

TRADE PREAMBLES

ELECTRICAL ENGINEERING SERVICES

Version 2010.01

**P Parkes MRICS
Head of Property Services**

**P N Harris CEng CEnv CMgr FCIBSE MIEE MEI MCMi MBIFM
Chief Engineer**

**N Papadopoulos BSc CEng MCIBSE
Principal Electrical Engineer**

These Trade Preambles form the County Council's standard technical requirements for electrical engineering installations, and shall be retained by the Contractor and referred to at the time of Tender, and complied with when carrying out works on the basis of:-

- (1) Emergency Maintenance and Request Orders
- (2) Specifications for Maintenance Contracts and Minor Works Contracts
- (3) Specifications for Capital Works Contracts.

CONTENT

PART 1 - GENERAL		PAGE NO.
1-1	SCOPE	1
1-2	REGULATIONS	1
1-3	WORKING DRAWINGS	1
1-4	DEFECTS LIABILITY PERIOD	1
1-5	BUILDERS WORK	2
1-6	ASBESTOS INSULATION	2
1-7	OPERATION AND MAINTENANCE INSTRUCTIONS	2
1-8	RECORD DRAWINGS	3
1-9	WIRING DIAGRAMS AND PRE-WIRED EQUIPMENT	3
1-10	ELECTRICAL SHOCK NOTICE	3
1-11	DISTRIBUTION DIAGRAMS	3
1-12	CIRCUIT LISTS	4
1-13	LABELS	4
1-14	COMPLETION CERTIFICATES	4
1-15	INSPECTION CERTIFICATES	4
1-16	TESTING	5
1-17	POSITIONS OF POINTS AND EQUIPMENT	5
1-18	MATERIALS	5
1-19	MATERIALS REMOVED	5
1-20	PROGRAMME OF WORKS	5
1-21	SCHEDULE OF RATES	6
1-22	CLEARING	6
PART 2 - SWITCHGEAR AND DISTRIBUTION EQUIPMENT		
2-1	SWITCHGEAR AND DISTRIBUTION EQUIPMENT	7
2-2	DISTRIBUTION BOARDS	7
2-3	ISOLATORS	7
PART 3 - PAPER INSULATED AND ARMoured DISTRIBUTION CABLING		
3-1	PILCSWASO	9
3-2	PVC/SWA/PVC	9
3-3	XLPE/SWA/PCV	9
3-4	XLPE/SWA/LSF	9
3-5	ROUTE OF SWA CABLES	9

3-6	TESTING	9
3-7	CABLE ACCESSORIES	9
3-8	UNDERGROUND CABLES	9
3-9	JOINTING	10
3-10	CABLE LABELLING	10
PART 4 - MINERAL INSULATED CABLES		
4-1	GENERAL	11
4-2	SIZES	11
4-3	INSTALLATION	11
4-4	FIXINGS	12
4-5	COLOUR	12
4-6	TERMINATIONS	12
4-7	TESTING	12
PART 5 - FP 200 FIRE RESISTANT CABLE		
5-1	INSTALLATION AND TERMINATIONS	13
5-2	FIXING	13
5-3	JOINTING	13
PART 6 - WIRING CABLES		
6-1	CABLES IN CONDUITS AND TRUNKING	14
6-2	FLEXIBLE CABLES	14
6-3	PVC/PVC CABLES	14
PART 7 - CABLE TRAY		
7-1	CABLE TRAY	16
7-2	CABLE BASKET	16
PART 8 - CONDUIT/TRUNKING		
8-1	STEEL CONDUIT	18
8-2	SURFACE CONDUIT	19
8-3	CONDUIT IN CEILING VOIDS	20
8-4	GALVANISED CONDUIT	20
8-5	CONDUIT BOXES	20
8-6	FLEXIBLE CONDUIT	21
8-7	LSOH CONDUITS	21
8-8	STEEL CABLE TRUNKING	21

8-9	PVC CABLE TRUNKING	22
8-10	PVC MINIATURE TRUNKING	23
PART 9 - WIRING ACCESSORIES		
9-1	GENERAL	24
9-2	LIGHTING SWITCHES	24
9-3	SOCKET OUTLETS	24
9-4	CONNECTION UNITS (FUSED SPURS)	24
9-5	POWER SWITCHES	25
9-6	COOKER CONTROLS	25
9-7	CLOCKS	25
9-8	MOUNTING HEIGHTS	25
PART 10 - EARTHING AND EQUIPOTENTIAL BONDING		
10-1	EARTHING AND EQUIPOTENTIAL BONDING	27
PART 11- LIGHTING FITTINGS AND LAMPS		
11-1	GENERAL	29
11-2	POINT POSITIONS	29
11-3	FIXINGS	29
11-4	SUSPENDED CEILINGS	29
11-5	SUSPENDED FLUORESCENT LUMINAIRES	29
11-6	LAMP HOLDERS	29
11-7	CEILING ROSES	30
11-8	BATTEN HOLDERS	30
11-9	FINAL CONNECTION	30
11-10	LAMPS AND TUBES	30
PART 12 - MOTORS/FAN CONVECTORS		
12-1	ELECTRIC MOTORS	31
12-2	FAN CONVECTOR MOTORS	31
PART 13 – FIRE ALARM SYSTEM		
13-1	GENERAL	32
13-2	SYSTEM WIRING	32
13-3	MAIN SUPPLY TO PANEL	32
13-4	PROGRAMME INSTRUMENT - (SCHOOL CLASS CHANGE)	32
13-5	COMMISSIONING OF FIRE ALARM INSTALLATION	32

	PART 14 – EMERGENCY LIGHTING	
14-1	GENERAL	33
14-2	COMMISSIONING OF EMERGENCY LIGHTING SYSTEM	33
	PART 15 – INTRUDER ALARM	
15-1	GENERAL	34
15-2	SYSTEM OF WIRING	34
15-3	CONTROL PANEL (DIGITAL COMMUNICATOR - IF REQUIRED)	34
15-4	COMMISSIONING OF THE INTRUDER ALARM SYSTEM	35
	PART 16 – MECHANICAL SERVICES	36
	Version Control	37

PART 1

GENERAL

1-1 SCOPE

This section of the specification sets out standards of workmanship, safety, etc., for the installation of the electrical services and shall be read in conjunction with the conditions of contract, Section 3 of the Electrical Specification (the particulars clause) and all relevant schedules and drawings.

The Contractor shall be an enrolled approved NICEIC Member or ECA registered

1-2 REGULATIONS

All equipment and installation work shall, as appropriate, fully comply with the following:-

- a) BS 7671:- The current Edition of the I.E.E. Wiring Regulations "Requirements for Electrical Installations", including the latest amendments.
- (b) The Electricity Supply Regulations.
- (c) The Health and Safety at Work etc Act 1974 and the Workplace Health Safety and Welfare Regulations.
- (d) The Electricity at Work Regulations 1989.
- (e) Requirements issued by the local Electricity Undertaking.
- (f) Home Office Manual of Safety Requirements in Theatres and Public Places of Entertainment.
- (g) Local Authority Undertakings and Regulations.
- (h) British Standard and British Standard Codes of Practice.
- (i) The Building Regulations.

1-3 WORKING DRAWINGS

All working drawings necessary for accurately and properly carrying out the works shall be prepared by the Contractor and submitted to the Supervising Officer for acceptance in principle, the installation shall not commence until this has been given. Acceptance of drawings submitted by the Contractor shall not in any way relieve the Contractor from his responsibility to provide equipment suitable in dimensions, construction and finish for the location in which it is to be installed.

The Contractor shall produce upon request drawings indicating all builders work in connection with his works.

It will be the responsibility of the Contractor to check from site, the accuracy of all dimensions taken from the Authority's or others drawings for use in the preparation of his working drawings.

1-4 DEFECTS LIABILITY PERIOD

The complete installation including all materials and workmanship shall be guaranteed by the Contractor for a period of twelve months from the date of handing over the complete installation, this is applicable to direct and indirect contracts, and also includes maintenance and repairs.

1-5 BUILDERS WORK

(a) Sub Contract

The Contractor whose tender is successful will become a Sub-Contractor to the General Building Contractor. Builders work, cutting away, making good, will be carried out by the General Contractor. The Contractor must include for marking out the positions of all holes and/or chases he may require at an early stage and co-operate with the Main Contractor, and shall, where necessary, provide drawings of the builders work required. The Contractor must include for correctly adjusting the depth of accessory boxes, etc., to suit the wall and ceiling finishes. He shall also include for providing and installing all plugs, bolts, and all other fixings.

(b) Direct Contract

Where the Contractor enters into a direct contract with the County Council he shall include for all builders work, including all making good, which shall match the existing finishes.

All cutting away shall be carried out in a careful manner.

All making good shall be done to a standard equal to the existing surrounding surfaces, otherwise the Contractor will be required to engage appropriate tradesmen at his own expense and complete this to the satisfaction of the Supervising Officer.

Floor boards shall be carefully lifted and replaced, when replaced they shall be screwed to the floor using counter sunk headed screws. All split or broken boards shall be replaced. Floor boards must be temporarily replaced during all periods when the work on a particular section is delayed, the Contractor shall take all necessary action to comply with the Health and Safety at Work Act by providing signs and barricades.

Where carpets are fitted, these shall be carefully lifted for access to floor boards, etc., and refitted properly when appropriate.

In rare cases where LSF/LSF or MICS cables are permitted to be installed without containment, all joists shall be drilled centrally between the top and bottom of the joist, and wiring shall pass through. Joists shall not be notched on top to allow the wiring to pass over the joist.

1-6 ASBESTOS INSULATION

The majority of County Council's buildings will hold an Asbestos Register which is available on the premises and is a record of a visual survey of the site detailing any asbestos material found.

You **must** consult this Register and obtain a copy of the site's Permit to Work before commencing any work on site.

If having checked the Register, or during the works, any suspected asbestos based materials are discovered, no further work must be undertaken on or within the vicinity of the material until clearance is given by the Contract Administrator.

(a) Thermal insulation within the boiler room, ducts and roof spaces, in many instances may, depending on age, contain 'asbestos' as may certain ceiling systems.

(b) Removal of any asbestos insulation/materials shall be carried out by a licensed Asbestos Removal Contractor listed by this Authority and in accordance with this Authority's removal and disposal procedure.

1-7 OPERATION AND MAINTENANCE INSTRUCTIONS

The Contractor shall include for giving all necessary detailed instructions and demonstrations for the correct operation and maintenance of all the apparatus, equipment and plant installed

under this contract to the Engineer during the **two weeks prior** to practical completion of the contract.

The Contractor shall include for handing to the Engineer two copies of the Operation and maintenance Manual. Each Manual shall comprise:

- (a) A plastic A4 folder suitable for enclosing operating and service instructions, certificates, test sheets, literature and drawings, inserted in Rexel/Nyrex reinforced pockets reference NPR/A4.
- (b) Certificates for the Electrical Installations, Fire Alarm Installation, emergency lighting, intruder alarms, etc.
- (c) Test sheets for Electrical Installation
- (d) Operating instructions for Fire Alarm system
- (e) Literature on MV switchgear, light fittings, fire alarm equipment and accessories.
- (f) 'As Installed' Drawings

1-8 **RECORD DRAWINGS**

After completion of the works, but before the release of any retention money, the Contractor shall issue one set of record drawings to the Supervising Officer for his approval.

Layouts must show the location of the main switchboard, all sub-main switchboards and distribution positions, and the accurate routes of all other cables and trunking runs. In particular, the layouts must show the locations of all junction boxes or equivalent, particularly those concealed above ceilings or in the building fabric, access panels must also be accurately shown. Cable references, sizes, and routes are to be shown together with circuit references. Sets of separate drawings shall be provided for each service such as lighting, power, fire alarm, telephones, emergency systems, public address, etc.

On receipt of approval of the record drawings submitted, the Contractor shall supply to the Property Officer for his permanent retention two full sets of approved drawings.

1-9 **WIRING DIAGRAMS AND PRE-WIRED EQUIPMENT**

The Contractor shall be responsible for the accuracy of all wiring diagrams provided by him and for the correct internal wiring of all pre-wired equipment supplied for the contract. The Contractor shall reimburse the full cost of abortive or remedial work due to any error in these respects.

1-10 **ELECTRICAL SHOCK NOTICE**

The Contractor shall supply and fix an electrical shock notice adjacent to the MV panel board. The notice required is as supplied by the Electrical Times based on the Holgar Neilsen and 'Mouth to Mouth' methods printed 475 x 300 with metal backing, or other equal and approved.

1-11 **DISTRIBUTION DIAGRAMS**

The Contractor shall provide a distribution diagram in an encapsulated/clear plastic frame, backed by a plywood sheet, or in a laminated format, for the main switchboard and all sub-switchboards. This shall be fixed to the switchroom walls adjacent to the Main switchboards and shall clearly show (diagrammatically) the cable sizes of all cables from the Main switchboards, distribution board references and sizes and also detail to position of the distribution boards and other items they serve.

The actual size of the diagram shall not be smaller than the diagram shown on the drawings.

All reference numbers and letters shown on the labels on the switchboards shall be clearly

shown on the distribution diagram.

1-12 **CIRCUIT LISTS**

A circuit list shall be provided and completed by the Contractor at the time when the distribution boards are installed.

Circuit lists shall be fitted in a transparent non-flammable pocket securely fixed to the inside of the door of the distribution board.

Where modern type MCB units are used, with only a narrow metal cover over the MCB, a separate circuit list shall be provided. These circuit lists shall be mounted in an encapsulated/clear plastic frame, securely fixed to the wall by the distribution board. The metal strip between the mcb's shall also be labelled.

The circuit list shall, in all cases, be typewritten on a substantially thick card (not less than 3 sheet thickness). Lists shall detail the distribution board, together with each circuit number, number of points connected to the circuit, wattage of each item and the total connected wattage, and the position of all the points. Also size of supply cable and position of the source of supply, together with details of the supply at the distribution board, i.e. SP&N, TP&N 230-400 volts.

1-13 **LABELS**

Labels fitted to switchboards, isolators, switches and fuseboards shall be on white laminated plastic material (as Traffolite) with black characters fixed with non ferrous screws.

- (a) They shall indicate on switches:
 - (1) the reference number of the switch
 - (2) the specified current rating
 - (3) size and number or cores of cables controlled
 - (4) the distribution or fuseboard controlled;
 - (5) Zs + PSC at DB
- (b) They shall include on fuseboard:
 - (1) the reference number
 - (2) type of board, i.e. lighting, sockets small power
 - (3) size of cable supplying the fuseboard
 - (4) where 'fed from'
- (c) labels shall also be fitted to other items of equipment detailed in the Specification;
- (d) labels shall be fitted to the main switchboard indicating the voltage present and also the type of supply, i.e. TNC, TNS, TNCS, TT or IT as defined in the IEE Wiring Regulations.

1-14 **COMPLETION CERTIFICATES**

The Contractor shall forward completion certificates to the Engineer on completion of the installation in accordance with the IEE Regulations, using the standard IEE completion certificates.

1-15 **INSPECTION CERTIFICATES**

When Contractors are instructed to carry out inspections of existing installations, the report, together with the inspection certificate, shall be forwarded to the Engineer.

Inspection certificates shall be as prescribed in the IEE Regulations for electrical installations and in the N.I.C.E.I.C. or ECA format.

1-16 **TESTING**

The whole installation shall be tested at completion in the manner prescribed by the IEE Wiring Regulations.

Any defects of workmanship, materials, performance, maladjustments or other irregularities which become apparent during the tests, shall be rectified by the Contractor and the tests repeated at the Contractor's expense, to the satisfaction of the Engineer .

The Contractor shall supply all labour, apparatus, and instruments necessary for the prescribed tests. The accuracy of the Contractor's instruments shall be demonstrated if required.

Test Certificates for works completed shall be submitted in duplicate to the Supervising Officer, as detailed in the IEE Wiring Regulations.

Prior notification of all site tests shall be given to the Engineer.

Installations, or sections thereof, which will be embedded in the structure, or concealed in permanent sealed ducts, trenches, roof spaces, etc., shall, in addition to the above specified tests, be individually tested as they are laid and before being embedded or concealed.

The Contractor shall record the results of all the tests, time and date, name of the testing Engineer and testing instrument details. The detail of the testing instrument shall be such that the calibration of the instrument can be traced. The Contractor shall submit a copy of these records together with the 'As Fixed' drawings at handover of the system.

1-17 **POSITIONS OF POINTS AND EQUIPMENT**

The positions of all accessories and fittings as shown on the drawings, shall be assumed correct for the purpose of the tender.

The Contractor shall allow, without extra cost, any variations within 1m of the height or position originally specified if required by the Engineer, providing such a requirement is made to the Contractor before the relevant section of work has been carried out. If items appear on the drawing but not in the specification (or vice versa) the cost must be deemed to be included within the tender price.

It is the responsibility of the Contractor to verify and co-ordinate all trunking, cable and conduit runs with the Main Contractor and Mechanical Contractor before the commencement of the installation of such items.

1-18 **MATERIALS**

All materials are to be of the specified manufacturer as detailed in the specification and drawings. The Contractor shall submit, if called upon, samples of materials as required before the work is commenced.

1-19 **MATERIALS REMOVED**

All materials removed from the works remain the property of the County Council. The Contractor shall carefully remove all items of equipment that are in good condition and hand these over to the Engineer. The Contractor shall dispose of all old, worn out, or unusable materials as instructed by the Engineer.

All hazardous materials e.g. batteries, fluorescent lamps etc shall be disposed of in the correct manner.

1-20 **PROGRAMME OF WORKS**

For Capital Works contracts the contractor shall agree a programme of works with the Main Contractor.

For Maintenance Contracts and Minor Works Contracts, the Contractor shall submit a programme of work to the Property Services Department. No work shall commence until the programme is approved. The tenderer shall allow ten clear working days for the programme to be approved.

Where possible all work is to be carried out in conjunction with the agreement of the Principal/Head of the premises. No additional claims will be met for any overtime working incurred.

In certain areas there will be no guarantee that continuous working in one area will be permissible and due allowance shall be made for flexible working.

1-21 SCHEDULES OF RATES

The Contractor shall, within 14 days of the Head of Property Services or his representative's request, submit a Quantified Schedule of Rates totalling to the tender figure.

This document shall be used for the purpose of measuring variations in the contract and shall be submitted before work is started on site.

1-22 CLEARING AWAY

The Contractor shall ensure that his operatives keep the site clean and tidy during the installation work, this will include drilling waste etc. which can be trodden into floor coverings. Time taken by Caretakers cleaning up after Contractors will be charged to the Contractor.

Upon completion of the work, the Contractor shall remove all rubbish and surplus materials, and leave the site clean and tidy to the satisfaction of the Engineer, Headmaster or the Caretaker.

The Contractor shall also clean all apparatus and accessories internally and externally and leave the site in full working order to the satisfaction of the Engineer.

PART 2**2-1 SWITCHGEAR AND DISTRIBUTION EQUIPMENT**

- (a) Generally all main and sub-main switchgear panels shall be factory built assemblies.
- (b) Cubicle type switchboards shall be manufactured and tested in accordance with BSEN 60439-1 and constructed to Form 1, 2, 3 or 4 classification, as detailed in Section 3, and fully fault rated to a minimum level of 30kA for 1 second.
- (c) Unless otherwise indicated, enclosures shall provide a minimum degree of protection of IP 21 when located within buildings and IP 44 when located outside buildings.

Loose switchgear where required shall be metal clad interlocking 500V rating, totally enclosed surface mounted and comply with BSEN60947-3.

- (d) Where distribution equipment is sited over formed floor trenches, the Contractor shall include for all necessary supporting steelwork, otherwise they shall be mounted on a purpose built plinth, and securely fixed.
- (e) All cable tails for the electricity company cut-outs, shall be included and installed in metal trunking as required.
- (f) Labels shall be fitted to all switchgear with the appropriate designation, and warning notices as necessary, fixed with screws.
- (g) Drawings detailing the proposed switchboard including all dimensions and layout of equipment and labelling, shall be submitted to the Engineer and Contractor prior to manufacture for approval.

2-2 DISTRIBUTION BOARDS

The enclosures shall be of metal clad construction with hinged doors and fitted with integral main isolator and if the Distribution board is located in a circulation area it must be complete with a lockable door.

They shall comply with BS 5486 and part 12 and BSEN 60439 part 1 and 3 and contain circuit protective device, of the following types as detailed in Section 3 of the Electrical Specification.

- (a) HRC cartridge fuses complying with BS 88.
- (b) Miniature circuit breakers (MCBs) complying with BSEN 60898, M9 rating and be of type B, C or type D as specified.
- (c) Moulded case circuit breakers (MCCBs) complying with BSEN 60947-2.
- (d) Residual current devices (RCDs) complying with BSEN 61008 and BSEN 61009.

Consumer units shall be of the same standard as for distribution boards.

Circuit lists to be provided as Clause 1-12.

Reference labels to be provided as Clause 1-13.

2-3 ISOLATORS

- (a) Each item of equipment is to be provided with means of isolation, either fitted to the equipment, or mounted adjacent or within near proximity, to enable the

electrical supply to be manually and readily disconnected, all in accordance with the latest edition of the I.E.E. Wiring Regulations and be labelled accordingly.

- (b) All electrical supplies to have means of isolation.
- (c) All starter/isolators for motors to have no-volt release coils incorporated, to prevent the motor restarting if switched off remotely and then re-energised (unless part of automatically controlled plant).
Note: RCD plug tops for small fixed bench equipment in CDT areas may be used to give N/V protection.
- (d) Isolators to have facility for locking in the 'off' position if required.
- (e) Note that in school craft rooms circuits shall be controlled by an arrangement of key switch/emergency stop - contactor control. Particular details shall be as specified.

PART 3**PAPER INSULATED AND ARMoured DISTRIBUTION CABLING**

All cables shall be manufactured by a member of the Cable Manufacturers Association and shall be BASEC approved.

3-1 PILCSWASO

Paper insulated cables shall comply with BS 6480, they shall be mass impregnated, non draining, belted type, complete with lead armoured sleeves.

3-2 PVC/SWA/PVC

Steel wired armoured cables shall have copper conductors, unless aluminium is specifically stated and shall comply with BS 6346 and BS 6360.

3-3 XLPE/SWA/PVC

Cross linked polyethylene insulated armoured cable shall comply with BS 5467.

3-4 XLPE/SWA/LSF

(Low smoke and fume) armoured cables shall comply with BS 5467 and BS 6724.

3-5 ROUTE OF SWA CABLES

The routes of cables, whether or not shown on the drawing, shall be confirmed on site with the Engineer before installation commences, and be so as to avoid any clashes with other services.

All entries into buildings shall be through pre-formed ducts, sealed after installation.

Cables run internally shall be supported by 'claw' type saddles securely fixed either on cable tray or to the structure.

Maximum spaces : 350mm horizontal runs
 450mm vertical runs

3-6 TESTING

Before the installation of sub-main feeder cables commence, the Contractor shall if required submit to the Engineer the cable manufacturers test certificates.

3-7 CABLE ACCESSORIES

The Contractor shall include for the supply and fixing of suitable cable spreader boxes direct to the fuse switch or distribution board as necessary for terminations and each core to terminate in a brass ferrule suitable for use with the particular switchgear.

Brass compression glands of an approved type to be used for terminations and brass earth tags bolted with brass nuts, bolt and corrugated washers to the switchgear enclosure and PVC shrouds shall be installed at all terminations.

Each core to be identified by means of coloured or numbered plastic stretch/shrink ferrules.

3-8 UNDERGROUND CABLES

Cables laid in ground shall be trenched to a depth of 750mm in undeveloped ground and 800mm where crossing roadways, where they shall be enclosed in a 100mm diameter salt glazed earthenware or heavy duty PVC duct, or clay Hepducts.

Cables to be surrounded by 75mm of sifted soil or sand and the trench backfilled to a depth of

300mm. Yellow PVC cable Marker Tape indicating electric cables shall be then laid and the trench backfilled to ground level and well rammed and seeded as required.

Where armoured cables rise from the ground they shall be protected by means of heavy gauge galvanised channel.

3-9 JOINTING

Where joints are required they shall be carried out using approved acrylic resin cold pouring insulating materials and the location of the joint recorded accurately.

A bonding conductor shall be connected across the armouring and core identification shall be matched.

3-10 CABLE LABELLING

Where a number of cables are connected to Distribution Board, each cable to be identified with a cable marker or label using a plastic tag or traffolite label.

PART 4**MINERAL INSULATED CABLES****4-1 GENERAL**

Mineral insulated copper sheathed cables shall be BASEC approved and comply with BS 6207 1991. They shall be sheathed, (unless specifically requested otherwise), with PVC shrouds at terminations.

They shall be heavy duty 1000 volt for all socket outlets, sub-mains, motor wiring and light duty for lighting, fire alarms and other low voltage systems, unless otherwise stated.

All mineral insulated cable used shall be manufactured to BS 6208: 1991.

All grades of mineral insulated cable used, 500 volt and 750 volt shall be of one manufacturing origin.

Accessories for mineral insulated cable shall be manufactured to NS 6081, and shall be of the same manufacturing origin as the cable used.

Moulded polymeric seals, pre-filled with sealing compound and conforming to the requirements of BS 6081, fitted in accordance with the manufacturer's recommendations, shall be used to terminate relevant sizes of mineral insulated cables, in the 500 volt light duty range, as available from the manufacturer.

Manufacturers of mineral insulated cable selected, shall hold BASEC approval for the products they manufacture and supply and, in addition, be approved to Quality Assurance Standard BS 5750 Part 2: 1987/ISO 9002-1987/EN 29002-1987.

All mineral insulated cable used shall be of totally inorganic construction, free from additives.

All mineral insulated cable used shall have a seamless copper sheath.

The fire performance of mineral insulated cables used shall comply with BS 6387 categories CWZ, all three tests having been carried out on the same piece of sample cable.

4-2 SIZES

The minimum conductor size for MICC cables to be:

- (a) 1.0 mm² for alarm, call and control circuits.
- (b) 1.5 mm² for three phase circuits.
- (c) 1.5 mm² for lighting circuits.
- (d) 2.5 mm² for socket outlets.

4-3 INSTALLATION

All cables to be drawn straight through a roller before installation and cable runs to be straight, parallel and at right angles to the sides of the building, and all drops vertical.

The formation of 90 degrees bend, in MICS cable shall have a radius of not less than 12 times the diameter of the cable.

4-4 FIXINGS

Fixing to be by the means of single or multi-way heavy duty bare or PVC covered copper saddles complete with spacer bars secured using plated steel or brass round head screws, plugged as required.

Fixing saddles to be installed at maximum spacings as detailed below:

Overall Cable Diameter (mm)	Max. spacing of Saddles (mm)	
	Horizontal	Vertical
Up to 9	600	800
9 - 15	900	1,200
15 - 20	1,500	2,000

Where four or more cables run together they shall be fixed to cable trays at the above spacings but spacer bars are not required. Bare or PVC covered copper strip may also be used in this instance secured using brass screws and units.

4-5 COLOUR

The colour of the PVC sheath will generally be orange, white or red, as detailed in Section 3.

4-6 TERMINATIONS

All terminations shall be cold screw-on seals (unless specified otherwise) comprising a brass screw on pot, sealing compounds, a stub cap closure and insulating conductor sleeving. Tails to be identified with suitable coloured sleeves.

Seals to be complete with compression ring gland and PVC shroud except where boxed with special MICS clamps have been specified.

Earth tail seals to be used at all cable terminations.

The termination is to be fitted as soon as the cable end has been prepared, using the appropriate cable manufacturers recommended tools and technique.

Where the conductor is 2.5mm^2 or less the tail end shall be bent upon itself where it enters the terminal connection.

Final connection shall be by a male hexagonal brass bush and serrated washer where entries are made to equipment which does not have a spouted entry.

Vibration loops shall be formed where MICS cable connections are made to motors and other equipment where vibration could be transmitted.

4-7 TESTING

In addition to the standard tests as required by the I.E.E. Wiring Regulations, insulation resistance tests shall be carried out using a 500 volt Insulation Resistance instrument t directly after installation and again 2 hours later. Any cables not giving an infinity reading shall be resealed.

A record of these tests shall be submitted to the Engineer when the work is completed.

PART 5

FIRE RESISTANT CABLES

5-1 INSTALLATION AND TERMINATIONS

Terminations to be carefully prepared and the PVC sheath removed without cutting right through to the aluminium foil. Care to be taken to prevent damage to the insulation and heat shrink tubing or a suitable plastic ferrule shall be used over the core/foil interface before splaying out the cover for the fire resistant cable

Earth continuity to be provided by the bare tinned copper circuit protective conductors with no additional connection to the aluminium sheath.

Cables to be terminated in a box using a PVC sealing ring shroud and the appropriate compression ring.

5-2 FIXING

Fixing of the fire resistant cables to be as for MICS cables with the exception that white PVC served P clips shall be used.

5-3 JOINTING

No joints shall be permitted within any cable run between equipment.

PART 6 - WIRING CABLES**6-1 CABLES IN CONDUITS AND TRUNKING**

Cables shall be:

- (a) PVC or LSF as indicated in the Specification Section 3 and shown on the drawing, 500 volt grade, having high conductivity stranded copper conductors and manufactured in accordance with BS 6004 and BS 6346. Solid copper conductors shall be avoided whenever possible.
- (b) Single core with minimum conductor size 1.5mm², and delivered on site with each coil having its seal intact and a label bearing the name of the manufacturer classification, size, description of cable, length and grade.
- (c) Coloured in accordance with the I.E.E. Regulations, or fitted with coloured sleeves only with the approval of the Supervising Officer, or coloured in accordance with the drawing and Schedule of Work Section 3 for special systems.
- (d) Installed without any joints, all connections being made at switch positions lighting points etc., on the 'loop in' system.
- (e) Installed with due regard to loading, length of run, and voltage drop, the minimum sub-circuit cable sizes will be detailed in Section 3 or on the drawings.
- (f) Segregated according to I.E.E. Regulations and only cable of one system shall be run grouped in conduit, the extra low voltage circuits to be separately run or screened to avoid cross talk or switching interference in audio circuits.
- (g) Terminated at equipment positions unless otherwise indicated, by means of either sweated lugs of appropriate size, eyelet type cable terminations or crimped type termination of reputable manufacture. Shake proof washers shall be used where electric motors are connected.
- (h) Double or twisted back on themselves for all single connection and pinching screws shall not be permitted to cut the conductors, and be firmly twisted together before the connection is made where possible.
- (i) High temperature grade when used for boiler house wiring, lighting and power (105 deg C)
- (j) Where cables pass through lighting fittings, they shall have insulation capable of withstanding the expected operating temperature, i.e. (heat resistant type or suitably sleeved).

6-2 FLEXIBLE CABLES

All flexible cables shall be LSF insulated (unless otherwise indicated) circular 40/0.2 300/500 volt grade minimum size.

Where connection is made to a fitting with a total load of 150 watts or more, all flexible cord to be of heat resistant types of butyl rubber or other approved equal.

Flexible cables to appliances, i.e. heaters immersion and water heaters, etc., shall be butyl rubber or equal, of size suitable for the load.

The flexible cables length to be restricted to 3 metres maximum.

6-3 PVC/PVC/LSF CABLES

PVC/PVC /LSF cables shall be 300/500 volts rating. Cable ref: 6242Y.

PVC /PVC/LSF run on the surface will not be employed for higher voltage or three-phase services.

PVC/PVC/ LSF cables shall be installed in compliance with manufacturers instructions and particular attention shall be observed in cold/freezing conditions.

Cables shall be single, twin or three-core, with circuit protective conductor, as required.

All cables shall be to relevant British Standard and colour coded to the latest requirements of the IEE Wiring Regulations.

Cables shall be fixed securely with approximately sized PVC cable slips, etc., not more than 150mm centres.

The minimum sizes of conductors shall be 1.5 mm for lighting and 2.5(4) mm for power.

Care shall be taken to eliminate any strain or stress on the sheathing.

Where cables are buried in walls, floors, ceilings, etc., they shall be protected by galvanised capping pinned to the walls, or PVC/steel conduit in partition walls. Vertical and horizontal runs only.

Where enclosed ceiling lighting fittings or bulkhead fittings are specified, a conduit box shall be fixed into the ceiling or wall behind the fitting to contain heat-resistant sheathed connectors, and allow heat resisting cables to be connected into the lighting fitting.

No more than three conductors will be permitted at any one termination.

In instances where multiple connections are unavoidable, they shall be enclosed in a suitable adaptable box complete with a DIN rail connector system and be suitably labelled.

Where PVC/PVC/LSF type cables are employed with metal boxes, the entries shall be bushed with PVC or rubber grommets.

PVC/PVC/LSF cables to be installed in fluorescent fittings shall only enter the fitting spine in a position whereby it avoids the cables passing the choke.

Conductors used as meter tails shall be LSF insulated and sheathed, sized and colour-coded to Electricity Board requirements. The Installer shall consult with the Electricity Company to determine any special meter tail requirements or termination features.

PART 7**7-1 CABLE TRAY**

Cable tray shall be:

- (a) Steel perforated not less than 20 swg up to 100mm width, 18 swg from 100mm to 150mm, width and 16 swg from 150mm to 300mm width and shall be galvanised.
- (b) Of adequate size to support the cables without undue bunching.
- (c) Supported at intervals by suitable brackets necessary to provide a rigid fixing, and capable of carrying without undue deflection the total weight of cable likely to be carried on the tray.
- (d) Fixed to the fabric of the building by means of specially designed masonry plugs or bolts with galvanised nuts, screws, washers, etc. A gap of 25mm shall be left between structure and tray.
- (e) Carried on specially designed galvanised supports such as a proprietary form of steel channel which will permit easy adjustments or modifications.
- (f) Installed using factory-formed bends, and when cut sections are used for sets they shall be free from sharp edges and welded.
- (g) Painted together with hand made accessories with zinc rich paint where cuts have been made.
- (h) Adequately bonded to earth.
- (i) Fire stopped when passing through fire barriers.
- (j) Cables shall be fixed to tray as follows:
 - (i) By means of proprietary forms of plastic cable clips, saddles, straps, etc.
 - (ii) By means of galvanised metal saddles and clips where higher than average temperatures are likely to be experienced.
 - (iii) By means of non-ferrous screw bolts, nuts, etc., where applicable.

7.2 CABLE BASKET

Cable basket shall be:

- a) Hot Dip Galvanised manufactured to BS EN ISO1461
- b) Of adequate size to support the cables without undue bunching. The minimum depth to be 50 mm.
- c) Supported at intervals by suitable brackets necessary to provide a rigid fixing, and capable of carrying without undue deflection the total weight of cable likely to be carried on the tray.
- (d) Fixed to the fabric of the building by means of specially designed masonry plugs or bolts with galvanised nuts, screws, washers, etc. A gap of 25mm shall be left between structure and tray.
- (e) Carried on specially designed galvanised supports such as a proprietary form of steel

channel which will permit easy adjustments or modifications.

- (f) Installed using site formed bends and cut sections and be free from sharp edges.
- (g) Painted together with hand made accessories with zinc rich paint where cuts have been made.
- (h) Adequately bonded to earth.
- (i) Fire stopped when passing through fire barriers.
- (j) Cables shall be fixed to cable tray as follows:
 - (i) By means of proprietary forms of plastic cable clips, saddles, straps, etc.
 - (ii) By means of galvanised metal saddles and clips where higher than average temperatures are likely to be experienced.

PART 8 - CONDUIT / TRUNKING**GENERAL**

Separate earth continuity conductors shall be installed in all conduits whether steel or PVC.

8-1 STEEL CONDUIT

Conduit shall be:

- (a) Heavy gauge steel screwed welded and not less than 20mm diameter manufactured by a member of BESA in accordance with British Standards BS 31, BS 4568, BS 6053, BS 6099.
- (b) Black enamelled or galvanised or Flocoat finish as specified in the schedule of work. Note: galvanised conduits shall always be used in Boiler/Plant Rooms.
- (c) Hot dip galvanised inside and outside for installation in situations liable to dampness or corrosion e.g. external positions and surface installation in Boiler House, Toilets, Showers, etc.
- (d) Threaded to length specified in BS 31, carefully reamed to remove all sharp edges and burrs after threading, oil and filings being completely removed before erection, and already cut threads cleaned by running dies over them and then wiping clean.
- (e) Fully protected to prevent ingress of plaster, concrete, debris, etc., into boxes and fittings during building work and swabbed dry before wiring is commenced.
- (f) Painted with rust inhibiting paint after erection where screwed threads are exposed and where the conduit finish is damaged.
- (g) Of adequate size to allow for easy draw in or withdrawal of any one or all cables.
- (h) Electrically and mechanically continuous throughout forming a completely bonded system.
- (i) Tested for continuity before plastering or floating of concrete (flush installations) or cabling (surface installations) is commenced.
- (j) Fitted with locknuts on all running couplings and only couplings having smooth even bearing faces shall be used.
- (k) Set on site to form all bends, using proprietary bending machines, all sets being neatly made without restricting the bore.
- (l) Concealed wherever possible, and where walls are fair faced on one side and plastered on the other, conduit shall be concealed on the plastered side of the wall and pass through the wall into the back of the box, which will be recessed in the fair faced brickwork, fixed using crampits at regular intervals.
- (m) Fitted with expansion couplers where they cross expansion joints.
- (n) Held in an efficient vice for screwing. Badly marked conduit or poor threads will not be accepted.
- (o) Coupled direct to fixed equipment having tapped circuit entries.
- (p) Coupled to equipment having untapped conduit entries by smooth bore brass bushes inside the equipment.

- (q) Coupled to cable trunking by smooth bore brass bushes inside the trunking.
- (r) Installed using independent systems for each of the following: lighting, general purpose power installations, fire alarm, intruder alarm, television, British Telecom telephone -internal telephone systems, computer systems.
- (s) Capable of withstanding a 'dead weight of 25kg' after installation in the presence of the Supervising Officer's representative at his discretion.
- (t) Securely fixed in floor screeds using crampits at regular intervals to ensure that the conduits are held rigidly in position and no movement takes place where the screed is laid, and the Electrical Contractor shall be present when this latter operation is carried out, to ensure that the conduits are not damaged.

Conduits shall **not**:

- (a) Have more than two right angle bends in any conduit run without the provision of a draw-in box.
- (b) Be installed in runs of more than 10m without draw-in boxes.
- (c) Be fitted with tees, elbows or manufactured bends, unless specifically stated in the Schedule of Work Section 3 or prior permission is given by the Supervising Officer.
- (d) Have cables drawn in until all conduit installation is complete.
- (e) Be installed within 150mm of gas or within 120mm of water, LPHW, gas or other piping except with the express approval of the Supervising Officer.
- (f) Be installed in ducts or surface fixed to floors without the express approval of the Supervising Officer.

8-2 SURFACE CONDUIT

Conduit on the surface shall be installed:

- (a) Using spacer bar saddles, unless detailed otherwise in Section 3, spaced at distances no more than:

Conduit Size	Vertical Spacing	Horizontal Spacing
20 mm dia	1500 mm	1200 mm
25 mm dia	1700 mm	1200 mm
32 mm dia	1800 mm	1500 mm

- (b) All saddles to be fixed with a proprietary make of wall plug and screws of sufficient length to enter the main fabric to a minimum of 25mm. All building fabric to be drilled.
- (c) With due regard to neatness and finished appearance, being made unobtrusive and where exposed on the surface of walls or ceilings, the runs shall be symmetrical and in keeping with the building design. The routes of all surface conduits shall be approved by the Supervising Officer before installation.
- (d) A distance of 25mm apart where two or more conduits run parallel, and where conduits must cross, a similar space must be left at the crossing.

8-3 CONDUIT IN CEILING VOIDS

Conduits installed in ceilings or roof spaces, shall be installed:

- (a) Using pressed saddles fastened by means of 2 No. min 25mm long No. 8 zinc coated or black japanned screws and proprietary plugs where necessary. Saddles in roof space and voids being installed at the minimum centres stated for surface work.
- (b) Using oversize lids for all circular draw-in boxes and also for all adaptable boxes.
- (c) In such a manner that the edge of the conduit box is flush with the finished surface. Particular note is drawn to suspended ceilings and where panelled ceilings are installed. The Contractor's attention is drawn to the need for accurate positioning of the boxes in the centre of panels, or on the centre lines.

8-4 GALVANISED CONDUIT

Conduit where galvanised shall be:

- (a) Fixed with galvanised saddles as for surface or flush installation.
- (b) Fixed with brass or galvanised screws.
- (c) Painted with zinc rich paint where exposed conduit threads are left.
- (d) Installed with all necessary galvanised accessories including box lids.

8-5 CONDUIT BOXES

Conduit boxes shall be:

- (a) Standard circular black enamelled or galvanised where appropriate, malleable cast iron to BS 31.
- (b) Fitted with heavy gauge cast iron or pressed steel lids secured in position with brass screws.
- (c) Provided with tapped spouted entries.
- (d) Of the waterproof type when erected in exposed positions and shall be packed with waterproof plastic compound after wiring.
- (e) Of the multiple adaptable type of dimensions not less than 75mm x 75mm x 27.5mm where two or more conduits will be permitted to enter the longer side of the box, and where more or larger boxes shall be used.
- (f) Of the pressed steel type with overlapping lids where used on flush installations.
- (g) Fixed to the fabric of the building and in accessible positions.
- (h) Of the tangent type where used on the surface, and to comply with the need to make the conduit unobtrusive.
- (i) Fitted with extension rings where necessary in order that the edge of the conduit box is flush with the finished ceilings.

8-6 FLEXIBLE CONDUIT

Flexible metallic conduit shall be:

- (a) PVC sheathed of ample capacity and mechanically robust.
- (b) Run between the internal wiring system and fixed apparatus, motors, thermostats, etc.
- (c) Kept to the shortest length except where terminating at motors and equipment which may need to be adjusted from time to time where adequate flexible conduit shall be left to accommodate the full length of the adjustment.
- (d) Connected to equipment with factory made clamps.
- (e) Run with an earth conductor of minimum size 2.5mm insulated cable, installed internally.

8-7 PVC CONDUITS

PVC conduits shall be:

- (a) Generally as detailed in clauses for steel conduit.
- (b) High impact, heavy gauge,
- (c) Fitted with expansion couplers at intervals not exceeding 6m. Silicone grease shall be used on the sliding portion of the expansion coupler to prevent the ingress of moisture.
- (d) Complete with all the manufacturer's accessories.
- (e) Securely fixed at all points and boxes etc. using the manufacturer's adhesive.
- (f) Set using the manufacturer's bending springs.
- (g) Fixed with the manufacturer's spacer bar saddles unless detailed otherwise in Section 3, spaced at distances no more than

Conduit Size	Vertical Spacing	Horizontal Spacing
20 mm dia	1000 mm	900 mm
25 mm dia	1200 mm	900 mm
32 mm dia	1400 mm	1000 mm
38 mm dia	1500 mm	1200 mm
50 mm dia	1800 mm	1200 mm

- h) Installed 150mm clear of heating pipes and any other heat producing equipment.
- (i) A protective conductor shall be drawn through all PVC conduits.

8-8 STEEL CABLE TRUNKING

- (a) Steel cable trunking shall be manufactured by an approved manufacturer from rust proofed or galvanised steel in the following gauges:
 - Up to 50mm x 50mm or equivalent cross section area 18s.w.g.
 - Above 50mm x 50mm and up to 100mm x 100mm or equivalent cross section area 16 swg.
- (b) Fitted with an overlapping lid, which shall be securely fixed to the trunking with mushroom headed 2BA or metric equivalent screws. Self tapping screws will not be accepted. Each length or cover shall be fixed with at least 4 No. fixing

screws irrespective of its length.

- (c) Fitted with steel fillets to provide the requisite number of compartments which will be needed to carry the wiring of different services, i.e:
 - (1) communications system
 - (2) extra low voltage system
 - (3) low voltage wiring

Note: automatic controls wiring shall be run within its own separate, dedicated trunking/conduit installation.

Where conduits are taken off such trunking, they shall pass through to the appropriate partition.

- (d) Fitted with cable retaining straps when the lid is not on the top side of the trunking.
- (e) Fitted with insulated cable support pins at intervals of 120mm in vertical runs exceeding 2m.
- (f) Fitted with internal fire barriers where vertical trunking passes through floors.
- (g) Adequately and substantially fixed to the building structure by purpose made brackets or clips at not more than 1.120m centres. Alternatively where clips are not required, trunking shall be fixed by drilling 5mm holes in the back (at centres not exceeding 1.120m) and using round head screws or nuts and bolts as necessary, or round head wood screws and plugs where fixed direct to walls.
- (h) Electrically and mechanically continuous throughout and free from all sharp projections and edges.
- (i) Supplied with copper links between each length, tee and elbow for the purpose of maintaining electrical continuity.
- (j) Fitted with purpose made radius bends, gusset-type tees, and right angle bends, complete with removable covers and terminated in blank end pieces.
- (k) Fitted with purpose made outlet bushes and flanges when required.
- (l) Of adequate size to accommodate the cables to be installed in it, and comply with the current IEE Regulations regarding space and space factors.

8-9 **PVC CABLE TRUNKING**

PVC trunking shall be generally as steel cable trunking and shall be:

- (a) Manufactured for heavy gauge PVC finished grey unless otherwise stated in Section 3 of the Electrical Specification.
- (b) Complete with manufacturer's bends, tees, flanges, end caps and clip on covers, etc.
- (c) Have cable retaining clips installed at regular intervals when the cover is not installed on the top.
- (d) Complete with protective conductor cables as detailed in the IEE Regulations.
- (e) Of adequate size to accommodate the number of cables installed on it as detailed in the IEE Wiring Regulations.

- (f) Installed clear of heating pipes, boilers and any other heat generating equipment.

8-10 **PVC MINIATURE TRUNKING**

PVC miniature trunking may be used for lighting and small power circuits and alarm circuits, as detailed in Section 3 of the Electrical Specification, and shall be:

- (a) Kept to the minimum size possible, but shall be of adequate size to comply with the IEE Wiring Regulations, minimum size 20mm (YT2) and finished white and neatly installed on the surface.
- (b) Be complete with manufacturer's bends, covers, stops and tees, reducers, coupling and flanges, and all necessary fittings produced by them.
- (c) All switch, socket, and spur boxes, etc., shall be finished white and shall be produced by the trunking manufacturer.
- (d) Trunking shall terminate in the manufacturer's flanges at all switch sockets, etc.
- (e) A protective conductor shall be installed throughout.
- (f) Shall be secured adequately by brass screws and not reliant solely on adhesive backing tape.

PART 9**WIRING ACCESSORIES****9-1 GENERAL**

All accessories to be flush mounted wherever possible, and be fitted with earth terminals as required, and be of the same finish, range and manufacture throughout an installation.

9-2 LIGHTING SWITCHES

Lighting switches shall be mounted alongside door entrances. Single, double and triple-gang plate switches shall be mounted on standard square switch boxes.

All lighting plate switch boxes shall have a minimum depth of 25mm.

Four to six-gang plate switches shall be mounted on rectangular switch boxes.

Where indicated on the drawing, single and double-gang lighting architrave plate switches shall be mounted on appropriate boxes.

Switches with secret key operation shall be installed as specified for security or emergency lighting controls, and shall be clearly labelled.

Grid switch type modular controls shall be used for the lighting installation unless otherwise specified.

Metal clad (all insulated) splash-proof/dust-proof/moisture-proof switches shall be installed as indicated.

External lighting is to be controlled as specified by suitably positioned photo-electric switches, with time switches to switch off, or P.I.R. units.

Ceiling pull cord switches are to be used for all bathroom/shower room lights.

9-3 SOCKET OUTLETS

Except where indicated, all socket outlets shall be switched single or twin gang. Double pole switches to be used from all circuits fed from safety earth leakage transformer units i.e. Blakley Units.

Socket outlets for I.T. equipment to have dual earth connections for high integrity earthing.

Not more than three sets of conductors may be taken into the terminals of socket outlets.

All socket outlets shall be mounted on 35mm deep boxes unless otherwise stated.

Where indicated, socket outlets shall be of the type incorporating a 30 milliamp residual current device (RCD).

No socket shall be installed within 1000mm of sink units.

9-4 CONNECTION UNITS (FUSED SPURS)

All connection units shall be mounted on 35mm deep boxes.

Where indicated, connection units will be either double pole switched or unswitched. For fan convectors, secret-key switched units with pilot light shall be installed.

All connection units will be of the type incorporating a neon pilot light unless specified otherwise.

Connection units shall be fitted with BS1363 3 amp or 13 amp fuse appropriate to the rating of the connected appliance.

Connection units as indicated shall be of the type incorporating flex outlet facilities.

9-5 POWER SWITCHES

20 amp, 30 amp or 45 amp DP switches (with neon pilot lights or with flex outlet facility) where required are to be installed where indicated.

Power switches are to be mounted on boxes with a minimum depth of 35 mm.

Power switches are to be labelled appropriately, e.g. WATER HEATER, SHOWER.

9-6 COOKER CONTROLS

Cooker control units shall consist of a 45 amp DP isolator and a neon indicator light, without a 13 amp socket.

Separate circuitry with two 45 amp cooker switches (with neon pilot lights) shall be installed for oven and hob units.

The cooker switch shall be installed adjacent to the cooker position.

Cooker control switches may not be located over the cooker, or where they will be concealed, or where easy access is restricted by the cooker or other kitchen fitments.

The cooker switch is to be permanently engraved/labelled 'COOKER'.

The oven and hob switches are to be permanently engraved/labelled with the appropriate wording.

A flush cooker connector unit is to be located 450 mm above floor level, to one side of the rear of the cooker position. This unit is to be interconnected with the cooker switch by means of a concealed 10 mm² PVC insulated and sheathed cable.

The installer is to arrange for the final connection of the cooker.

9-7 CLOCKS

Generally these are to be battery operated, with radio control where specified. If electric clocks are required they shall be synchronous mains clocks, supplied from a circular fused flush clock connector mounted on a standard B.S. circular box mounted behind the clock.

9-8 MOUNTING HEIGHTS

Where mounting heights, positions, etc., of electrical items of equipment are indicated on the drawings, these shall be worked to.

Before commencing work in any room or area, the Sub-Contractor shall check with the Clerk of Works and the Principal Contractor to ascertain whether any revised drawings have been issued by the Supervising Officer giving revised details of the layout of electrical items of equipment and other fittings on the walls, ceilings, or on benches, etc.

Sockets - general	450mm from the FFL to the bottom or 150mm from the top of the bench to the bottom
Light switches	1100mm from FFL to the centre of switch
Cooker control units	1550mm from the FFL to the bottom
Room thermostat	1500mm from the FFL to the bottom

CO ₂ Sensors	1500mm from the FFL to the bottom
Clocks	2350mm from the FFL to the bottom
Distribution boards	1500mm from the FFL to the bottom in Secured areas
Distribution boards	mounted below ceiling level in unsecured areas
Telephone outlets	450mm from the FFL to the bottom
Fire alarm break glass Contacts	1100mm from the FFL to the bottom
Fire alarm bells	2350mm from the FFL to the bottom
Fire alarm panel	1500mm from the FFL to the bottom

Note: mounting heights are subject to change to suit site conditions, DDA and accessibility requirements, and the need to maintain an acceptable aesthetic appearance. Where stated on tender drawings, mounting heights shall be confirmed by the Electrical Contractor and in all cases, approval shall be obtained from the Supervising Officer before cutting out and chasing commences.

PART 10**10-1 EARTHING AND EQUIPOTENTIAL BONDING**

The earthing and equipotential bonding of the installation shall comply with the IEE Wiring Regulations and the following requirements:

- (a) At all main distribution panels and main service positions an earth tape, consisting of copper tape to BS 1432 of 25mm x 3mm minimum cross sectional area shall be provided and all equipment including the lead sheath and armouring of cables, the metal cases of all switches, distribution fuseboards, and metal frames shall be bonded to it.
- (b) The earth tape shall be connected by means of a copper tape or cable of suitable c.s.a., to an earth electrode which shall be one or more earth rods as specified in the Schedule of Work Section 3.
- (c) All tapes to be of high conductivity soft copper, untinned except where otherwise specified, and where run underground, or through walls, floors, etc., it shall be served with corrosion resisting PVC or LSF oversheath.
- (d) Where the earth electrodes are located outside the building, a removable test link shall be provided inside the building as near as possible to the point of entry of the tape, for isolation of the earth electrode for testing purposes.
- (e) Earthing of sub-main distribution equipment shall be deemed to be satisfactory where the sub-main cables are lead covered, armoured, or M.I.C.S., subject to a satisfactory earth bonding test. They shall connect the cable sheath and armouring to the distribution equipment.
- (f) On completion test that the earth continuity resistance complies with the figure stated in the current edition of the IEE Wiring Regulations.
- (g) Where an earth rod is specified it shall be of proprietary manufacture, solid hard drawn copper or steel-cored with bonded copper sheath, of min 6mm diameter driven into the ground to a depth of 2.4m. It shall be made up of 1.2m sections with internal screw and socket joints and fitted with hardened steel tip and driving cap. Connection to the rod shall be by means of a purpose made clamp of non ferrous metal, and the actual connection made below ground level in a concrete inspection pit with removable inspection cover.
- (h) Where an earth rod is used, the earth resistance shall be tested in the manner described in the current edition of the IEE Wiring Regulations by the Contractor in the presence of the Supervising Officer, and the Contractor shall be responsible for the supply of all test equipment.
- (i) Where copper tape is fixed to the building structure, it shall be by means of purpose made non ferrous brackets which space the conductor away from the structure a minimum of 6mm. Fixings shall be made using purpose made plugs. No fixings requiring holes to be drilled through the tape will be accepted.
- (j) Joints in copper tape shall be tinned before assembly, riveted with a minimum of two copper rivets and sweated solid.
- (k) Where holes are drilled in the earth tape for connection to items of equipment the effective c.s.a. must not be less than required to comply with the regulations, and bolts, nuts, and washers for any fixing to the earth tape must be of non ferrous material.

- (l) Copper tapes or cables shall be used for equipotential bonding of all exposed conductive parts, and extraneous conductive parts to earth.
- (m) All bonding conductors shall connect to the main earthing terminal for that installation from all extraneous conductive parts including the following from the point of entry of the service into the building.
 - (1) main water pipes
 - (2) main gas pipes
 - (3) other service pipes and ducts
 - (4) risers for central heating and air conditioning systems
 - (5) exposed metallic parts of the building structure
 - (6) Lightning protection systems
- (n) Equipotential bonding conductors shall have the cross sectional areas as detailed in the IEE Wiring Regulations.
- (o) All surfaces shall be thoroughly cleaned before connections are made, and where non-ferrous metals are involved the surfaces shall be tinned.
- (p) Supplementary bonding conductors shall be provided to hot and cold water services as applicable. The bonding clamps to be used shall be as manufactured by Tenby, or equal and shall be complete with label stating 'Safety Electrical Connection - Do Not Remove' engraved in red.

For the conduit and trunking systems the Contractor shall pay particular attention to earth continuity at joints, accessories and box terminations.
- (q) All metal parts of light fittings shall be efficiently earthed. All ball and socket joints in back plates shall be bonded.

The earth terminal at each socket outlet served by conduit or trunking shall be connected to the back box by a flexible earthing bond, with LSF sheath.
- (r) The actual type of system of earthing (TN/S, TN/C or TT) will be as detailed in Section 3 of the Electrical Specification.

PART 11**LIGHTING FITTINGS AND LAMPS****11-1 GENERAL**

- (a) At all lighting points marked in the drawing and detailed on the schedules, the Sub-Contractor shall supply install and connect luminaires of the type indicated by the reference letter and schedule of luminaires.
- (b) All lighting fittings and their associated diffusers and/or glassware, lamps and tubes shall be thoroughly cleaned before erection and shall have all dust and any paint which may have been accidentally smeared on the fitting by the decorators removed before the installation is accepted.
- (c) The Contractor shall ensure that the metalwork on all lighting fittings is efficiently earthed.

11-2 POINT POSITIONS

Where ceiling tiles are to be erected, particular care should be taken in setting out to ensure that the luminaires are symmetrically disposed in relation to the ceiling panels and except where otherwise specified, the centres of luminaires shall coincide with the centre of the ceiling panels.

11-3 FIXINGS

Under no circumstances shall luminaires be secured to ceiling plaster boards only, suitable wooden battens or noggins shall be fixed above the ceiling to take the weight of the luminaires. Where the suspended ceiling cannot support the weight of the luminaire, the latter should be suspended from the structural ceiling.

On non-suspended ceilings, lighting points shall terminate in 50mm circular loop in boxes with internal earth lugs and fittings securely fixed to the ceiling using 4No. No. 8 wood screws whether conduit box fittings are available or not.

11-4 SUSPENDED CEILINGS

Lighting points shall terminate with a 3-core white flex from a standard BS 67 ceiling rose or plug in ceiling rose mounted on a 50mm BESA box fitted with internal earth lugs. Where the false ceiling is a plenum void the flexible cable shall not exceed 2.0m in unenclosed length. Unless otherwise indicated, luminaires shall be supported independently from the false ceiling structure.

The Electrical Contractor shall adequately support the lighting fittings using threaded rods, 2 or 4 No. dependent on the size and weight of the fitting.

11-5 SUSPENDED FLUORESCENT LUMINAIRES

Where luminaires are required to be suspended, they shall be supported by means of suspension sets comprising heavy gauge metal chain two-dome hook plates and two suspension hooks complete with backnuts and washers.

All fittings incorporating tube suspensions shall be complete with non-rigid connections to the general conduit system, the connections being made via the ball-and-socket type of plate.

However, fittings in general shall be fitted directly on to the ceiling unless otherwise stated.

11-6 LAMP HOLDERS

Lamp holders shall be manufactured to BS 5042 PE1.

In kitchens and bathrooms 'Home Office' type skirts shall be used.

11-7 CEILING ROSES

These shall be manufactured to BS 67 and provided with separate terminals for each conductor.

11-8 BATTEN HOLDERS

Batten holders shall be installed in bathroom and other positions where indicated on the drawings. These shall be provided with non-rising terminals and shall be fitted with 'Home Office' type ventilated skirts.

11-9 FINAL CONNECTION**(a) Surface mounted Luminaires**

The luminaires shall be mounted on conduit boxes and all insulated heat resisting shrouded connectors shall be connected to the circuit wiring behind the entry to each luminaire. Final connections shall be made using heat-resisting flexible cords to BS 6141 300/500 volt grade. Where the temperature is likely to exceed 85°C, fibre glass sleeving shall be fitted.

(b) Recessed Luminaires

In areas where there is a suspended ceiling, the conduit shall be fixed to the soffit of the slab and terminated adjacent to each luminaire in a plug-in ceiling rose, manufactured to BS 67 or 5733. Final connections shall be made using 3-core heat resisting flexible cord, to BS 6141. The luminaires shall be supported from the slab on adjustable conduit or rod suspensions to allow for final alignment with the ceiling tiles.

(c) Lighting cabling shall not pass through lighting fittings unless of the heat resistant type.

11-10 LAMPS AND TUBES

The lamps and tubes for the fittings specified, and of the wattage stated in the Schedule of Luminaires, and on the drawings, shall be supplied and installed by the Contractor who will be responsible for any failure within the 12 months maintenance period.

The lamps shall be low energy sources and the colour rating of all fluorescent tubes shall be 'white' unless specified otherwise in Section 3 of the Electrical specification.

New tubes to be 16mm dia T5, and new lamps shall be compact fluorescent type. As the availability of new technologies progress, preference will be given to LED and other lamps offering greater luminous efficacy and reduced electrical consumption.

CFL or LED lamps to be used wherever possible instead of incandescent or halogen lamps for spotlights, etc.

Where recessed downlighter fittings are used, these shall have integral fire rating to the same standard as the surface they penetrate.

PART 12**MOTORS / FAN CONVECTORS / EXTRACT FANS****12-1 ELECTRIC MOTORS**

- (a) All fan, pump and burner motors shall be continuously rated, with not less than Class 'E' insulation.
- (b) All motors shall comply with BS 5000 and shall have the enclosures specified in Clause 2, 107(3) and shall be of such a size and type as adequately to drive the equipment under all normal conditions of service without overloading. Motors other than low power types shall be three phase.
- (c) Fan, pump and similar motors larger than 0.75kW shall be screen protected and drip-proof, except in solid fuel fired boiler houses. Fractional horsepower motors and all motors in solid fuel boiler houses shall be totally enclosed.
- (d) Motors arranged for automatic restart shall be provided with a prominent label of durable material having in clearly inscribed letters:

DANGER: THIS MOTOR IS AUTOMATICALLY CONTROLLED AND MAY START WITHOUT WARNING. ISOLATE BEFORE INSPECTION.
- (e) Contactor operating coils shall be supplied at no more than 240 volts. Where operation is remotely controlled, a protective fuse shall be provided. All starters shall be protected by isolators.
- (f) The control gear for each motor of more than 0.375kW rating shall include:
 - (1) Over-current releases with adjustable time lags for each phase
 - (2) Under voltage protection
 - (3) Emergency 'stop' push button
- (g) Motors for circulating pumps and all other motors under automatic control, including motors having integral inverter and variable speed drives, shall have starters arranged for automatic restart without the need for re-programming after interruption of the mains supply when full mains voltage is restored.
- (h) Starters shall normally be rated for intermittent duty shall be suitable for direct on-line starting for motors up to 3.75kW rating and for star-delta starting for larger motors.
- (i) Extract fans shall be minimum IP44 rating controlled by a 3 pole isolator.
- (j) All motors to have an approved method of isolation.

12-2 FAN CONVECTOR MOTORS

Unless the installation is specifically arranged differently, secret-key switched fused spur units having neon indicators shall be installed either inside or outside all fan convectors for the electricity supply to the fan motor. The final connection between the spur unit and the motor shall be made with heat resistant flexible cable.

The controlling thermostat internal or external will be as detailed in Section 3 of the Electrical Specification.

Generally the spur units will be wired on common circuits from a distribution board in the boiler room, or boiler house control panel, as detailed. Some installations may incorporate "hold-off" or speed control thermostats fixed to the heating pipework by others, and the Electrical Contractor shall liaise with the Mechanical Contractor to ensure correct functioning of these devices.

PART 13

FIRE ALARMS

13-1 GENERAL

Fire alarm systems shall be in compliance with latest edition BS 5839, Part 1, to be conventional zoned systems for small installations and analogue addressable for large installations.

13-2 SYSTEM OF WIRING

All fire alarm wiring shall be in accordance with the system manufacturers diagrams.

Systems to be wired using MICS/PVC, Firetuf, FP200 cables, or approved alternatives, preferably with red sheath,

Every effort shall be made to conceal the wiring. Where it is found impractical it shall be run surface enclosed in red plastic mini trunking minimum size YT2 (20mm), with all necessary bends, stop ends and entries as applicable.

Cables shall be terminated in strict accordance with manufacturers recommendations. Seals shall be fitted with earth tails where MICC cable is used to maintain continuity when terminated in plastic boxes.

13-3 MAIN SUPPLY TO PANEL

The mains supply to the fire alarm panel to be taken from the mains incoming distribution equipment of the premises and suitably labelled 'Fire Alarms – Do Not Switch Off'.

The supply to terminate adjacent to the control panel at an un-switched fused connection unit.

13-4 PROGRAMME INSTRUMENT - (SCHOOL CLASS CHANGE)

It is normally included within the fire alarm installation in schools to incorporate a 'class change' system which utilises a programmable control panel to pulse the alarm sounders. Manufacturers such as Danfoss Randall 841 and Bellringer produce units suitable for this purpose.

13-5 COMMISSIONING OF FIRE ALARM INSTALLATION

The fire alarm system is to be commissioned by the equipment manufacturer's engineers on completion of the work. The commissioning is to be carried out after all wiring installation works and manual testing has been done by the installer.

The completed installation shall comply with the current issue of the British Standard and on handover a Certificate of Compliance shall be obtained

Any electrical work associated with the Fire Alarm installation shall be installed to BS7671 and a certificate issued .

PART 14

EMERGENCY LIGHTING

14-1 GENERAL

The emergency lighting system is to be in compliance with the latest edition of BS 5266, Part 1, and agreed European standards.

The emergency lighting luminaires are to be in compliance with BS 4533:102.22:1990, EN 60598 2.22, CEB 169WG3.

The emergency lighting system shall comprise either self-contained units, with their own 3 hour duration batteries, or centralised battery system.

All self-contained emergency lighting luminaires shall have a means of testing by key switch operation. Luminaires on a common circuit in a single area may be grouped on a common test switch. Failure of the local lighting circuit must ensure that the associated emergency luminaires shall be activated. All test key switches shall be labelled accordingly.

Central battery units shall be complete with phase failure monitoring units and shall be of the Active Static Inverter type

Self testing emergency luminaires shall be self-contained type with lamp, control gear, self testing processors, inverter, battery pack, charges, etc., all within a single unit.

If self testing luminaires are specified on refurbishment projects, any existing non-self testing shall be replaced.

14-2 COMMISSIONING OF EMERGENCY LIGHTING SYSTEM

The emergency lighting system shall be certified, and inspection and test certificates be issued in accordance with BS 5266.

In the case of the Central Battery system the unit shall be commissioned by the manufacturer and a certificate issued.

Any Electrical work associated with the Emergency lighting installation shall be installed to BS 7671 and a certificate issued.

PART 15

INTRUDER ALARMS

15-1 GENERAL

Intruder alarm systems to be in compliance with EN 50131 – 1 enhanced with NSI PD 6662 and ACPO DD 243.

The installer to be a member of NSI (National Security Installers) and approved to **Gold** Level of work.

The installation and operation shall comply with the intruder alarm policy of the local Police Force.

The designer shall determine the grading of the Intruder Alarm system by undertaking the Risk Assessment with regards to the Building use, Location and occupancy. The system shall be classified as:

- 1) 2X Low Risk - Audible only.
- 2) 2X Low Risk (enhanced) - Audible only with Keyholder response via a digital communicator or speech dialler.
- 3) 2B Medium Risk - Audible system with Classic Red Care and sequential detection - Police response.
- 4) 3B High Risk – Dual Signalling with Red Care plus GSM and sequential detection - Police response.

15-2 SYSTEM OF WIRING

The intruder alarm wiring system shall be completely segregated from all other wiring systems to avoid spurious signals and in accordance with BS7671.

Wherever possible, cabling shall be installed within roof spaces and routed such that the possibility of any mechanical damage to the cables is eliminated.

Cables in roof spaces shall be installed parallel to walls, and any change in direction shall be by means of right angle bends, no cable should be routed diagonally across any roof space.

All cables with the exception of cables run in plastic trunking shall be clipped to the fabric of the building.

The plastic trunking to be screw fixed to the fabric of the building (self adhesive trunking shall not be used).

In roof spaces containing steel work only, cables should be fixed with the aid of plastic tie wraps.

Cables passing through fire stop blockwork/partitioning in ceiling voids shall be protected by 25mm bushed galvanised conduit, (provided by the Contractor), packed with glass fibre material, and the cable tied at either end of the conduit with incombustible string for a distance of 75mm from the end of the conduit.

All holes around the conduit shall be made good to the thickness of the original blockwork or partitioning.

Surface run cables shall be concealed within Egatube Limited compact mini-trunking, YT2 or equal and approved.

Catenary wires between buildings, where accepted, as a general rule shall not exceed 15m length and they are to be run as high as possible.

Before installation details of catenary wires runs shall be agreed with the Engineer.

If the distance of the catenary exceeds 15m, or if stated otherwise or catenaries are impracticable, intruder alarm cabling must be installed in underground ducts between buildings.

Underground cables shall be PVC SWA PVC armoured type cables or a suitable size, trenched to a depth of 450mm and covered with yellow identification tapes.

The Contractor shall allow for full excavation and permanent reinstatement to the trench to the Engineer's satisfaction.

If it is necessary to install alarm cabling in heating ducts, the cable shall be enclosed in black plastic conduit manufactured by Egatube Limited, type H.I.P. or equal and approved, as for the miniature trunking all accessories and adhesives shall be used in its installation and the contractor shall take note of the installation recommendations made by the manufacturer.

Under no circumstances shall extra low voltage intruder alarm cables be installed in lift shafts or adjacent to mains cables carrying 230V.

Where ceiling tiles are removed and replaced, the Contractor shall ensure that no damage is caused to the ceiling grid or tiles.

In the event of damage, the Contractor shall be held responsible for replacement.

15-3 **CONTROL PANEL (DIGITAL COMMUNICATOR - IF REQUIRED)**

Multi zone control panels, as manufactured by Menvier Ltd. and matching Digital Communicator shall be positioned adjacent in the most appropriate and convenient locations.

The units shall be wall mounted at a height of approximately 1,800mm above finished floor level. The final positioning of the Panels is to be agreed on site with the Engineer.

The Control Panels shall be supplied with a mains/battery unit with float charge stand-by facility, capable of operating the unit in the event of mains failure.

15-4 **COMMISSIONING OF THE INTRUDER ALARM INSTALLATION**

The Intruder alarm system is to be commissioned by the installation engineers on completion of the work. The commissioning is to be carried out after all wiring installation works and manual testing has been completed.

The completed installation shall comply with the current issue of the British Standard and on handover a Certificate of Compliance shall be obtained.

PART 16

MECHANICAL SERVICES

For the electrical installation associated with Mechanical Services please refer to the latest edition of Trade Preambles, Engineering Mechanical Services, Part 8.

Version control sheet

Document: Electrical Engineering Trade Preambles

Original version: 2010.00 Date of publication: 15.4.2010

Modification record

Version Number	Date Published	Details of amendments and reasons	By whom made
2010.00	15.4.2010	Replaced 2006 edition	P Harris
2010.01	05.05.2010	Version control sheet incorporated	P Harris
2010.02			
2010.03			
2010.04			
2010.05			
2010.06			
2010.07			
2010.08			