
Annexure: C3.6.3

SPECIFICATION

FOR THE

ELECTRICAL INSTALLATION

OF

COMPLETION OF DR. JL DUBE MEMORIAL PROJECT

INDEX

1. **Part 1 - General Specification for Electrical Installation Work**
2. **Part 2 - Installation Details**
3. **Part 3 - Quality Specification for Material and Equipment of Electrical
 Installations**
4. **Annexure A: Electrical Drawings**

PART 1**GENERAL SPECIFICATION FOR ELECTRICAL WORK****CONTENTS**

<u>CLAUSE</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1	TESTS	1
2	MAINTENANCE OF INSTALLATIONS	1
3	REGULATIONS	1
4	NOTICES AND FEES	1
5	SCHEDULE OF FITTINGS	2
6	QUALITY OF MATERIALS	2
7	CONDUIT AND ACCESSORIES	2
8	SURFACE MOUNTED CONDUIT	3
9	CONDUIT IN CONCRETE SLABS	4
10	FLEXIBLE CONDUIT CONNECTIONS	4
11	WIRING	5
12	SWITCHES AND SOCKET OUTLETS	5
13	SWITCHGEAR	5
14	SWITCHBOARDS	6
15	WORKMANSHIP AND STAFF	6
16	CERTIFICATE OF COMPLIANCE	6
17	EARTHING OF INSTALLATION	6
18	MOUNTING AND POSITIONING OF LUMINAIRES	8

PART 1

GENERAL SPECIFICATION FOR ELECTRICAL INSTALLATION WORKS

1 TESTS

After completion of the works and before first delivery is taken, a full test will be carried out on the installation for a period of sufficient duration to determine the satisfactory working thereof. During this period the installations will be inspected, and the Contractor shall make good, to the satisfaction of the Representative/Agent, any defects which may arise.

The Contractor shall provide all instruments and equipment required for testing and any water, power and fuel required for the commissioning and testing of the installations at completion.

2 MAINTENANCE OF INSTALLATIONS

The maintenance period for the works shall be 6 months. With effect from the date of the First Delivery Certificate the Contractor shall at his own expense undertake the regular servicing of the installation during the maintenance period and shall make all adjustments necessary for the correct operation thereof.

If during the said period the installations is not in working order for any reason for which the Contractor is responsible, or if the installations develops defects, he shall immediately upon being notified thereof take steps to remedy the defects and make any necessary adjustments.

Should such stoppages however be so frequent as to become troublesome, or should the installations otherwise prove unsatisfactory during the said period the Contractor shall, if called upon by the Representative/Agent or the Director-General, at his own expense replace the whole of the installations or such parts thereof as the Representative/Agent or the Director-General may deem necessary with apparatus specified by the Representative/Agent or the Director-General.

3 REGULATIONS

The installation shall be erected and tested in accordance with the following Acts and regulations:

The latest issue of SABS 0142: "Code of Practice for the Wiring of Premises",

The Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended,

The Local Government Ordinance 1939 (Ordinance 17 of 1939) as amended and the municipal by-laws and any special requirements of the local supply authority,

The Fire Brigade services Act 1993 Act 99 of 1987 as amended,

The National Building Regulations and Building Standards Act 1977 (Act 103 of 1977) as emended,

The Post Office Act 1958 (Act 44 of 1958) as amended,

The Electricity Act 1984 (Act 41 of 1984) as amended and

The Regulations of the local Gas Board where applicable.

4 NOTICES AND FEES

The Contractor shall give all notices required by and pay all necessary fees, including any inspection fees, which may be due to the local Supply Authority.

On production of the official account, only the net amount of the fee charged by the Supply Authority for connection of the installation to the supply mains will be refunded to the Contractor by the Client.

5 SCHEDULE OF FITTINGS

In all instances where schedule of light, socket outlet and power points are attached to or included on the drawings, these schedules are to be regarded as forming part of the specification.

6 QUALITY OF MATERIALS

Only materials of first class quality shall be used and all materials shall be subject to the approval of the Engineer and Client. The specifications for various materials to be used on this Contract are attached to and form part of this specification.

Wherever applicable the material is to comply with the relevant South African Bureau of Standards, specifications, or to British Standard Specifications, where no SABS Specifications exist.

Materials wherever possible, must be of South African manufacture.

7 CONDUIT AND ACCESSORIES

The type of conduit and accessories required for the service, i.e. whether the conduit and accessories shall be of the screwed type, plain-end type or of the non-metallic type and whether metallic conduit shall be black enamelled or galvanised, is specified in Part 2 of this specification.

Unless other methods of installation are specified for certain circuits, the installation shall be in conduit throughout. No open wiring in roof spaces or elsewhere will be permitted.

The conduit and conduit accessories shall comply fully with the applicable SABS specifications as set out below and the conduit shall bear the mark of approval of the South African Bureau of Standards.

Screwed metallic conduit and accessories: SABS 1065, parts 1 and 2.

Plain-end metallic conduit and accessories: SABS 1065, parts 1 and 2.

Non-metallic conduit and accessories: SABS 950

All conduit fittings except couplings, shall be of the inspection type. Where cast metal conduit accessories are used, these shall be of malleable iron. Zinc base fittings will not be allowed.

Bushes used for metallic conduit shall be brass and shall be provided in addition to locknuts at all points where the conduit terminates at switchboards, switch-boxes, draw-boxes, etc.

Draw-boxes are to be provided in accordance with the "Wiring Code" and wherever necessary to facilitate easy wiring.

For light and socket outlet circuits, the conduit used shall have an external diameter of 20mm. In all

other instances the sizes of conduit shall be in accordance with the "Wiring Code" for the specified number and size of conductors, unless otherwise directed in part 2 of this specification or indicated on the drawings.

Only one manufactured type of conduit and conduit accessories will be permitted throughout the installation.

Running joints in screwed conduit are to be avoided as far as possible and all conduit systems shall be set or bent to the required angles. The use of normal bends must be kept to a minimum with exception of larger diameter conduits where the use of such bends is essential.

All metallic conduits shall be manufactured of mild steel with a minimum thickness of 1,2mm for plain-end conduit and 1,6mm in respect of screwed conduit.

Under no circumstances will conduit having a wall thickness of less than 1,6mm be allowed in screeding laid on top of concrete slabs.

Bending and setting of conduit must be done with special bending apparatus manufactured for the purpose and which are obtainable from the manufacturers of the conduit systems. Damage to conduit resulting from the use of incorrect bending apparatus or methods applied must on indication by the Engineer or his / her Representative, be completely removed and rectified and any wiring already drawn into such damaged conduits must be completely renewed at the Contractor's expense.

Conduit and conduit accessories used for flame-proof or explosion proof installations and for the suspension of luminaires as well as all load bearing conduit shall in all instances be of the metallic screwed type.

All conduit and accessories used in areas within 50 km of the coast shall be galvanised to SABS 763.

Tenderers must ensure that general approval of the proposed conduit system to be used is obtained from the local electricity supply authority prior to the submission of their tender. Under no circumstances will consideration be given by the Engineer or Client to any claim submitted by the Contractor, which may result from a lack of knowledge in regard to the supply authority's requirements.

8 SURFACE MOUNTED CONDUIT

Wherever possible, the conduit installation is to be concealed in the building work; however, where unavoidable or otherwise specified under Part 2 of the specification, conduit installed on the surface must be plumbed or levelled and only straight lengths shall be used.

The use of inspection bends is to be avoided and instead the conduit shall be set uniformly and inspection coupling used where necessary.

No threads will be permitted to show when the conduit installation is complete, except where running couplings have been employed.

Running couplings are only to be used where unavoidable, and shall be fitted with sliced couplings as a lock-nut.

Conduit is to be run on approved spaced saddles rigidly secured to the walls.

Alternatively, fittings, tees, boxes, couplings etc., are to be cut into the surface to allow the conduit to fit flush against the surface. Conduit is to be bedded into any wall irregularities to avoid gaps between the surface and the conduit.

Crossing of conduits is to be avoided, however, should it be necessary purpose-made metal boxes are to be provided at the junction. The finish of the boxes and positioning shall be in keeping with the general layout.

Where several conduits are installed side by side, they shall be evenly spaced and grouped under one purpose-made saddle.

Distribution boards, draw-boxes, industrial switches and socket outlets etc., shall be neatly recessed into the surface to avoid double sets.

In situations where there are no ceilings the conduits are to be run along the wall plates and the beams.

Painting of surface conduit shall match the colour of the adjacent wall finishes.

Only approved plugging materials such as aluminium inserts, fibre plugs, plastic plugs, etc., and round-head screws shall be used for fixing saddles, switches, socket outlets, etc., to walls, wood plugs and the plugging in joints in brick walls are not acceptable.

9 CONDUIT IN CONCRETE SLABS

In order not to delay building operations the Contractor must ensure that all conduits and other electrical equipment which are to be cast in the concrete columns and slabs are installed in good time.

The Contractor shall have a representative in attendance at all times when the casting of concrete takes place.

Draw-boxes, expansion joint boxes and round conduit boxes are to be provided where necessary. Sharp bends of any nature will not be allowed in concrete slabs.

Draw and/or inspection boxes shall be grouped under one common cover plate, and must preferable be installed in passages or male toilets.

All boxes, etc., are to be securely fixed to the shuttering to prevent displacement when concrete is cast. The conduit shall be supported and secured at regular intervals and installed as close as possible to the neutral axis of concrete slabs and/or beams.

Before any concrete slabs are cast, all conduit droppers to switchboards shall be neatly spaced and rigidly fixed.

10 FLEXIBLE CONDUIT CONNECTIONS

Flexible tubing connections shall be of galvanised steel construction, and in damp situations of the plastic sheathed galvanised steel type. Other types may only be used subject to the prior approval of the Engineer's site electrical representative.

Connectors for coupling onto the flexible tubing shall be of the gland or screw-in types, manufactured of either brass or cadmium or zinc plated mild steel, and the connectors after having been fixed onto the tubing, shall be durable and mechanically sound.

Aluminium and zinc alloy connectors will not be acceptable.

11 WIRING:

Except where otherwise specified in Part 2 of this specification, wiring shall be carried out in conduit throughout. Only one circuit per conduit will be permitted.

No wiring shall be drawn into conduit until the conduit installation has been completed and all conduit ends provided with bushes. All conduits to be clear of moisture and debris before wiring is commenced.

Unless otherwise specified in Part 2 of this specification or indicated on the service drawings, the wiring of the installation shall be carried out in accordance with the "Wiring Code". Further to the requirements concerning the installation of earth conductors to certain light points as set out in the "Wiring Code", it is a specific requirement of this document that where plain-end metallic conduit or non-metallic conduit has been used, earth conductors must be provided and drawn into the conduit with the main conductors to all points, including all luminaires and switches throughout the installation.

Wiring for lighting circuits is to be carried out with 2,5mm² conductors and a 1,5 m² earth conductor. For socket outlet circuits the wiring shall comprise 4mm² conductors and a 2,5 m² earth conductor. In certain instances, as will be directed in Part 2 of this specification, the sizes of the aforementioned conductors may be increased for specified circuits. Sizes of conductors to be drawn into conduit in all other instances, such as feeders to distribution boards, power points etc., shall be as specified elsewhere in this specification or indicated on the drawings. Sizes of conductors not specified must be determined in accordance with the "Wiring Code".

The loop-in system shall be followed throughout, and no joints of any description will be permitted.

The wiring shall be done in PVC insulated 600/1000 V grade cable to SABS 150.

Where cable ends connect onto switches, luminaires etc., the end strands must be neatly and tightly twisted together and firmly secured. Cutting away of wire strands of any cable will not be allowed.

12 SWITCHES AND SWITCHED SOCKET OUTLETS

All switches and switch-socket outlet combination units shall conform to the relevant SABS specification and bare the SABS mark of approval.

No other than 16 A 3 pin sockets are to be used, unless other special purpose types are distinctly specified or shown on the drawings.

All light switches shall be installed at 1,4m above finished floor level and all socket outlets as directed in the Schedule of Fittings which forms part of this specification or alternatively the height of socket outlets may be indicated on the drawings.

13 SWITCHGEAR

Switchgear, which includes circuit breakers, contactors, time switches, etc., is to be in accordance with the relevant SABS specification which form part of this specification and shall be equal and similar in quality to such brands as may be specified.

For uniform appearance of switchboards, only one approved make of each of the different classes of switchgear mentioned in the Quality Specifications shall be used throughout the installations.

14 SWITCHBOARDS

All boards shall be in accordance with the types as specified, be constructed according to the detail or type drawings and must be approved by the Engineer before installation.

In all instances where provision is to be made on boards for the supply authority's main switch and/or metering equipment the contractor must ensure that all requirements of the authorities concerned in this respect are met.

Any construction or standard type aboard proposed as an alternative to that specified, must have the prior approval of the Engineer.

All busbars, wiring, terminals, etc., are to be adequately insulated and all wiring is to enter the switchgear from the back of the board. The switchgear shall be mounted within the boards to give a flush front panel. Cable and boxes and other ancillary equipment must be provided where required.

Clearly engraved labels are to be mounted on or below every switch. The working of the labels in English and Afrikaans, is to be according to the lay-out drawings or as directed by the Engineer's representative and must be confirmed on site. Flush mounted boards to be installed with the top of the board 2,0m above the finished floor level.

15 WORKMANSHIP AND STAFF

Except in the case of electrical installations supplied by a single-phase electricity supply at the point of supply, an accredited person shall exercise general control over all electrical installation work being carried out.

The workmanship shall be of the highest grade and to the satisfaction of the Engineer.

All inferior work shall, on indication by the Engineer, immediately be removed and rectified by and at the expense of the Contractor.

16 CERTIFICATE OF COMPLIANCE

On completion of the service, a certificate of compliance must be issued to the Engineer's Representative/Agent in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).

17 EARTHING OF INSTALLATION

Main earthing

The type of main earthing must be as required by the supply authority and in any event as directed by the Engineer, who may require additional earthing to meet test standards.

Where required an earth mat shall be provided, the minimum size, unless otherwise specified, being 1,0m x 1,0m and consisting of 4mm diameter hard-drawn bare copper wires at 250mm centres, brazed at all intersections.

Alternatively or additionally earth rods or trench earths may be required as specified or directed by the Engineer.

Installations shall be effectively earthed in accordance with the "Wiring Code" and to the requirements of the supply authority. All earth conductors shall be stranded copper with or without green PVC installation.

Connection from the main earth bar on the main board must be made to the cold water main, the incoming service earth conductor, if any and the earth mat or other local electrode by means of 12mm x 1,60 mm solid copper strapping or 16 mm² stranded (not solid) bare copper wire or such conductor as the Engineer may direct. Main earth copper strapping where installed below 3m from ground level, must be run in 20 mm diameter conduit securely fixed to the walls.

All other hot and cold water pipes shall be connected with 12mm x 0,8mm perforated for solid copper strapping (not conductors) to the nearest switchboard. The strapping shall be fixed to the pipework with brass nuts and bolts and against walls with brass screws at 150 mm centres. In all cases where metal water pipes, down pipes, flues, etc., are positioned within 1,6m of switchboards an earth connection consisting of copper strapping shall be installed between the pipework and the board. In vertical building ducts accommodating both metal water pipes and electrical cables, all the pipes shall be earthed at each distribution board.

Roofs, gutters and down pipes

Where service connections consist of overhead conductors, all metal parts of roofs, gutters and down pipes shall be earthed. One bare 10mm² copper conductor shall be installed over the full length of the ceiling void, fixed to the top purlin and connected to the main earth conductor and each switchboard. The roof and gutters shall be connected at 15m intervals to this conductor by means of 12mm X 0,8mm copper strapping (not conductors) and galvanised bolts and nuts. Self-tapping screws are not acceptable. Where service connections consist of underground supplies, the above requirements are not applicable.

Sub-distribution boards

A separate earth connection shall be supplied between the earth busbar in each sub-distribution board and the earth busbar in the Main Switchboard. These connections shall consist of a bare or insulated stranded copper conductors installed along the same routes as the supply cables or in the same conduit as the supply conductors. Alternatively armoured cables with earth continuity conductors included in the armouring may be utilised where specified or approved.

Sub-circuits

The earth conductors of fall sub-circuits shall be connected to the earth busbar in the supply board in accordance with SABS 0142.

Ring Mains

Common earth conductors may be used where various circuits are installed in the same wire way in

accordance with SABS 0142. In such instances the sizes of earth conductors shall be equivalent to that of the largest current carrying conductor installed in the wire way, alternatively the size of the conductor shall be as directed by the Engineer. Earth conductors for individual circuits branching from the ring main shall be connected to the common earth conductor with T-ferrules or soldered. The common earth shall not be broken.

Non-metallic Conduit

Where non-metallic conduit is specified or allowed, the installation shall comply with the standard quality specification for "conduit and conduit accessories".

Standard copper earth conductors shall be installed in the conduits and fixed securely to all metal appliances and equipment, including metal switch boxes, socket-outlet boxes, draw-boxes, switchboards, luminaires, etc. The securing of earth conductors by means of self-threading screws will not be permitted.

Flexible Conduit

An earth conductor shall be installed in all non-metal flexible conduit. This earth conductor shall not be installed externally to the flexible conduit but within the conduit with the other conductors. The earth conductor shall be connected to the earth terminals at both ends of the circuit.

Connection

Under no circumstances shall any connection points, bolts, screws, etc., used for earthing be utilised for any other purpose. It will be the responsibility of the Contractor to supply and fit earth terminals or clamps on equipment and materials that must be earthed where these are not provided.

Unless earth conductors are connected to proper terminals, the end shall be tinned and lugged.

18 MOUNTING AND POSITIONING OF LUMINAIRES

The lay-out of the post top luminaires as indicated on the drawings must be adhered to as far as possible and the final positions must be confirmed with the Landscape Architects representative on site.

PART 2**ELECTRICAL INSTALLATION DETAILS****CONTENTS**

<u>CLAUSE</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1	CABLE SLEEVE PIPES	1
2	NOTICES	1
3	ELECTRICAL EQUIPMENT	1
4	DRAWINGS	1
5	BALANCING OF LOAD	1
6	SERVICE CONDITIONS	1
7	SWITCHES AND SOCKET OUTLETS	1
8	LIGHT FITTINGS AND LAMPS	1
9	EARTHING AND BONDING	2
10	MAINTENANCE OF ELECTRICAL SUPPLY	2
11	EXTENT OF WORK	2
12	SUPPLY AND CONNECTION	2
13	CONDUIT AND WIRING	2
14	POWER POINTS	3
15	CABLES	4
16	DISTRIBUTION BOARDS	5
17	SCHEDULE OF LIGHT FITTINGS	5
18	SCHEDULE OF POWER POINTS	6
19	SCHEDULE OF CABLES, CONDUIT AND WIRING	6
20	SCHEDULE OF DISTRIBUTION BOARDS	6
21	SUMMARY OF SWITCHGEAR AND CIRCUITS	6

PART 2

ELECTRICAL INSTALLATION DETAILS

1 CABLE SLEEVE PIPES

Where cables cross under roadways, other services and where cables enter buildings, the cables shall be installed in asbestos-cement pipes, earthenware or high-density polyethylene pipes.

The ends of all sleeves shall be sealed with a non-hardening watertight compound after the installation of cables. All sleeves intended for future use shall likewise be sealed.

2 NOTICES

The Contractor shall issue all notices and make the necessary arrangements with Supply Authorities, the Postmaster-General, and SA. Transport Services, Provincial or National Road Authorities and other authorities as may be required with respect to the installation.

3 ELECTRICAL EQUIPMENT

All equipment and fittings supplied must be in accordance with the attached quality specification (Part 3 of this document), suitable for the relevant supply voltage, and frequency and must be approved by the Engineer's representative.

4 DRAWINGS

The drawings generally show the scope and extent of the proposed work and shall not be held as showing every minute detail of the work to be executed.

The position of power points, switches and light points that may be influenced by built-in furniture must be established on site, prior to these items being built in.

5 BALANCING OF LOAD

The Contractor is required to balance the load as equally as possible over the multiphase supply.

6 SERVICE CONDITIONS

All plant shall be designed for the climatic conditions appertaining to the service.

7 SWITCHES AND SOCKET OUTLETS

The installation of switches and socket outlets must conform to clause 12 of Part 1 of this specification.

8 LIGHT FITTINGS AND LAMPS

The installation and mounting of luminaires must conform to clause 18 of Part 1 of this specification.

All fittings and lamps to be supplied by the Contractor shall have the approval of the SABS.

The light fittings must be of the type specified in the Schedule of Light Fittings.

9 EARTHING AND BONDING

The Contractor will be responsible for all earthing and bonding of the building and installation. The earthing and bonding is to be carried out strictly as described in clause 17 of Part 1 of this specification and to the satisfaction of the Engineer's representative.

10 MAINTENANCE OF THE ELECTRICAL SUPPLY

All interruptions of the electrical supply that may be necessary for the execution of the works, will be subject to prior arrangement between the Contractor and the Local Supply Authority.

11 EXTENT OF WORK

The work covered by this contract comprises the complete electrical installation, in working order, as shown on the drawings and as per this specification, including the supply and installation of all fittings and also the installation of such equipment supplied by the Client.

The extend of the work could be summarised as follows:

- Small power and lighting installation for the, single and double storey building, including electrical distribution board;
- Site electrical distribution kiosk and bulk electrical cable reticulation supply
- Cable reticulation trenching;
- Site lighting;
- Earthing and lightning protection
- Telephone sleeve and manhole installation:
- Cable wire ways and termination outlets for electronic services.
- Fire Detection installation
- Generator Installations

12 SUPPLY AND CONNECTION

The supply is at 400/230 Volt 50Hz.

The Engineer shall arrange in good time with the Supply Authority for the installation of the required point of supply for the development and provide the account to the Contractor for payment.

13. CONDUIT AND WIRING

Conduit and conduit accessories shall be black enamelled/galvanised screwed conduit or black enamelled/galvanised plain end conduit in accordance with SABS 162, 763 and 1007 respectively.

All conduits, regardless of the system employed, shall be installed strictly as described in the applicable paragraphs of clauses 7 to 10 of Part 1 of the specification. Wiring of the installation shall be carried out as directed in clause 11 of part 1 of this specification.

Where plain end conduit is offered all switches and light fittings must be supplied with a permanent earth terminal for the connection of the earth wire.

Lugs held by switch fixing screws or self tapping screws will not be acceptable.

13.1 **Provision For Telephone, Data And Electronic Services Installation**

General

Tenderers shall allow for the supply, delivery and installation of all telephone, data and electronic services conduits, draw boxes, outlets, draw-wires.

Draw-wires

All conduits, sleeves, etc. required for the telephone, data and electronic services installation shall be fitted with galvanised steel draw-wires.

Allow for the installation of 110 mm diameter sleeves and manholes for the telephone cable installation.

13.2 **Trunking**

A P9000 unistrut (for power and lighting) shall be suspended from slab and roof soffit, bottom of tray at 150mm below the soffit.

A 150mm medium duty cable tray (for electronic services including voice & data) shall be provided from the Server Room to each of the data and telephone riser shafts in the ground floor. The tray shall be suspended from the slab and roof soffit, bottom of tray at 150mm below the soffit.

Vertical cable trays 150mm wide shall be provided to interlink the data and telephone risers. A 150mm wide tray shall be provided from the Server Room to the perimeter of the ground floor to accommodate Telkom's incoming lines.

The proposed cable routes in the office-ceiling void are shown on the drawings.

14. **POWER POINTS**

Allow for the installation of power points and equipment as listed in the schedule, indicated on the drawings and described below:

IRRIGATION CONTROLLERS

No irrigation controllers required on this project.

15. CABLES

Cable to be replaced where necessarily.

The Contractor shall supply and completely install all distribution cables as indicated on the drawings, and listed in the Schedule of Cables.

The storage, transportation, handling and laying of the cables shall be according to first class practice, and the contractor shall have adequate and suitable equipment and labour to ensure that no damage is done to cables during such operations.

The cable-trenches shall be excavated to a depth of 900 mm deep below natural or finished ground level and shall be 450mm wide for one to three cables, and the width shall be increased where more than three cables are laid together so that the cables may be placed at least two cable diameters apart throughout the run. The bottom of the trench shall be level and clean and the bottom and sides free from rocks or stones liable to cause damage to the cable.

The Contractor must take all necessary precautions to prevent the trenching work being in any way a hazard to the personnel and public and to safeguard all structures, roads, sewage works or other property on the site from any risk of subsidence and damage.

In the trenches the cables shall be laid on a 100 mm thick bed of soft sifted soil / earth and be covered with a 150 mm layer of soft sifted soil / earth before the trench is filled in. Danger tape shall be placed on top of the 150 mm layer of soft sifted soil / earth before the trench is back filled

All joints in underground cables and terminations shall be made either by means of compound filled boxes according to the best established practice by competent cable jointers using first class materials or by means of approved epoxy-resin pressure type jointing kits such as "Scotchcast". Epoxy-resin joints must be made entirely in accordance with the manufacturer's instructions and with materials stipulated in such instructions. Low voltage PVC cables are to be made off with sealing glands and materials designed for this purpose which must be of an approved make. Where cables are cut and not immediately made off, the ends are to be sealed without delay.

The laying of cables shall not be commenced until the trenches have been inspected and approved by the Engineer, Client and the site representative. The cable shall be removed from the drum in such a way that no twisting, tension or mechanical damage is caused and must be adequately supported at intervals during the whole operation. Particular care must be exercised where it is necessary to draw cables through pipes and ducts to avoid abrasion, elongation or distortion of any kind. The ends of such pipes and ducts shall be sealed to approval after drawing in of the cables.

Backfilling (after bedding) of the trenches is to be carried out with a proper grading of the material to ensure settling without voids, and the material is to be tamped down after the addition of every 150mm. The surface is to be made good as required.

On each completed section of the laid and jointed cable, the insulation resistance shall be tested to approval with an approved "Megger" type instrument of not less than 500 V for low tension cables.

Earth continuity conductors are to be run with all underground cables constituting part of a low-tension distribution system. Such continuity conductors are to be stranded bare copper of a cross-sectional area equal to at least half that of one live conductor of the cable, but shall not be less than 4mm² or more than 70mm². A single earth wire may be used as earth continuity conductor for two or more cables run together, branch earth wires being brazed on where required.

15.1 LAYING, JOINTING AND MAKING OFF OF ELECTRICAL CABLES

1. The use of the term "Inspector", includes the engineer or inspector of the Client or an empowered person of the concerned supervising consulting engineer's firm.
2. No cable is to be laid before the cable trench is approved and the soil qualification of the excavation is agreed upon by the Contractor and inspector.
3. After the cable has been laid and before the cable trench is back-filled the inspector must ensure that the cable is properly bedded and that there is no undesirable material included in the bedding layer.
4. All cable jointing and the making off of the cables must only be carried out by qualified experienced cable jointers. Helpers of the jointers may not saw, strip, cut, solder, etc. The cable and other work undertaken by them must be carried out under the strict and constant supervision of the jointer.
5. Before the Contractor allows the jointer to commence with the jointing work or making off of the cable (making off is recognised as half a joint) he must take care and ensure that he has adequate and suitable material available to complete the joint properly and efficiently. Special attention must be given to ensure the cable ferrules and cable lugs are of tinned copper and of sufficient size. The length of the jointing lugs must be at least six times the diameter of the conductor,

16. DISTRIBUTION BOARDS

In addition to clause 13 and 14 of Part 1 of this specification the following shall also be applicable to switchboards required for this service.

The Contractor shall supply and install the distribution boards as indicated on the drawings and listed in the distribution Board Schedule. All distribution boards shall comply with the quality specification in Part 3 of this specification and be approved by the Engineer's representative. Circuit Breakers(CB's) to be used shall be SABS approved and Not less Than 5KA

The following types of distribution boards require upgrading and replacement.

Kiosk	New Installation Standing, Outside, Green
Main Distribution DB-A	Flush mounted....Green...New Installation-Water Proof
Main Distribution- DB-B	Flush mounted....Green...New Installation-Water Proof
Data DB/Tel	Surface Mounted...White....New Installation-Water Proof
DB – Tuckshop 1	Surface mounted.....White...New Installation-Indoor
DB – Tuckshop 2	Surface mounted.....White...New Installation

SUBSTATION

Transformer work will be needed on this project

17. SCHEDULE OF LIGHTFITTINGS

The light fittings and accessories are to be according to the quality specifications in Part 3 and shall be approved by the Engineer, Landscape Architect and Client.

- Type A: Surface mounted low brightness LED fluorescent light fitting complete with luvre with a wide body manufactured from 0.8 mm thick mild steel body, white epoxy powder coated. Slide on telescopic lamp holders. SABS approved electronic ballasts (control gear). 1200 mm long equipped with 2 x 28 W (T5) fluorescent lamps. IP 22 rated.
- Type B: Decorative interior LED bulkhead luminaire with a die cast aluminium base 280 mm diameter white epoxy powder coated with four mounting holes outside the lamp compartment, high pressure die cast black epoxy powder coated trim ring mounted on to the base with four fixing screws. Round dome type diffuser manufactured from opal non-discolouring high impact acrylic injection moulded with vandal resistance UV resistant with a groove, tongue and gasket fixing. SABS approved control gear. Equipped with 2 no of PL 18 Watt lamps. IP65 rated. Similar to Beka Series 31
- Type C: Decorative exterior LED bulkhead luminaire with a die cast aluminium base 280 mm diameter white epoxy powder coated with four mounting holes outside the lamp compartment, high pressure die cast black epoxy powder coated trim ring mounted on to the base with four fixing screws. Round dome type diffuser manufactured from opal none discolouring high impact acrylic injection moulded with vandal resistance UV resistant with a groove, tongue and gasket fixing. SABS approved control gear. Equipped with 2 no of PL 18 Watt lamps. IP65 rated. Similar to Beka Series 31
- Type D: LM6 die cast aluminium Foot Light operate at 6W LED, Diffuser is opal high impact acrylic, finishing is powder Coated, Recessed, Galvanised Steel Mounting Box for Installation EPDM Gasket, IP65. Similar to Lotus Frame
- Type E: Bollard Light Fitting: IP Rating IP65, LED 54W Aluminium Extruded body Cast Aluminium Base plate for Surface Mounting
- Type F: Floods Light- 100W LED, Aluminium Tempered Glass, Black, 4000K, W260X240X21 IP Rating IP65 Similar to Spazio Lighting
- Type G: 1X25W LED Post Top, 4000K luminaire output Flux of 3100LM, IP66, Marine grade aluminium (EN 1706 AC-44300) Body. The Luminaire should be supplied with a pole on a mounting height of 6M. With Polycarbonate Protector. Black (Ral 9017) Textured Finish colour. Similar to Zela
- Type H: Open channel LED fluorescent light fitting with a wide body manufactured from 0.8 mm thick mild steel body, white epoxy powder coated. Slide on telescopic lamp holders. SABS approved electronic ballasts (control gear). 1500 mm long equipped with 2 x 58 W (T5) fluorescent lamps. IP 44 rated.

Type I: Extruded Aluminium 36w LED Light fitting, PMMA Matt opal profile High Transmission Diffuser Powder Coated, Suspended with Suspension accessories of Stainless-Steel wire 12mm Rod complete with mounting cups, 4000k, Body colour Black, IP65

18. SCHEDULE OF POWER POINTS

The electrical contractor shall be responsible for the installation and provision of electrical power supply point to the Air Conditioning Package Unit, the extraction fans and push through geyser in the cells

19. SUMMARY OF SWITCHGEAR AND CIRCUITS

The switchgear to be supplied is indicated on the single line diagrams for the distribution kiosks and the office distribution board.

The indicated fault current rating (5kA) is the minimum value that the switchgear must comply with for connecting to the busbars of the respective panels-distribution boards.

PART 3**QUALITY SPECIFICATION FOR MATERIAL AND EQUIPMENT OF ELECTRICAL INSTALLATIONS****CONTENTS**

<u>CLAUSE</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1.	CONDUIT AND CONDUIT ACCESSORIES	1
2	PVC INSULATED CABLES	2
3	GLANDS FOR PVC INSULATED CABLES	3
4	CABLE TERMINATIONS AND JOINTS	4
5	UN SWITCHED AND SWITCHED SOCKET OUTLETS	5
6	POST TOP LUMINAIES	6
7	STEEL HOT DIPPED GALVANISED POLES	9
8	EARTHING ELECTRODES	10
9	LOW VOLTAGTE DISTRIBUTION KIOSKS	11
10	MOULDED CASE CIRCUIT BREAKERS	16
11	EARTH LEAKAGE RELAYS	17
12	ON LOAD ISOLATORS	17
13	STANDERD PAINT SPECIFICATION	18
14	EARTHING	19
15	PROVISION FOR TELEPHONE INSTALLATION	24
16	BULKHEAD LUMINAIRES	26
17	HIGH BAY LUMINAIRES	31

PART 3

QUALITY SPECIFICATION FOR MATERIAL AND EQUIPMENT OF ELECTRICAL INSTALLATIONS

1 CONDUIT AND CONDUIT ACCESSORIES

1.1 General

This section covers the requirements for conduit and conduit accessories for general installations under normal environmental conditions.

1.2 Screwed conduit

Conduits shall comply with SABS 162 and shall bear the SABS mark.

All conduits shall be heavy gauge, welded or solid drawn, hot-dip galvanised or black enamelled, screwed tube.

Galvanised conduit shall be hot-dipped inside and outside in accordance with SABS 763.

All conduit ends shall be reamed and threaded on both sides and delivered with a coupling at one end and a plastic cap on the other end.

1.3 Metal conduit accessories

All metal conduit accessories shall be malleable cast iron or pressed steel with brass bushes in accordance with SABS 162. Alloy or pressure cast metal accessories or zinc base alloy fittings are not acceptable. All fittings whether galvanised or black enamelled, shall be fitted with brass screws.

Accessories must be hot-dip galvanised to SABS 763.

1.4 Circular type boxes

The boxes shall be of the long spout pattern, manufactured of malleable cast iron or pressed steel and stove enamelled jet black or galvanised as required. The two cover fixing holes shall be diametrically opposite each other, drilled and tapped at 50 mm centres.

Junction, draw-in and inspection boxes shall be of adequate size and shall be supplied with heavy gauge metal cover plates.

Boxes shall comply with SABS 162.

1.5 Switch boxes and socket-outlet boxes

All switch boxes and socket-outlet boxes shall be manufactured of pressed galvanised steel of at least 1 mm thickness. All boxes shall be fitted with the necessary lugs to suit standard flush mounted switches and socket-outlets manufactured in accordance with SABS 518 and SABS 1085.

Only galvanised or metal wall boxes will be acceptable to the Engineer, even if the tenderer offered to use non metallic conduit and accessories. Light switch boxes shall be 100 x 50 x 50 mm with two 20 mm knock-outs on the sides and a single knock-out on the top, bottom and back.

Socket-outlet boxes shall be 100 x 100 x 50 mm with two 20 mm knock-outs each on the top, bottom, sides and back.

Where cavity walls are encountered tenderers must allow to install deep back to back open ended or one end closed wall boxes. Switch and socket-outlet cover plates shall comply with SABS 1084.

1.6 Flexible conduit

Flexible steel conduit and adapters shall comply with BS 731, Part 1 where applicable. Flexible conduit shall be of galvanised steel construction and plastic sheathed (copex or equal). Flexible conduit shall only be used as specified and shall then be installed in accordance with SABS 0142.

1.7 Plain-end metallic conduit

As an alternative to the threaded conduit, plain-end (unthreaded) metallic conduit with accessories may be used under the conditions stated in the Standard Specification for "INSTALLATION AND TERMINATION OF CONDUITS AND CONDUIT ACCESSORIES".

Unthreaded conduit shall be manufactured of mild steel with a minimum thickness of 0,9 mm and shall comply with the SABS 1007. Bending and setting of conduit shall be done with the correct apparatus recommended by the manufacturer of the conduit.

The Contractor or Supplier shall be responsible for obtaining the approval of local authorities for the use of this system.

All conduit and accessories used in areas within 50 km of the coast shall be hot-dip galvanised to SABS 763.

1.8 Non-metallic conduit

Non-metallic conduit shall comply fully with SABS 950 and shall be installed in accordance with Appendix C of the same specification as well as the Standard Specification for "INSTALLATION AND TERMINATION OF CONDUITS AND CONDUIT ACCESSORIES".

1.9 Earth clamps

Earth clamps shall consist of copper strips at least 1,2 mm thick and not less than 12 mm wide secured with a brass bolt, nut and washer and shall be so constructed that the clamp will fit firmly to the conduit without any additional packing.

2 PVC-INSULATED CABLES - 600/1000 V GRADE

2.1 General

This section covers the requirements for PVC-insulated cables for general installations under normal environmental conditions.

2.2 Construction

Cables shall be manufactured in accordance with SABS 1507, shall come only from fresh stocks, and shall be constructed as follows:

- | | | | |
|-----|--------------------|---|--|
| (a) | Un armoured cables | - | PVC-insulated/PVC-sheathed |
| (b) | Armoured cables | - | PVC-insulated/PVC-bedded /
armoured/black extruded PVC outer sheath |
| (c) | Single core cables | - | PVC-insulated/unsheathed |

The conductors shall be of high conductivity annealed stranded copper and the cores may be shaped or circular.

The insulation shall be general purpose PVC, 600/1000 V Grade.

The bedding shall consist of a continuous impermeable sheath of PVC extruded to fit the core or cores closely and in the case of multi-core cables, to fill the interstices between the cores.

Where armouring is specified it shall consist of one layer of galvanised steel wire in the case of multi-core cables and non-magnetic metallic wire in the case of single core cables. Aluminium strip or tape armouring is not acceptable.

Where specified, an earth continuity conductor shall be provided in the armouring in accordance with SABS 1507.

2.3 PVC-Sheathed aluminium-covered cables

Aluminium covered cables shall comprise PVC-insulated copper conductors protected by an aluminium foil tape screen and a PVC sheath.

Cable ends shall be made off with compression glands fitted with a neoprene ring to seal the end.

Aluminium sheathed cable shall be installed on surface only, using matching saddles installed at suitable intervals to prevent sagging.

Where exposed to sunlight, the cable shall have a stabilised black outer sheath.

2.4 Lengths

Cable shall be manufactured and supplied in one length to the lengths specified unless these lengths exceed a standard drum length in which case a ruling shall be obtained from the Engineer.

2.5 Tests

At the option of the Engineer, acceptance tests shall be carried out on production runs of the cable in accordance with SABS 1507.

3 GLANDS FOR PVC-INSULATED CABLES

Glands to be used for terminating PVC/PVC/SWA/PVC cables shall be of the adjustable type.

Glands shall be suitable for general purpose 600/1000 V Grade cable with steel armouring.

The glands shall be made of nickel-plated bronze or brass.

The glands shall consist of a barrel carrying a cone bush screwed into one end and a nickel-plated brass nipple carrying a nickel-plated brass or a heavy galvanised steel locknut screwed into the other end. The galvanising shall comply with SABS 763.

Non-watertight glands must be easily converted to watertight glands by means of a waterproofing shroud and inner seal kit. On the cable entry side of the barrel a concave groove shall be provided to accommodate the top rim of the waterproofing shroud.

The shrouds shall be made of non-deteriorating neoprene or other synthetic rubber, and shall be resistant to water, oil and sunlight. The shrouds shall fit tightly around the glands and cable.

Glands shall be provided with ISO threads and shall be suitable for the specified cable sizes.

Flameproof glands shall comply with SABS 808, Groups 1, 2a and 2b.

Suitable accessories shall be provided with glands to be used on ECC armoured cables to facilitate a bolted lug connection of the earth continuity conductors. Grooves cut into the barrel or cone bush to accommodate the earth continuity conductors are not acceptable.

For unarmoured cables the cone bush and compression ring of the gland shall be replaced with a synthetic rubber compression bush and ring to provide the required grip on the outer sheath of the cable.

4. CABLE TERMINATIONS AND JOINTS

4.1 Heat-shrinkable materials

4.1.1 General

The complete kit shall be packed in a container that is marked for the type of cable insulation and construction as well as the voltage range for which the materials are suitable.

An illustrated set of instructions for the installation of the materials shall accompany every kit.

The joints and terminations shall make minimal, if any, use of insulating or stress relieving tapes. The use of electrical stress control and insulating tubing that is heat-shrunk onto the termination or joint, is preferred above other methods.

The materials shall comply with VDE 9278 and the supplier shall be called upon to confirm this aspect before acceptance of the materials or installation.

The heat-shrinkable and other materials used for the terminations and joints shall be of a high quality and shall retain their electrical and mechanical properties without deterioration.

4.1.2 Terminations with heat-shrinkable materials

Terminations shall be made of a material that gives lasting protection against ultraviolet radiation.

The cores of all cables terminated outdoors and the cores of 3,3 kV and higher voltage cables terminated indoors, shall be completely covered with a shrunk-on protective layer against surface tracking, ultraviolet radiation and weathering.

5 UN-SWITCHED AND SWITCHED SOCKET OUTLETS

5.1 General

This section covers the requirements for un-switched and switched socket-outlets for use in general installations under normal environmental conditions.

Switch sockets of one manufacturer only, will be accepted per project.

5.2 Flush and surface mounted switched sockets

All switched socket-outlets shall be suitable for mounting in 100 x 100 x 50 mm or 100 x 50 x 50 mm boxes, shall comply with SABS 164 and shall bear the SABS mark.

Switches shall be of the tumbler operated micrograph type rated at 16 A, 220/250 V.

Terminals shall be enclosed for safe wiring.

Contacts shall be of silver material.

Safety shutters shall be provided on live and neutral openings.

The yoke strap shall be slotted to allow for easy alignment.

The covers of surface mounted switched sockets shall have toggle protectors.

Miniature circuit-breakers shall be used in lieu of a switch where specified.

Where 13 A flat pin switched socket-outlets are specified, these shall comply with BS 1363.

5.3 Watertight switched sockets.

The housing of watertight switched socket shall be of galvanised cast iron or die-cast aluminium with watertight machined joints.

The switch shall have porcelain base and a quick-acting spring mechanism and shall be rated at 16 A, 220/250 V.

The ON/OFF positions shall be clearly marked on the switch housing.

The socket openings shall be rendered watertight by means of a gasketed cover plate, which is screwed onto the body of the unit. The cover plate shall be secured to the body of the unit by means of a chain.

6 POST TOP LUMINAIRES FOR EXTERIOR APPLICATIONS

6.1 SCOPE

The post light fittings to be supplied shall be according to the standard specification of Electricity as well as the following requirements.

6.2. GENERAL

- 6.2.1 The luminaire should be manufactured within the Republic of South Africa.
- 6.2.2 If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.
- 6.2.3 A sample luminaire shall be provided for evaluation and approval by the Engineer prior to installation.
- 6.2.4 Luminaires, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective covering.
- 6.2.5 Lamps shall be delivered separately.

6.3 STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

- 6.3.1 SABS 1421: High-pressure mercury vapour lamps.
- 6.3.2 SABS IEC 662: High-pressure sodium vapour lamps
- 6.3.3 IEC 61167: Metal Halide lamps
- 6.3.4 SABS 56: Incandescent lamps
- 6.3.5 SABS 1250: Capacitors for use with discharge lamp Ballasts.
- 6.3.6 SABS 1464: Safety of luminaires.
- 6.3.7 SABS IEC 922 and
SABS IEC 923: Ballasts for discharge lamps.
- 6.3.8 SABS IEC 926 and
SABS IEC 927: Starting devices (other than glow starters).
- 6.3.9 SABS 890, IEC 920
And IEC 921: Ballasts for fluorescent lamps
- 6.3.10 ABS IEC 400: Lamp holders for fluorescent lamps
- 6.3.11 ABS 1247: Coatings applied by the powder-coating process.
- 6.3.12 ABS 783: Baked enamels.
- 6.3.13 ABS 0142: The wiring of Premises
- 6.3.14 ABS 1507: Electric cables with extruded solid dielectric insulation for
fixed installations.
- 6.3.15 SABS 165 and:
VC 8011 Lamp holders
- 6.3.16 SABS 1277: Street lighting luminaires.
- 6.3.17 SABS 1088: Luminaire entries and spigots

6.3.18 Any standard referred to in the above specifications.

6.4. **PHYSICAL AND ENVIRONMENTAL REQUIREMENTS**

6.4.1 AREAS OF APPLICATION: The luminaires are intended for standard exterior use on premises.

6.4.2 FIXING: The luminaires shall be suitable for mounting on vertical poles. Spigot entries shall have an internal diameter of 76mm and shall be 75mm deep in accordance with SABS 1088 Table 1 (Type 2).

6.4.3 ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C. The luminaire shall have an ingress protection rating of IP55 in order to prevent air from entering the lamp compartment and this rating shall be certified by a SABS report.

6.4.4 SAFETY: The luminaire shall bear the SABS 1464 safety mark.

6.4.5 NOISE: Noisy ballasts will not be accepted and shall be replaced at no cost to the Engineer. All ballasts shall comply with the requirements of the latest edition of SABS IEC 920, 921, 922 and 923.

6.5. **GENERAL TECHNICAL REQUIREMENTS**

6.5.1 General

6.5.1.1 The internal components of the luminaire shall be able to withstand internal temperatures of at least 45°C without resulting in any electrical or mechanical component exceeding its maximum rated operating temperature. Certified proof from an authorised testing facility shall be presented on request.

6.5.1.2 The luminaire colour shall be as specified in the project specification.

6.5.1.3 The luminaire shall bear the SABS 1277 mark.

6.5.2 Construction

6.5.2.1 The luminaire shall consist of a spigot base manufactured from high-pressure die-cast aluminium, a lamp compartment with integral control gear as applicable, and a prismatic diffuser and top canopy. The base shall be of sufficient strength for the mounting of the entire luminaire.

6.5.2.2 The luminaire shall be designed to accommodate the control gear, wiring, lamp holders, the diffuser and reflectors where applicable. It shall be possible to reach the control gear without disconnecting wiring or removing the luminaire.

6.5.2.3 All components, including screws, bolts and nuts utilised in the construction of the luminaire or fixing of its components, shall be corrosion proof. Cadmium plated or stainless steel materials are preferred.

6.5.2.4 The luminaire spigot shall be provided with at least three M8 stainless steel Allen grub screws for mounting onto the pole.

6.5.3 Internal wiring

- 6.5.3.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body or control gear trays.
- 6.5.3.2 The wiring shall preferably be totally metal enclosed to prevent any possible contact with live components while changing lamps.
- 6.5.3.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.
- 6.5.3.4 The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable.
- 6.5.3.5 An earth terminal, forming part of the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

6.5.4 Lamp holders

Lamp holders shall be of the type suitable for the relevant lamp used. Lamp holders shall not deteriorate as a result of normal operating temperatures in the luminaire.

6.5.5 Control gear

- 6.5.5.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted
- 6.5.5.2 Ballasts shall comply with SABS IEC 920, 921, 922 and 923 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.
- 6.5.5.3 Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in Clause 5.1.1 above are not exceeded.
- 6.5.5.4 The luminaire control gear shall be mounted onto a control gear mounting assembly, which also contains the lamp holder. The assembly shall be mounted on the spigot base and the whole assembly shall be removable as a unit without dismantling the luminaire as such.
- 6.5.5.5 The luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.
- 6.5.5.6 In those applications where ignitors are used, these shall be of the superposed pulse type.
- 6.5.5.7 The reflector, if specified in the project specification, shall be mounted on a white epoxy powder coated steel mounting plate at least 0.7 mm thick, which shall be mounted to the spigot body. The reflector shall be made from highly polished anodised aluminium plate and shall be manufactured to give optimum performance with the prismatic diffuser.

6.5 Capacitors

Capacitors shall comply with SABS 1250. The power factor of each complete fitting shall be corrected

6.5.7 Lamps

6.5.7.1 The following standard lamps shall be used for the purposes of this specification:

<u>Lamp</u>	<u>Lamp holder</u>
Mercury Vapour 125 W	E27

All lamps shall be of the elliptical coated type.

6.5.7.2 The lamps shall be prevented from loosening in the holders as a result of vibrations under normal working conditions.

6.5.8 Diffuser

6.5.8.1 The diffuser shall consist of a high-impact resistant ultra-violet stabilised acrylic moulding with internal prismatic refractors and the outer surface shall be smooth. The prisms shall be designed to work in conjunction with the reflectors to provide the optimum light output.

6.5.8.2 The diffuser shall be mounted to the body by means of a round ring surface at the bottom, which fits onto the spigot base with a neoprene gasket. A drip ridge shall be provided at the bottom edge to prevent direct contact by rainwater with the gasket. The diffuser top shall be formed in such a manner that the top canopy-cover fits over the diffuser.

6.5.8.3 The top canopy cover shall be manufactured from a robust material that is highly resistant to weather, hail, corrosion and vandalism. The inside of the canopy shall be provided with ribbed struts, formed as part of the moulding, to provide additional strength to the canopy. The canopy shall be provided with an internal groove into which the diffuser top edge shall fit and this shall be sealed by means of a neoprene gasket. The cover shall be bolted down onto the body by means of a single central nut on top of the cover.

6.6. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements, shall be submitted with the luminaire.

6.7. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

7 STEEL HOT DIPPED GALVANISED POLES

The poles offered shall be 4500 mm long steel hot dipped galvanised pole. The pole shall be according to the specifications and requirements of Ekurhuleni Municipality Electricity.

The surface of the pole shall be smooth tapered seamless.

The pole shall be coloured throughout in the standard colour green.

A cable entry of 80mm diameter shall be provided $\pm$ 600mm below ground level.

The pole shall have an access door of 250mm x 80mm. The door cover shall be an overlapping cover smaller in diameter than the pole to ensure a tight fit. The cover shall be secured to the pole by means of two captive stainless steel ALLEN cap screws that are completely tamper proof and only accessible with an ALLEN key. The door cover shall be completely replaceable and interchangeable.

The pole is to have a 300mm x 300mm hot dipped galvanised baseplate secured to the pole.

The pole shall be supplied with a gland plate to accommodate 2 x 20mm glands, 10 Amp MCCB, 4 x 16 amp terminal block and earth stud. This gland plate shall be removable so that the work can be executed outside the pole.

A pamphlet furnishing full details of the pole offered, shall submitted with the tender.

8 EARTHING ELECTRODES

8.1 General

This section covers uncoated, coated and metal clad circular rod electrodes intended to provide an earth in soil for electrical and lightning arrestor systems.

8.2 Category and type

Only the following type of earthy rods shall be used:

- 1 (a) - Solid copper
 (b) - Solid stainless steel
- 2 (a) - Solid steel with bonded copper protection
 (b) - Solid steel with plated copper protection
 (c) - Solid steel with a shrunk-on copper jacket
3. - Solid steel with a shrunk-on stainless steel jacket
4. - Galvanised steel

8.2.2 Bare aluminium is not acceptable as an electrode material.

8.2.3 All rods shall be solid and of circular cross section with length as specified in the Project Specification.

8.2.4 The nominal diameter of the earthing rods shall not be less than 16 mm unless the rods are specified for placing in pre-drilled holes in which event the minimum nominal diameter shall not be less than 12 mm.

8.3 Couplings and conductor clamps

Earthing electrodes shall be provided with (n-1) couplings where n = number of rods supplied.

Rods designed for coupling by means of external sleeves shall be provided with an adequate quantity of hydrocarbon or silicon grease to be applied to the coupling before the joint is made.

Rods designed for coupling by means of internal pins or splines shall be provided with thin-walled tubes and hydrocarbon or silicon grease to seal the joint.

Conductor clamps shall be provided to suit the type and size of rods provided and the type and size of conductor specified in the Project Specification.

The material of the clamps shall be electrolytically compatible with the rod and conductor materials.

Where brazed or welded connections are specified, the supplier of the rods shall stipulate at least two types of metals, which are compatible with the rod and conductor materials.

An adequate number of driving caps of bolts shall be supplied with the rods to protect the ends of the earthing rods whilst being driven into hard soil.

9 LOW VOLTAGE DISTRIBUTION CUBICLES (KIOSKS)

9.1 General

This specification covers the manufacture of distribution kiosks for general reticulation and distribution systems in normal environmental conditions for three-phase, four wire, 400/231 V, 50 Hz systems.

9.2 Size

Kiosks shall be of ample size to accommodate the specified equipment and provide space for future requirements as specified.

9.3 Moisture and vermin

Kiosks shall be weatherproof. To prevent the ingress of water onto live equipment, the door entry surrounds shall have a channel shape, at least 12 mm deep, to accommodate the door edge.

The roof shall be constructed with an overhang above non-continuous panelling and shall be provided with a drip-edge.

9.4 Ventilation

Two ventilation grilles or slots, approximately 150 x 125 mm, verminproofed and insectproofed by means of 1,5 mm brass mesh or perforated steel plate spotwelded on the inside, shall be provided on the top and bottom of both side panels.

The construction of the grilles shall prevent the ingress of rain or water.

9.5 Sheet steel canopies

Where specified the canopy and doors shall be manufactured of steel to the following requirements:

A metal framework shall be manufactured from solid angle iron, channel iron or 2,5 mm minimum folded sheet steel.

Joints shall be non-continuously butt welded. Welds shall be ground smooth and the joints wiped

with plumber's metal in order to provide a smooth finish.

Side panels, doors and the roof shall be manufactured from 2 mm minimum sheet/galvanised steel. The panels shall have upturned edges which are recessed in the frame or which fit over lips on the frame. The side panels may be either bolted or welded to the frame or form part of the folded metal frame.

The roof of the cubicle shall be removable and shall be fitted by means of bolts, which shall be accessible from inside the cubicle only.

All panels and doors shall be suitably braced and stiffened to ensure rigidity and to prevent warping.

The steel canopy and framework shall be fixed to the base frame by four M16 high tensile steel bolts.

9.5.1 Finish and colour of sheet steel kiosks

Metal components of the framework, panels and doors shall be painted in accordance with the "STANDARD PAINTING SPECIFICATION".

The colour shall be "BISCUIT", colour B64 or "LIGHT STONE", colour C37 of SABS 1091. A tin of matching touch-up paint (not smaller than 500 ml) shall be provided with each consignment.

9.6 Doors

Doors shall be fitted to the front and to the rear of each cubicle. The doors shall provide free access to equipment which has to be operated and shall provide a full view of all meters. Cubicles wider than 700 mm shall be provided with double doors.

Doors shall have well returning edges to fit into the channel of the door entry surrounds.

Doors shall swivel through 135°.

Brass hinges shall be used to hang the doors. The hinges shall be bolted to the canopy with brass bolts and nuts. Bolt heads or nuts shall not protrude beyond the outer surface of the kiosk. Nylon, aluminium or piano hinges are not acceptable.

Doors shall be fitted with lever locks equal or similar to the "BARKER & NELSON" type with a 135° movement. The locking mechanism shall have a catch on the rear, which catches behind the frame or door entry surround. The locking mechanism as well as the catch support area shall be backed with brass or galvanised steel plates. The locking mechanism shall be padlockable. Padlocks will be proved by the Engineer, unless otherwise specified in the Project Specification.

The locking mechanism shall be made of brass or stainless steel.

Door restraints shall be provided. Cloth or canvas straps are not acceptable. The fixing points of the restraint at both the door and canopy shall be reinforced.

At least three hinges shall be supplied on steel doors higher than 1,2 m.

Doors shall be fitted with neoprene or equivalent seals.

Metal doors shall be earth bonded to the frame by means of a copper braided strap, tooth washers,

bolts and nuts.

9.7 Equipment support frame

A free standing, angle iron or similar type rigid support framework shall be provided.

The frame shall be bolted down on the base by four M16 high tensile steel bolts. The holding-down bolts shall be accessible from the inside of the cubicle only. The frame of sheet steel canopies may be bolted to the canopy framework.

A galvanised steel cable gland plate shall be bolted to the bottom of the frame across the full width of the cubicle to cover the cable entry opening in the base.

The gland plate shall be suitably punched to accept the number and size of cables specified.

All steelwork shall be hot-dip galvanised in accordance with SABS 753.

A panel of resin bound synthetic wood or other suitable dielectric material shall be provided for the mounting of all equipment and busbars. Impregnated hardboard, other treated or untreated wood products are not acceptable.

Alternatively, all equipment and busbars shall be flush mounted within a purpose-made sheet metal frame enclosed by a machine punched removable front panel through which the operating handles of the equipment protrude. Care shall be exercised that the rear studs of circuit-breakers are properly insulated from the steel chassis. Miniature circuit-breakers may be installed in clip-in trays mounted on the frame.

9.8 Concrete bases and base frames

To ensure stability of the kiosk after installation, it shall be mounted on a base frame which, in turn, shall be bolted to a concrete base cast onto the bottom of the cable trench.

The base frame shall be constructed of angle iron, at least 50 x 4 mm thick and shall be of welded construction hot-dip galvanised and coated with epoxy resin tar.

The vertical height of the box frame shall be at least 900 mm and the construction shall be such as to provide a rigid support for the kiosk.

The base frame shall protrude to a maximum height of 200 mm above ground level. Provision shall be made for the protection and concealing of the cables entering the kiosk and to prevent access of animals and vermin.

The base frame shall be secured by at least four M16 bolts to the support frame of the kiosk and four M16 bolts and nuts to the concrete base. The bolts, nuts and washers shall be galvanised and supplied with the kiosk.

All galvanising shall be to SABS 763.

The kiosk manufacturer shall supply a detailed drawing of the base frame and the concrete base required.

Alternative designs and materials for the base (or root) of the kiosk will be considered but full details

must be submitted for approval by the Engineer.

9.9 Wiring

9.9.1 Cabling

Incoming and outgoing cables shall be terminated on the gland plate. Cables up to 70 mm² may terminate on clamp type terminals where the clamping screws are not in direct contact with the conductor. All cable sizes larger than 70 mm² shall terminate on busbar stubs which shall be connected to the associated equipment. Parallel incoming or outgoing cables shall be connected to a collector busbar without crossing the conductors.

9.9.2 Current rating

The current rating of conductors for the internal wiring shall be sufficient to carry the maximum continuous current that can occur in the circuit. This value shall be determined from the circuit-breaker or fuse protection of the circuit. The smallest conductor size to be used for power wiring shall be 2,5 mm².

9.9.3 Internal wiring

Standard 600/1000 V Grade PVC-insulated stranded annealed copper conductors to SABS 1507 shall be used for the internal wiring.

Wiring shall be installed away from terminals, clamps or other current carrying parts. Wiring shall also be kept away from exposed metal edges or shall be protected where they cross metal edges.

Joints in the wiring are not acceptable.

Where conductors change direction, smooth bends shall be formed with a radius of at least 5 times the outside diameter of the conductor.

9.9.4 End connections

The supply end connections to equipment shall be at the top and the load end connections at the bottom.

9.9.5 Conductor terminations

All conductors terminating on equipment with screwed terminals shall be fitted with lugs. The lugs shall be soldered or crimped to the end of the conductor with the correct amount of insulation removed from the end to fit into the lug. Strands may not be cut from the end of the conductor.

Connections to circuit-breakers, isolators or contactors shall be as specified above. The devised colour codes shall be shown on a wiring diagram. Coloured PVC or other tape will not be acceptable for colour coding.

9.10 Mounting of equipment

The mounting of equipment shall comply with SABS 1180 where applicable. Equipment shall be fixed to the support panel with bolts, nuts, washers and spring washers or "NYLOC" nuts with

washers. Self-tapping screws are not acceptable.

Equipment shall be arranged and grouped in a logical fashion.

All equipment shall be flush mounted behind panels with only circuit-breaker and isolator toggles and meter faces protruding. The front panels shall be secured in position by "DZUS" or "CAMLOC" fasteners. Self-tapping or similar screws are not acceptable.

Blanking plates shall be fitted over slots intended for future equipment. These plates shall be fixed so that fixing holes do not need to be drilled through the front panel.

9.11 Access

All equipment, busbars and wiring shall be completely accessible with the door open and the back door and front panel removed. In the case of fibreglass kiosks, the complete canopy shall be removable.

9.12 Labelling

All equipment shall be fully labelled and accurate descriptions shall be given in English.

Engraved brass shall be used for labels. The labels shall be riveted to the kiosks.

The following labels shall be supplied as a minimum requirement:

- (a) Number and allocation of kiosk,
e.g. KIOSK B26

(Lettering: At least 10 mm high. Label on the outside in a prominent position).

- (b) Designation of circuit i.e. circuit-breaker, isolator, meter, etc.

e.g. ADMIN BLOCK
ADMIN BLOK

(Lettering: At least 5 mm high. One label installed directly below each item of equipment pertaining to the particular circuit shall be provided).

- (c) The main switch shall be marked in accordance with the regulations.
- (d) The function and circuits of all other equipment shall be clearly identified. Flush mounted equipment within the front panel shall be identified by labels fixed to the front panel. The labels for all equipment installed behind panels shall be fixed to the support panel close to the equipment.
- (e) The labels shall be secured by means of rivets. Self-tapping screws are not acceptable. Labels shall not be glued to their mounting positions. Sufficient rivets shall be provided to prevent labels from warping.
- (f) All label designations shall be confirmed with the Engineer before manufacture.

9.13 Notices

At least one notice with the words "GEVAAR.DANGER.INGOZI" shall be mounted outside on the front of the kiosk. This notice shall be riveted to the steel door so that it cannot easily be removed. Brass rivets shall be used. The notice shall be laminated into the fibreglass door in the case of fibreglass kiosks.

9.14 Inspections

The Engineer shall be notified at least two weeks in advance of the completion of the kiosks in order that an inspection may be carried out before delivery.

9.15 Drawings

9.15.1 Drawings for approval

A set of three prints of the shop drawings of the cubicles shall be submitted to the Engineer for approval before the cubicles are manufactured. The following information shall be presented:

- (a) Schematic and wiring diagrams of the cubicles.
- (b) A complete layout of the arrangement of the cubicles showing all equipment dimensions and constructional details. The positions and methods of fixing of busbars shall be shown.
- (c) All labelling information in English on a separate sheet.
- (d) The makes, catalogue numbers and capacities of all equipment.
- (e) A detail drawing of the concrete plinth, showing concrete mixes, dimensions, opening sizes, steel reinforcing details and holding-down bolt fixing details.

The approval of drawings shall not relieve the Contractor of his responsibility to the Engineer to supply the cubicles according to the requirements of this Specification.

9.15.2 Final drawings

A complete set of "record" drawings of the cubicles shall be submitted to the Engineer within two weeks after delivery of the kiosks.

The information contained in Par. 3.11.17.1 shall be provided.

9.15.3 Completion

The supply contract shall be regarded as incomplete until all drawings have been handed to the Engineer.

10 MOULDED-CASE CIRCUIT-BREAKERS

This section cover single or multi-core moulded case circuit-breakers for use in power distribution systems, suitable for panel mounting, for ratings up to 1000 A, 600 V, 50 Hz.

The circuit-breakers shall comply with SABS 156.

The continuous current rating, trip rating and rupturing capacity shall be as specified.

The contacts shall be silver alloy and shall close with a high pressure wiping action.

Where specified, the circuit-breaker shall be capable of accommodating a factory fitted shunt trip or auxiliary contact units or similar equipment.

The operating handle shall provide clear indication of "ON", "OFF" and "TRIP" positions.

The mechanism shall be of the TRIP-FREE type preventing the unit from being held in the ON position under overload conditions.

All moulded-case circuit-breakers in a particular installation shall as be as far as is practical be supplied by a single manufacturer.

The incoming terminals of single-pole miniature circuit-breakers shall be suitable for connection to a common busbar.

The circuit-breaker shall have a rating plate indicating the current rating, voltage rating and breaking capacity. Extension type operating handles shall be provided for units of 600 A rating and above.

11 EARTH LEAKAGE RELAYS

Earth leakage relays shall be single or three-phase units with a sensitivity of 30 Ma, on-load switch or circuit-breaker type for use on 220/250 V single phase or 380/433 V three-phase, 50 Hz, supplies.

The units shall be suitable for installation in switchboards in clip-in trays or bolted to the chassis.

The earth leakage relay shall comply with SABS 767 as amended, and shall bear the SABS mark. Integral test facilities shall be incorporated in the unit.

Circuit-breakers with trip coils used integrally with earth leakage units (two-pole for single-phase units and three-pole for three-phase units) shall comply with SABS 156.

On-load switches used integrally with earth leakage units (two-pole for single-phase units and three-pole for three-phase units) shall comply with SABS 152.

The fault current rating of the unit shall be 5 kA as required, when tested in accordance with SABS 156.

12 ON-LOAD ISOLATORS

This section covers switches suitable for panel mounting for use in power distribution systems up to 600 V, 50 Hz. Switches for motor isolation are included.

The switches shall be of the triple-pole, hand operated type complying with SABS 152.

The switches shall have a high speed closing and opening feature.

The switches shall be suitably rated for the continuous carrying, making and breaking of the rated

current specified as well as the through-fault current capacity as specified.

To distinguish the switches from circuit-breakers the operating handles shall have a distinctive colour and/or the switch shall be clearly and indelibly labelled "ISOLATOR".

13 STANDARD PAINT SPECIFICATION

13.1 Finish required

Metalwork of electrical equipment such as switchboards, equipment enclosures, sheet steel luminaire components, purpose-made boxes, etc. shall be finished with a high quality paint applied according to the best available method. Baked enamel, electro-statically applied powder coating or similar proven methods shall be used.

13.2 Corrosion resistance

Painted metal shall be corrosion resistant for a period of at least 168 hours when tested in accordance with SABS Methods 155.

13.3 Edges

Care shall be taken to ensure that all edges and corners are properly covered.

13.4 Surface preparation

Surface preparation shall comply with SABS 064. Prior to painting, all metal parts shall be thoroughly cleaned of rust, millscale, grease and foreign matter to a continuous metallic finish. Sand or shot blasting or acid pickling and washing shall be employed for this purpose.

13.5 Baked enamel finish

Immediately after cleaning all surfaces shall be covered by a rust inhibiting, tough, unbroken metal-phosphate film and then thoroughly dried.

Within forty eight (48) hours after phosphating, a passivating layer consisting of a high quality zinc chromate primer shall be applied, followed by two coats of high quality alkyd-based baked enamel.

The enamel finish on metal luminaire components shall comply with SABS 783, Type III.

Other metal parts e.g. switchboard panels, etc., shall comply with SABS 783, Type IV with a minimum paint thickness after painting of 0,06 mm. In coastal areas, the dry film thickness shall be increased to at least 0,1 mm.

The paint shall have an impact resistance of 5,65 J on cold-rolled steel plate and a scratch resistance of 2 kg.

13.6 Powder coated finish

Immediately after cleaning the metal parts shall be pre-heated and then covered by a microstructured paint powder applied electrostatically.

The paint shall be baked on and shall harden within 10 minutes at a temperature of 190°C.

The minimum paint thickness after baking shall be 0,05 mm. The dry film thickness shall be increased in coastal areas. The paint cover shall have an impact resistance of 5,65 J on cold-rolled steel plate and scratch resistance of 2 kg.

13.7 Touch-up paint

In the case of switchboards and larger equipment enclosures, a tin of matching touch-up paint not smaller than 1 litre shall be provided.

13.8 Colours

The colour of LV switchboards and equipment enclosures in buildings shall be "WHITE" colour G80 or "BISCUIT" B64 of SABS 1091.

The colour of LV distribution kiosks and miniature substations shall be "BISCUIT", colour B64 or "LIGHT STONE", colour C37 of SABS 1091.

14. EARTHING

This section covers the earthing of electrical installations in buildings or other structures. The total earthing system of any electrical installation shall be in complete accordance with SABS 0142.

14.1. GENERAL RECOMMENDATIONS ON THE PRACTICAL INSTALLATION OF EARTH ELECTRODES

14.1.1 Requirements of an Effective Earth

An effective earth must prevent dangerous over voltages arising between metallic structures, frames, supports or enclosures of electrical equipment and the ground during fault conditions.

An effective earth must be able to permit fault currents of sufficient magnitude to flow so as to operate protective devices to isolate the fault before damage can occur.

The ohmic resistance of an effective earth must be low enough to ensure that the step potential on the ground in the vicinity of the earthing point is within safe limits under fault conditions i.e. a voltage gradient not exceeding 40 V/m for fault durations exceeding 1s.

14.1.2 Types of Earth Electrodes

Three types of earth electrodes are suitable:

Trench Earths

Trench earths comprise a bare copper or galvanised iron conductor laid at a minimum of 800mm below ground level, usually when underground cables are installed. This type of earth electrode provides a relatively large contact area between electrode and surrounding ground, makes contact with a variety of types of soil and soils of varying moisture content en route and is economical to install.

Spike Earths

Spike earths comprise rods of bare copper, copper-coated steel, stainless steel or galvanised steel designed for the purpose of penetrating ground to depths of up to several metres. A low resistance earth may sometimes be obtained by driving multiple spikes at some distance from each other in order to provide parallel paths.

In hard or rocky ground, it is usually necessary to drill holes into which earth spikes are inserted and then packed with soft soil.

Foundation Earths

Foundation earths comprise bare copper or galvanised iron conductors laid under the foundations of buildings, miniature substations, distribution pillars, bases of wooden, concrete or steel poles and structures. Because soil under foundations usually retains moisture, foundation earths are located to take advantage of this favourable condition. Furthermore, they are economical to install.

14.1.3 Materials for Earth Electrodes

Bare copper, either in stranded, strip or rod form, is considered the most suitable general purpose material for earth electrodes. Its main disadvantage is its cost and susceptibility to theft.

Bare galvanised iron and steel, either in stranded, strip or rod form, has a satisfactory record of survival in non-aggressive soils and is more economical than copper.

Bare aluminium is unsuitable as electrode material.

14.1.4 Corrosion

Because galvanised ferrous metals corrode sacrificially to copper, galvanised iron and steel electrodes should not be buried in close proximity to bare copper.

14.2. TECHNICAL REQUIREMENTS OF NEUTRAL EARTHING

The following relevant aspects have been extracted from the "AMEU CODE OF PRACTICE FOR THE APPLICATION OF NEUTRAL EARTHING ON LOW VOLTAGE DISTRIBUTION SYSTEMS."

14.2.1 Distribution Systems

Multiple Earthed Neutral (MEN) and Protective Multiple Earthing (PME) systems.

Distribution equipment associated with transformer substations that are either ground mounted or pole mounted and fed by underground cable or overhead line, with or without an earth continuity conductor, (ECC), should be installed, connected and earthed in accordance with the following requirements:

- (a) Where the resistance to earth of the HV equipment earth is 1 ohm or less, it is permissible to earth the LV neutral to the HV earth electrode.

- (b) Where the HV equipment earth exceeds 1 ohm the LV neutral shall be earthed at a minimum distance of 6m from the HV equipment earth (i.e. 6m from the HV electrode/s and also from any earthed metalwork connected thereto).
- (c) Notwithstanding the requirements of (a) above, where transformers are associated with HV overhead lines, it is considered good practice to separate the HV and LV earth electrodes. The minimum earth separation should be 6m or one LV span.
- (d) The overall resistance to earth of the neutral of an LV distributor or distribution system must not exceed 10 ohms.
- (e) The LV neutral may be connected to other supply neutrals, earth electrodes, cable sheaths and armouring and these connections used to obtain the required earthing value of 10 ohms or less specified in par. (d). above.
- (f) The neutral of underground and overhead LV distributors must be earthed at the remote ends of each distributor.
- (g) Where the overall resistance to earth of the neutral of the distribution system exceeds 10 OHMS, the neutral shall be earthed at intermediate positions on the distributor/s to reduce its resistance to earth to below this limit.
- (h) The cross-sectional area of the neutral of all LV distributors must not be less than that of a phase conductor.
- (i) No circuit-breakers, isolators, fuses, switches or removable links shall be installed in the neutral between the transformer star point and the remote end of any LV distributor or service connection.
- (j) All metallic sheathing and armouring of cables and all metalwork associated with meter cabinets, fuse pillars, etc., supporting or enclosing LV cables shall be bonded to the distributor neutral conductor.
- (k) Where a Separate Neutral Earth (SNE) cable is part of an MEN or PME system, the armouring and/or metallic sheath and any ECC shall be bonded to the neutral at the supply end of the cable.
- (l) To ensure the integrity of the neutral, it is recommended that all connections and joints on or to overhead line conductors be made by compression fittings or, alternatively double bolted connectors.
- (m) MEN or PME may be applied to any single LV distributor without alterations to other LV distributors supplied from the same transformer.

14.2.2 Protective Neutral Bonding (PNB) System

Since the neutral is earthed at one point only, the question of multiple earthing does not arise and there is therefore no necessity to meet the MEN/PME technical requirements.

14.2.3 Service Connections

MEN System

The following conditions apply to consumers' service connections as well as service connections to traffic signals, road signs, street lighting and other power-consuming equipment installed in public places:

- (a) All service connections must be by means of cable with an insulated phase, an insulated neutral conductor and an ECC.
- (b) A single phase service connection comprises a live, a neutral and an ECC.
- (c) A polyphase service connection comprises two or three phase conductors, a neutral and an ECC.
- (d) The service neutral and ECC must be solidly and separately connected to the distributor neutral at the tee-off point.
- (e) The consumer's earthing lead is connected to the Supply Authority's earth terminal which is in turn connected to the ECC in the service cable at the consumer's supply point.
- (f) The neutral must not be connected to earth at the consumer's supply point.
- (g) If required by the Supply Authority, an earth electrode must be installed at the consumer's supply point.
- (h) In a service connection to traffic signals, street light and other power-consuming equipment installed in public places, such equipment is earthed to the ECC of the service connection.

PME System

- (a) All service connections must be by means of a cable with an insulated phase and an insulated neutral conductor.
- (b) A single phase service comprises a live conductor and a neutral.
- (c) A polyphase service connection comprises two or three phase conductors and a neutral.
- (d) The consumer's earthing lead is connected to the supplier's neutral and to a mandatory earth electrode at the consumer's supply point.
- (e) A label must be attached at the consumer's supply point on his premises indicating that the installation is part of a PME system.

Note: It is not recommended that the PME system be applied to supply traffic signals, street signs or other power-consuming equipment installed in public places, because the PME system is inherently unsafe under "broken-neutral" conditions.

14.3. SUBSTATION EARTHING

In order to comply with the requirements of par. 1 and 2 above, an earth resistivity measurement shall be undertaken at the site of a new substation or miniature substation, preferably by a specialist firm. The contractor shall then submit to the Department details of a proposed substation earth indicating whether a trench earth, spike earth or foundation earth is intended and the proposed interconnections with the installation.

14.4. FENCES OF OUTDOOR SUBSTATIONS

In cases where substations contain transformers or switchgear installed outdoors, the compulsory fence shall be earthed as follows, if no other method is specified:

- (a) A 70mm² earth wire shall be installed 400mm below ground level and 500mm from the fence on the outside of the sub-station along the entire length of the fence. This earth wire shall be earthed at each corner by means of a 1,8m earth rod and the rod and earth wire bonded to the fence. The earth wire shall also be bonded, at least at two points, to the main earthing system.
- (b) A 70mm² earth wire shall also be buried at a depth of 400mm around each transformer and switch and bonded to the main earthing system.

14.5. EARTHING OF A GENERAL ELECTRICAL INSTALLATION

14.5.1 General

All earth conductors shall be stranded copper with or without green PVC insulation. The conductors shall comply with the Department's quality specification for "PVC-INSULATED CABLES", Section C4. All earth conductor sizes shall be determined in accordance with SABS 0142, par. 4.6 where the earth does not form an integral part of the cable.

14.5.2 Switchboards

A separate earth connection shall be supplied between the earth busbar of the main switchboard and the earth busbar of every sub-switchboard. These connections shall consist of bare or insulated stranded copper conductors installed along the same routes as the supply cables or in the same conduit as the supply conductors. Alternatively armoured cables with earth continuity conductors included in the armouring may be utilised.

14.5.3 Sub-circuits

The earth conductors of all sub-circuits shall be connected to the earth busbar in the supply switchboard in accordance with SABS 0142.

14.5.4 Ring Mains

Common earth conductors may be used where various circuits are installed in the same wiring channel in accordance with SABS 0142. In such instances the sizes of earth conductors shall be specifically approved by the Department. Earth conductors for individual circuits branching from the ring main shall be connected to the common earth conductor with T-ferrules or soldered. The common earth shall not be broken.

14.5.5 Connections

Under no circumstances shall connection points, bolts, screws, etc. used for earthing be utilised for any other purpose. It will be the responsibility of the Contractor to supply and fit earth terminals or clamps on equipment and materials that must be earthed where these are not provided. Unless earth conductors are connected to proper terminals, the ends shall be tinned and lugged. Lugs may be crimped, using mechanical or pneumatic tools designed for this purpose, on condition that evidence is submitted that the method used complies with the performance requirements of BS 4579, Part 1:

"COMPRESSION JOINTS IN COPPER."

14.5.6 Non-metallic Conduit

Where non-metallic conduit is specified or allowed, stranded copper earth conductors shall be installed in the conduits and fixed securely to all metal appliances and equipment, including switch boxes, socket-outlet boxes, draw-boxes, switchboards, luminaires, etc. The securing of earth conductors by means of self-threading screws will not be permitted.

14.5.7 Flexible Conduit

An earth conductor shall be installed in all non-metallic flexible conduit. This earth conductor shall not be installed external to the flexible conduit but within the conduit with the other conductors. The earth conductor shall be connected to the earth terminals at both ends of the circuit.

14.5.8 Water Pipes

Metal cold water mains shall be bonded to the earth busbar in the Main Switchboard by solid 15 x 2mm copper strapping. All other hot and cold water pipes shall be connected by 12 x 0,8mm perforated or solid copper strapping (not conductors) to the nearest switchboard. The strapping shall be fixed to the pipe work by brass nuts and bolts and against walls be brass screws at 150mm centres. In all cases where metal water pipes, down pipes, flues, etc. are positioned within 1,6 m of switchboards, an earth connection consisting of copper strapping shall be installed between the pipe work and the board. In vertical building ducts accommodating both metal water pipes and electrical cables, all the pipes shall be earthed at each switchboard.

14.5.9 Roofs

Where service connections consist of overhead conductors, all metal parts of roofs, gutters and down pipes shall be earthed. One bare 10mm² copper conductor shall be installed over the full length of the ceiling void, fixed to the top purlin and connected to the main earth conductor of each switchboard. The roof and gutters shall be connected at 15m intervals to this conductor by means of 12 x 0,8mm copper strapping (not conductors) and galvanised bolts and nuts. Self-tapping screws are not acceptable. Where service connections consist of underground supplies, the above requirements are not applicable.

15. PROVISION FOR TELEPHONE INSTALLATION

15.1. CONTRACTOR'S RESPONSIBILITY

The Contractor shall only supply and install outlet points, wiring channels and/or conduits for telephones. The telephone installation will be carried out by others.

15.2. REGULATIONS

All provisions for telephones in buildings shall comply with the latest issue of "FACILITIES FOR TELECOMMUNICATION SERVICES IN BUILDINGS" as issued by the Department of Posts and Telecommunications.

15.3. SEPARATION OF SERVICES

Cables or conductors for telephone services shall be separated from all other services by:

- (a) providing separate metal channels or conduits, or
- (b) installing power cables, conductors and accessories at a minimum distance of 300mm from routes reserved for telephone cables, or
- (c) an earthed metal barrier installed in such a manner to ensure that the minimum distance through free air space between the telephone cables and other services is at least 300mm.

In cases where high voltage cable runs are parallel to telephone cable runs for more than 50m, the correct spacing shall be determined by conferring with the Department of Posts and Telecommunications.

Conduits or wiring channels provided for telephone services may not be used for any other purpose. Where non-metallic channels are used, the separation stated in par. 3.1 (b) shall be maintained throughout the installation.

15.4. MAIN TELEPHONE DISTRIBUTION BOARD

The size and position of the Main Telephone Distribution Board, where required, shall be in accordance with the requirements of the Detail Technical Specification.

The board shall consist of a metal tray, architrave frame and hinged doors and shall be flush mounted in the position shown on the drawing(s).

A 20mm thick soft wooden panel (fine grade pine to SABS 1098, without knots) shall be installed in the main telephone distribution board and shall cover the entire back of the board. Chipboard or similar materials are not acceptable.

All conduits and sleeves to telephone outlets or sub-distribution boards in the buildings or on the site as well as the main incoming sleeves, shall terminate at the main telephone distribution board as indicated on the drawing(s).

Where 100 x 100 x 50mm draw-boxes are specified as main or sub-distribution boards, the boxes shall be flush mounted and provided with a cover plate. A wooden panel need not be provided in these cases.

15.5. VERTICAL BUILDING (SERVICE) DUCTS

If the telephone cables are to be installed in the same duct as power cables the separation of services described in par. 3 shall be maintained.

Conduits and metal channels to and from building duct(s) shall be installed from the section containing the telephone cables to obviate telephone cables crossing power cables or other services in the duct.

Where more than one vertical building duct is provided in the structure, the ducts shall be interconnected by at least 2 x 32mm dia. conduits at each floor level unless otherwise specified or indicated on the drawings.

15.6. TELEPHONE OUTLETS

Blank cover plates shall be fitted to all telephone outlets.

Telephone outlets in walls shall consist of flush mounted 100 x 100 x 50mm draw-boxes.

Telephone outlets in floors shall be of the same type as floor outlets for power socket-outlets. These provisions also apply to under floor ducting. If the type of floor outlet is not specified, 100 x 100 x 50mm flush mounted draw-boxes shall be provided in the floor at the positions indicated on the drawings. The cover plates for these draw-boxes shall be of the die cast type.

Where twin under floor ducts are provided and where the one duct is intended for telephone cables, the separation between the ducts shall be maintained throughout the under floor ducting installation.

Where power skirting is specified for telephone installations, the Contractor need only install the skirting with covers since the telephone socket will be fixed directly to the cover. Where multiple power skirting is provided containing other services, no other cables may be installed in the section intended for telephone cables and the separation between the sections shall be maintained throughout the installation.

Refer also to the Department's standard specification for the "INSTALLATION OF WIRING CHANNELS, UNDERFLOOR DUCTING AND POWER SKIRTING", Section B2.

15.7. CONNECTION OF TELEPHONE OUTLETS

Telephone outlets shall be inter-connected and connected to the telephone distribution boards as shown on the drawings.

If the inter-connecting conduits are not specified, conduit sizes shall be determined as follows:

Inter-connection of 10 outlets maximum - 25mm dia. conduit.

Inter-connection of 20 outlets maximum - 32mm dia. conduit.

Metal channels or power skirting installed on the same floor level on opposite walls of the same area as well as parallel runs of under floor ducting intended for the installation of telephone cables, shall be interconnected at intervals of 6m. Conduit may be used for these inter-connections.

All conduits and all ducts or channels which do not have removable covers, shall be provided with galvanised steel draw-wires.

Conduit connections to power skirting or surface mounted metal channels, shall consist of a 100 x 100 x 50mm draw-box which is flush mounted immediately behind the duct or channel in which the telephone cables are to be installed. A hole shall be cut in the back of the duct or channel, immediately opposite the draw-box. The edges of the hole shall be grommited. The draw-box shall be accessible from the front when the cover is removed.

Purpose-made accessories for the connection of conduits to under floor ducts shall be used. Where these are not available, a 100 x 100 x 50mm draw-box shall be installed below the under floor duct opposite a floor telephone outlet. Inter-connecting conduits shall terminate at the draw-box. The edges of the hole shall be grommited. The draw-box shall be accessible from the top via the floor

outlet.

Exposed conduit ends intended for future extensions shall be terminated by means of a coupling and screwed brass plug. Only galvanised conduit shall be used in these instances.

16. BULKHEAD LUMINAIRES FOR USE WITH COMPACT FLUORESCENT LAMPS FOR INTERIOR AND EXTERIOR APPLICATIONS

16.1. SCOPE

This specification covers the requirements for bulkhead type luminaires, using compact fluorescent or tungsten filament lamps, for general indoor and outdoor use. The types of luminaires covered are decorative round, rectangular or square surface-mounted and recessed types and include luminaires with one or more lamps with standard wattage ratings as specified in the project specification. Luminaires for use in special applications or atmospheres are not included in this specification.

16.2. GENERAL

To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

Luminaires, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective covering.

Lamps shall be delivered separately.

16.3. STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

SABS 1119: Interior luminaires for fluorescent lamps. Note: The latest Amendments whereby luminaires with compact fluorescent lamps are covered, shall apply.

SABS 1250: Capacitors for use with fluorescent and other discharge lamp ballasts.

SABS 890, IEC 920

and IEC 921 : Ballasts for fluorescent lamps.

SABS 1464: Safety of luminaires.

SABS 1479: Glow starters for fluorescent lamps.

SABS IEC 400: Lamp holders for tubular fluorescent lamps.

SABS 1041, IEC 81

and IEC 901 : Tubular fluorescent lamps for general service.

SABS 1247: Coatings applied by the powder-coating process.

SABS 783:	Baked enamels.
SABS 0142:	The wiring of Premises
SABS 56:	Incandescent lamps

Any standard referred to in the above specifications.

16.4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

AREAS OF APPLICATION: The luminaires are intended for standard indoor and exterior use in buildings under the control of the Department of Public Works.

FIXING: The luminaires shall be suitable for mounting against ceilings or walls as described in the project specification.

ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C.

SAFETY: The luminaire shall bear the *SABS 1464* safety mark.

NOISE: Noisy ballasts will not be accepted and shall be replaced at no cost to the Department. All ballasts shall comply with the requirements of the latest edition of SABS 890, Part 1 or IEC 920 and 921.

16.5. GENERAL TECHNICAL REQUIREMENTS

16.5.1 General

Compact fluorescent lamp luminaires shall comply fully with SABS 1119 and all amendments as well as the additional requirements of this specification. Luminaires, which bear the SABS mark, are preferred. Luminaires shall at least have an SABS Certificate of Compliance.

The Department reserves the right to have samples of luminaires offered tested by the SABS for compliance with SABS 1119. If a sample luminaire is found not to comply with SABS 1119 the cost of such tests shall be borne by the Tenderer.

Luminaires for tungsten filament lamps shall not materially differ from those for compact fluorescent lamps, but shall be capable of dissipating the extra heat generated without deterioration in the luminaire materials.

16.5.2 Construction

A luminaire shall consist of a ventilated body manufactured from die-cast aluminium. The body shall be of sufficient strength for the mounting of the entire luminaire.

The luminaire shall be designed to accommodate the control gear, wiring, lamp holders, the diffuser and reflectors. It shall be possible to reach the control gear without disconnecting wiring or removing the luminaire.

Except for mounting holes and/or slots, the back of the body shall be closed over the full extent of the luminaire.

Suitable knockouts shall be provided in the rear of the luminaire body for wire entry.

All components, including screws, bolts and nuts utilised in the construction of the luminaire or fixing of its components, shall be corrosion proof. Cadmium plated or stainless-steel materials are preferred.

The luminaire shall, as an option, be available with a high-pressure die-cast aluminium skirt, which shall be designed in such a way that it covers the base completely when mounted. The skirt shall be mounted onto the body by means of at least three screws.

16.5.3 Internal wiring

Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body.

The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.

The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable.

An earth terminal, welded to the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

16.5.4 Lamp holders

Lamp holders shall be of the type suitable for the relevant compact fluorescent or general lighting service lamp. The following standard lamps and lamp holders shall apply:

<u>LAMP</u>	<u>HOLDER</u>	<u>LAMP</u>	<u>HOLDER</u>
7W PL	2G11	13W PLC	G24d-1
9W PL	2G11	18W PLC	G24d-2
11W PL	2G11		

16.5.5 Control gear

The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted. All fluorescent luminaires shall operate on a switch-start basis where external starters are employed.

Ballasts shall comply with SABS 890 and SABS 891, or IEC 920 and IEC 921 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.

Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in paragraph 3.5 of SABS 1119 are not exceeded.

Starters shall comply with SABS 1479 or with BS 3772 if it is not covered by SABS 1479. Starters with metal cans shall contain integral earthing facilities to earth the can upon insertion.

Starters shall be accessible from the outside of the luminaire, and the replacement of the starter shall not necessitate the removal of lamps.

The luminaire reflector shall act as the gear/mounting tray and shall be manufactured from sheet steel at least 0,7mm thick. The gear tray shall preferably be white epoxy powder coated after all the cut-outs and holes have been made on the tray. The tray shall be mounted to the body of the luminaire by means of screws and the tray shall be provided with a hole through which the screw head can pass plus a slot of the same width as the screw thickness so that the tray can be removed without removing the screws completely.

The gear tray shall be equipped with the components suitable for the luminaires specified in the project specification.

16.5.6 Capacitors

Capacitors shall comply with SABS 1250. The power factor of each complete fitting shall be corrected to at least 0,85.

16.5.7 Lamps

Fluorescent lamps shall be suitable for the control circuitry used. Lamps shall comply with the applicable clauses of SABS 1041 and, where it does not apply, the lamps shall comply with IEC 81 or IEC 901.

If no colour is specified in the Detail Technical Specification, the light colour shall correspond to colour 2 (4 300K) of SABS 1041.

Lamps of the same colour shall be provided for an entire installation unless specified to the contrary.

There shall be no visible flicker in the lamps and lamps shall readily strike when switched on. Faulty lamps or ballasts shall be replaced at no cost to the Department.

The following standard lamps shall be used for the purposes of this specification:

PL lamps:	7W, 9W AND 11W
PLC Lamps:	13W

16.5.8 Diffuser

The diffuser shall consist of a high-impact resistant ultra-violet stabilised acrylic moulding. The diffuser shall be either transparent or opaque as described in the project specification. Where transparent diffusers are required, these shall be moulded with internal prismatic refractors and the outer surface shall be smooth.

The diffuser shall be mounted to the body by means of an external mounting ring and at least three screws, which should preferably not pass through the diffuser body as well. A silicon sponge gasket which fits into a groove on the diffuser shall be used to allow breathing of the luminaire whilst prohibiting the ingress of insects.

16.6. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements, shall be submitted with the luminaire.

16.7. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

17. HIGH BAY LUMINAIRES

17.1. SCOPE

This specification covers the requirements for high bay luminaires using sodium vapour, mercury vapour or metal halide lamps with standard wattage ratings as specified in the project specification.

17.2. GENERAL

To promote work creation in South Africa, the luminaire should preferably be manufactured within the Republic of South Africa and should have a local content of at least 50%.

If the luminaire offered is of foreign origin, full specifications on technical performance and quality must be submitted and full reasons shall be given why the unit had to be imported.

A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

Luminaires, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective covering.

Lamps shall be delivered separately.

17.3. STANDARDS

The following standard specifications of the South-African Bureau of Standards and the International Electrotechnical Commission shall apply to this luminaire specification:

SABS 0142:	The wiring of Premises.
SABS 165: and VC8011	Lamp holders
SABS 783:	Baking enamels.
SABS 1222:	Enclosures for electrical equipment.
SABS 1247:	Coatings applied by the powder-coating process.
SABS 1250:	Capacitors for use with fluorescent and other discharge lamp ballasts.
SABS 1464:	Safety of luminaires.
SABS 1507:	Electric cables with extruded solid dielectric insulation for fixed Installations.

SABS IEC 662:	High-pressure sodium vapour lamps.
SABS 1421	Mercury vapour lamps
IEC 61167	Metal halide lamps
SABS IEC 922 and SABS IEC 923:	Ballasts for discharge lamps.
SABS IEC 926 and SABS IEC 927:	Starting devices (other than glow starters).

Any standard referred to in the above standards.

17.4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

AREAS OF APPLICATION: The luminaires are intended for interior use in establishments under the control of the Department of Public Works.

FIXING: The luminaires shall be suitable for mounting against horizontal surfaces or beams or as described in the project specification.

ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C. The luminaire shall have an ingress protection rating of IP 22 for the control gear compartment and this shall be certified in a SABS report.

SAFETY: The luminaire shall bear the SABS 1464 safety mark.

NOISE: Noisy ballasts will not be accepted and shall be replaced at no cost to the Department. All ballasts shall comply with the requirements of the latest edition of SABS IEC 922 and 923.

17.5. GENERAL TECHNICAL REQUIREMENTS

The internal components of the luminaire shall be able to withstand internal temperatures of at least 45°C without resulting in any electrical or mechanical component exceeding its maximum rated operating temperature. Certified proof from an authorised testing facility shall be presented on request.

All metal components shall be manufactured from corrosion-resistant materials or shall be treated to prevent corrosion.

All screws and other components must be easily reachable and must be mounted on the luminaire body.

Luminaires shall preferably bear the SABS mark.

17.6. CONSTRUCTION

17.6.1 BODY

The luminaire shall consist of two components, viz. a reflector housing the lamp and a control gear compartment onto which the lamp holder is fixed.

Provision shall be made for the effective dissipation of heat emanating from the lamp and the control gear.

The overall height of the luminaire shall not exceed 550mm.

The mass of the complete luminaire shall not exceed 12kg.

17.6.2 REFLECTOR

The reflector shall be of a spun-aluminium construction. The aluminium shall be of high purity and shall be brightened and anodised.

The size and shape of the reflector shall be designed so that it neatly fits onto the control gear body and it shall be of sufficient size to house the lamp. The reflector shall preferably be adjustable to accommodate the particular type of lamp used.

The reflector shall be shaped to provide the maximum light output and shall minimise glare. The reflector shall have a maximum diameter of not more than 540mm.

The reflector shall be sufficiently rigid to ensure that it does not bend or distort as a result of heat developed by the lamp or control gear.

The reflective properties of the reflector shall not change as a result of periodic cleaning by maintenance personnel. No part of the reflector shall become detached or distorted as a result of normal handling of the luminaire or vibration under working conditions.

The reflectors shall be manufactured with such close tolerances that all luminaires of the same type have the same light distribution characteristics.

17.6.3 CONTROL GEAR

The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted and for the lamps specified in the project specification.

Ballasts shall comply with SABS IEC 922 and 923 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.

Ballasts shall further be suitable for the particular luminaire to ensure that the thermal limits specified in Clause 5.1 above are not exceeded.

The luminaire control gear shall be mounted inside a separate control gear compartment. The control gear housing shall consist of two parts. The top part shall be provided with 20mm diameter conduit entry knock-outs and mounting facilities to enable the mounting of this part of the control gear compartment by means of mounting brackets, vibration-proof mounting bolts or suspension hooks as detailed in the project specification.

The bottom part of the control gear compartment shall be hooked or hinged onto the top portion so that it can be fixed onto the top portion after prior installation of the top part. The bottom section shall house the control gear, which shall be mounted on a removable gear tray.

The gear-mounting tray shall be manufactured from sheet steel at least 0,7mm thick and shall be epoxy powder coated.

In those applications where ignitors are used, these shall be of the superposed pulse type. The wire between the ignitor and the lamp holder shall be insulated to withstand a voltage of at least 5kVDC.

Capacitors shall comply with SABS 1250. The power factor of each complete luminaire shall be corrected to at least 0,85.

17.6.4 INTERNAL WIRING

Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body or control gear trays.

The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration. Silicon insulation shall be used throughout.

The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires. Terminals where screws bear down directly on wires will not be acceptable. The terminal block shall be mounted in the control gear compartment.

An earth terminal, forming part of the luminaire body, shall be provided. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

All circuits that require ignitors shall have an insulated wire between the ignitor and the lamp holder, capable of withstanding a voltage of at least 5kV.

17.6.5 LAMP HOLDERS

Lamp holders shall be of the type suitable for the relevant lamp used. Lamp holders shall not deteriorate as a result of normal operating temperatures in the luminaire. Lamp holders shall comply with SABS VC8011 and shall be able to withstand a temperature of 240° C.

Lamp holders shall not degenerate under normal working conditions and shall not work loose as a result of vibration.

17.6.6 LAMPS

The following standard lamps shall be used for the purposes of this specification:

<u>LAMP</u>	<u>LAMP HOLDER</u>
Sodium Vapour	(These lamps shall be of the tubular clear type.)
150W	E40
250W	E40
400W	E40
Mercury vapour (All mercury vapour lamps shall be of the elliptical coated type.)	
250W	E40

400W	E40
Metal Halide	(These lamps shall be of the elliptical coated type.)
250W	E40
400W	E40

17.7. ELECTRICAL SUPPLY

The luminaires shall be suitable for connection to a single-phase electricity supply with a nominal voltage of 220V to 250V at 50Hz.

The actual voltage will be furnished in the project specification.

17.8. PHOTOMETRIC DATA

Photometric data sheets of the luminaire as prepared by a laboratory that complies with SABS requirements, shall be submitted with the luminaire.

17.9. TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaire offered with the tender.

PART 4

BILL OF QUANTITIES FOR THE ELECTRICAL INSTALLATION WORK

TYPICAL ITEMS/PREAMBLES TO BE INSERTED IN THE BILLS OF QUANTITIES

The conditions of contract and the application of the Contract Price Adjustment Provisions shall be as set out in Part A: Section 1: Preliminaries.

The descriptions in these bills of quantities shall be read in conjunction with the specification.

The unit rate for each item in the Bills of Quantities shall include for all materials, labour, profit, transport, etc., everything necessary for the execution and complete installation of the work in accordance with the description.

The Bills of Quantities shall not be used for ordering purposes. The Contractor shall check the lengths of cables and overhead conductors on site before ordering any of the cables. Any allowance for off-cuts shall be made in the unit rates.

The rates shall exclude Value-Added Tax and the total carried over to the final summary in PART A.

All material covered by this **Specification** shall, wherever possible, be of South African manufacture.

ANNEXURE A**ELECTRICAL WORK: SCHEDULE OF MATERIAL OFFERED**

The contractor shall complete the following schedule of material offered with the tender and submit them with the completed tender document.

The schedules will be scrutinised by the Representative/Agent and should any material offered not comply with the requirements contained in the specification, the Contractor will be required to supply material in accordance with the contract at no additional cost.

NOTE:

Should the contractor wish to supply materials other than that originally offered, prior written approval must be obtained from the Representative/Agent before any orders are placed

CONTRACTOR: _____

SIGNED: _____

DATE: _____