush type conduit box, with white break-joint provided between the luminaire and ceiling to form a heat sink and to allow circulation of air around the luminaire.

EC.36.0 FLUORESCENT TYPE CLOSE CEILING MOUNTED LUMINAIRES

- EC.36.01 The Electrical Services Installer shall allow for a space to be provided between the luminaire and ceiling where the latter is non-fire rated, unless the luminaire complies with the Mark safety requirements. The space shall be a minimum of 6mm.

EC.37.0 TUNGSTEN TYPE SUSPENDED LUMINAIRES

- EC.37.01 The Electrical Services Installer shall allow in his tender for any modification to the manufacturers standard suspension in order to comply with the requirements relative to mounting heights. In the event of extra long stems or chains being required for luminaires, the Electrical Services Installer shall order the stems or chains, concurrent with the luminaires. Modifications shall be effected only for the purpose of shortening the standard suspension stems or chains, but the fundamental method of suspension shall not differ from that adopted by the manufacturer.

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EC.38.0 FLUORESCENT TYPE SUSPENDED LUMINAIRES

- EC.38.01 The Electrical Services Installer shall allow for fluorescent luminaires to be suspended by means of conduit tube suspensions unless specified otherwise in Section EL of the Specification Document.
- EC.38.02 Tube suspensions shall incorporate non-rigid connections to the general conduit system (i.e. hook plate or ball and socket type).
- EC.38.03 Where chain suspensions are specified, these shall comprise heavy duty suspension sets, incorporating dome hook plates, lengths of galvanised steel chain and suspension hooks complete with back nuts and washers. Where the length of chain is less than 1 metre, a plug in type ceiling rose shall be installed for each luminaire. Where the length of chain is more than 1 metre, a three pole in-line flat connector shall be installed in the flexible cord, within 150mm of the luminaire.

EC.39.0 LAMP HOLDERS

- EC.39.01 Lampholders shall be of the insulated heat resistant type and shall incorporate a metal lined insert where the lamp enters the lampholder. Lampholders shall be fitted with cord grip and shade carrier and be white finish and conform to BS.7895: 1997, AMD 9884:1998, BS EN 61184:1997, AMD 13193:2001.

EC.40.0 CEILING ROSES

- EC.40.01 Ceiling Roses shall be provided with an earth terminal and shall be white finish and conform to BS.67 1987.

EC.41.0 BATTEN HOLDERS

- EC.41.01 Batten Holders shall be installed in bathrooms, and other positions where indicated in Section EL of the Specification Document and/or on drawings. These shall be provided with an earth terminal, shall be fitted with a protective shield complying with BS EN 61184:1997, AMD 13193:2001, and provided with heat resisting tails and white finish.

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EC.42.0 LAMPS AND TUBES

- EC.42.01 Luminaires shall in all cases except where indicated in Section EL of the Specification Document and/or on drawing be provided with lamp and tubes.
- EC.42.02 Tungsten Lamps shall be of the coiled coil type 250 volt and shall be pearl finish when installed in open shades.
- EC.42.03 Fluorescent tubes shall be white unless otherwise specified in Section EL of the Specification Document and/or on the Contract Drawings.
- EC.42.04 Lamps and tubes shall be fitted at the conclusion of the electrical installation works unless otherwise approved by the Contract Administrator.

EC.43.0 DIFFUSERS AND GLASSWARE

- EC.43.01 Diffusers and glassware shall be fitted at the conclusion of the electrical installation works unless otherwise approved by the Contract Administrator.
- EC.43.02 Prior to handover the diffusers and glassware shall be cleaned to the approval of the Contract Administrator.

EC.44.0 APPROVED METHODS OF CONNECTING LUMINAIRES

- EC.44.01 Approved methods of connecting light fittings are as follows:-
- Terminated direct to luminaire.
 - Final connection via heat resistant flex and 'plug – in' ceiling rose flex to any one luminaire shall not exceed 2m in length.
- EC.44.02 Under no circumstances shall any luminaire be used as a through box.
- EC.44.03 No cable or flex shall be allowed to pass or come into contact with the luminaire's choke and/or control gear

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EC.45.0 EARTHING AND BONDING – GENERAL

- EC.45.01 All earthing and bonding shall be carried out in accordance with the requirements of:
- i) BS 7671: 2008, Requirements for Electrical Installations Wiring Regulations Seventeenth Edition.
 - ii) Any requirements of the Statutory Electricity Supply Authority.
 - iii) Any conditions indicated elsewhere in the Specification, in Section EL or on the drawings.

EC.46.0 EARTHING AND BONDING - EXTRANEOUS CONDUCTIVE PARTS

- EC.46.01 Sinks, baths and metal work surfaces are generally shown on the Contract Drawings. Where such items are identified, and notwithstanding their individual resistance to earth, and Electrical Services Installer shall install a 10mm² insulated bonding conductor with earth clamps to BS.951 between all incoming metallic water pipes and all outgoing metallic waste pipes.
- EC.46.02 The Electrical Services Installer shall include for testing, during building construction, the resistance, to the installation main earthing terminal, of all extraneous conductive parts such as exposed pipework, radiators, boilers, water tanks, structural and non-structural metalwork.
- EC.46.03 Where suspended floors form part of the fabric structure the Electrical Services Installer shall include for supplementary bonding the flooring grid pedestals at multiples of nine tiles in addition to the manufacturer's lay-in contacts.
- EC.46.04 Where the resistance is greater than 0.5 ohms the Electrical Services Installer shall install supplementary equipotential conductors, the cost of which will be met as an addition to the Contract, however, the Contract Administrator must be informed of each individual case before the work is carried out.

EC.47.0 LABELLING

- EC.47.01 Every switch or circuit breaker shall be labelled to indicate the apparatus or circuit controlled.
- EC.47.02 The labels shall be ivory or similar non-corrodable material and fixed to the cover of the units with aluminium or brass screws. **ADHESIVE OR DYMOTAPE LABELS WILL NOT BE ACCEPTED.**

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EC.47.0 LABELLING (Cont'd)

- EC.47.03 Circuit labels, neatly typed and enclosed in a plastic envelope shall indicate the position, number of outlets/luminaires fed, approximate load and size of each fuse or circuit breaker. **HAND WRITTEN LABELS WILL NOT BE ACCEPTED.**
- EC.47.04 Each single phase distribution board shall be marked to indicate the phase to which it is connected by means of a circular ivory or similar label approximately 15mm in diameter attached to the fuseboard by means of a brass screw. The label shall be coloured according to which phase the board is connected to.
- EC.47.05 The Electrical Services Installer shall leave in position on all equipment, of which he is not the actual manufacturer, the manufacturer's plate or markings normally attached thereto by the manufacturer of such equipment supplied for the purpose of the contract.
- EC.47.06 He is, however, at liberty to fix to equipment not manufactured by himself, a plate in the form to be agreed with the Contract Administrator, having the words 'Supplied by'. Under no circumstances shall equipment not manufactured by the Electrical Services Installer, be devoid of ready means of identification to enable replacement parts to be obtained from the manufacturer.
- EC.47.07 Each socket outlet, light switch, connection unit etc shall be labelled with its circuit reference e.g. DB1/L1/11, DB1/L2/11 DB1/L3/11 using 3mm black lettering on white traffolyte label permanently fixed to the faceplate.
- EC.47.08 Connection units or DP switches serving fixed equipment shall be labelled or engraved with the name of the item being used

EC.48.0 GENERAL SPARES

- EC.48.01 All spares shall be delivered to the Contract Administrator at the time the building is handed over, and an official receipt obtained.

EC.49.0 SPARES - H.R.C. FUSES

- EC.49.01 The Electrical Services Installer shall supply 25% spare fuses with a minimum of three of each type and size used in the installation.

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EC.50.0 SPARES - MOULDED CASE CIRCUIT BREAKERS

EC.50.01 The Electrical Services Installer shall supply one spare M.C.C.B. of each type and size used in the installation.

EC.51.0 SPARES - MINIATURE CIRCUIT BREAKERS

EC.51.01 The Electrical Services Installer shall supply two spare MCB's of each type and size used in the installation.

EC.52.0 SPARES - FUSES FOR 13 AMP PLUG TOPS

EC.52.01 The Electrical Services Installer shall supply 25% spare fuses with a minimum of three of each size used in the installation.

EC.53.0 KEYS AND SPECIAL TOOLS

EC.53.01 Where the contract includes the installation of key operated equipment and special fittings the Electrical Services Installer is to supply a duplicate set of keys and special tools to the Contract Administrator and receive an official receipt.