



VRYHEID MAGISTRATE COURT

GENERAL ELECTRICAL INSTALLATION

PART 3: SECTION C: QUALITY SPECIFICATIONS FOR MATERIAL AND EQUIPMENT OF ELECTRICAL INSTALLATIONS

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SECTION C1

CONDUIT AND CONDUIT ACCESSORIES

1. GENERAL

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

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.

- (a) Screwed metallic conduit and accessories: SABS 1065 parts 1 and 2.
- (b) Plain-end metallic conduit and accessories: SABS 1065 Parts 1 and 2.
- (c) Non-metallic conduit and accessories: SABS 950

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

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

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.

2. SCREWED CONDUIT

- 2.1 Conduits shall comply with SABS 1065 and shall bear the SABS mark.
- 2.2 All conduits shall be heavy gauge, welded or solid drawn, hot-dip galvanised or black enamelled, screwed tube.
- 2.3 Galvanised conduit shall be hot-dipped inside and outside in accordance with SABS 763.
- 2.4 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.

3. METAL CONDUIT ACCESSORIES

All metal conduit accessories shall be of malleable cast iron or pressed steel with brass bushes in accordance with SABS 1065. 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.

4. CIRCULAR TYPE BOXES

- 4.1 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 50mm centres.

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

4.3 Boxes shall comply with SABS 1065.

5. SWITCH BOXES AND SOCKET OUTLET BOXES

5.1 All switch boxes and socket outlet boxes shall be manufactured of pressed galvanised steel of at least 1mm 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.

5.2 Light switch boxes shall be 100 x 50 x 50mm with two 20mm knockouts on the sides, one 20mm knockout on the top, bottom, side and back.

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

5.4 Switch and socket outlet cover plates shall comply with SABS 1084.

6. FLEXIBLE CONDUIT

Flexible steel conduit and adaptors shall comply with BS 731, part 1 where applicable. Flexible conduit shall be of galvanised steel construction and in damp areas of the plastic sheathed galvanised steel type. Flexible conduit shall only be used as specified and shall then be installed in accordance with par. 5.4.4 of SABS 0142.

7. PLAIN-END METALLIC CONDUIT

7.1 As an alternative to the threaded conduit, plain-end (unthreaded) metallic conduit with accessories may be used under the conditions stated in the Department's standard specification for "INSTALLATION AND TERMINATION OF CONDUITS AND CONDUIT ACCESSORIES", par. 3 of Section BI.

7.2 Unthreaded conduit shall be manufactured of mild steel with a minimum thickness of 1,2mm and shall comply with SABS 1007.

7.3 Bending and setting of conduit shall be done with the correct apparatus recommended by the manufacturer of the conduit.

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

7.5 All conduit and accessories used in areas within 50 km of the coast shall be hot-dip galvanised to SABS 763. In inland areas electro-galvanised or cadmium-plated accessories will be accepted.

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 Department's standard specification for "INSTALLATION AND TERMINATION OF CONDUITS AND CONDUIT ACCESSORIES", par. 4 of Section BI.

9. EARTH CLAMPS

Earth clamps shall consist of copper strips at least 1,2mm thick and not less than 12mm 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.

SECTION C2

WIRING CHANNELS, UNDERFLOOR DUCTING AND POWER SKIRTING

1. WIRING CHANNELS

1.1 General

1.1.1 The channels shall be manufactured of rolled sheet steel.

1.1.2 The minimum thickness of the sheet steel shall be:

- (a) 1,6mm for ribbed channels with a maximum width of 42mm.
- (b) 2,5mm for unribbed channels with a maximum width of 42mm.
- (c) 1,2mm for channels with a width in excess of 42mm.

1.1.3 The channels shall be finished as follows:

- | | | |
|-----|---|---|
| (a) | In coastal areas (under all installation conditions) | Hot-dip galvanised to SABS 763 or epoxy powder coated |
| (b) | Cast in concrete | Pre-galvanised |
| (c) | False ceiling voids | Pre-galvanised |
| (d) | Vertical building ducts | Hot-dip galvanised to SABS 763 or epoxy powder coated |
| (e) | Surface mounted in plant rooms, substations, service tunnels, basements | Epoxy powder coated or electro-galvanised |
| (f) | Damp areas, exposed to weather, underground runs in contact with earth | Hot-dip galvanised to SABS 763 or epoxy powder coated |
| (g) | Undercover industrial applications | Hot-dip galvanised to SABS 763 or epoxy powder coated |

1.1.4 The above-mentioned finishes shall apply unless specified to the contrary or approved by the Department. Hot-dip galvanised ducts shall be cold galvanised at all joints, sections that have been cut and at places where the galvanising has been damaged. Powder coated ducts shall likewise be touched up at joints, cuts and damaged portions using methods recommended by the manufacturer of the channels.

1.2 Cover Plates

1.2.1 All channels shall be supplied with cover plates,

1.2.2 Channels up to 127mm wide shall have snap-in cover plates of metal or PVC.

1.2.3 For channels wider than 127mm only metal cover plates shall be used.

1.2.4 The finish of steel cover plates shall be the same as the finish of the channels.

1.3 Accessories

All accessories i.e. hangers, brackets etc. shall be purpose made and in general have the

same finish as the channels.

1.4 Wiring Supports

Wiring supports shall be provided in order to prevent the wires falling out when cover plates are removed.

2. UNDERFLOOR DUCTING

2.1 General

- 2.1.1 The ducting shall be manufactured of 2mm thick rolled sheet steel or rectangular tubing. Galvanised steel shall be used or shall be epoxy coated after manufacture.

2.2 Outlets

- 2.2.1 Outlets shall be provided on a modular basis in the ducting to accommodate pedestal or recessed socket units. Tapped holes shall be provided to fix the pedestal units to the ducting.
- 2.2.2 Draw boxes at junctions of perpendicular ducts shall have removable barriers for wiring and shall be provided with a heavy gauge cover plate.

2.3 Pedestals

- 2.3.1 Pedestals shall be manufactured of die-cast aluminium or pressed steel.
- 2.3.2 The finish of pedestals shall be epoxy powder coating of an approved colour.

3. POWER SKIRTING

3.1 General

- 3.1.1 The channel and cover shall be manufactured of 1mm thick rolled sheet steel.
- 3.1.2 The channel and cover shall be epoxy coated after manufacture.

3.2 Outlets

- 3.2.1 Outlets pre-punched on a modular basis shall be provided to accommodate socket outlets or future socket outlets.
- 3.2.2 In addition to standard lengths, covers of 250mm length shall be provided for installation on building module lines.

SECTION C4

PVC-INSULATED CABLES - 600/1 000 V GRADE

1. GENERAL

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

2. CONSTRUCTION

2.1 Cables shall be manufactured in accordance with SABS 150, shall come only from fresh stocks, and shall be constructed as follows:

- | | | |
|-----|--------------------|--|
| (a) | Unarmoured 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 |

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

2.3 The insulation shall be general purpose PVC, 600/1 000V Grade.

2.4 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.

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

2.6 Where specified, an earth continuity conductor shall be provided in the armouring in accordance with SABS 150.

3. PVC-SHEATHED ALUMINIUM-COVERED CABLES

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

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

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

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

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 Department.

5. TESTS

At the option of the Department, acceptance tests shall be carried out on production runs of the cable in accordance with SABS 150

SECTION C5

GLANDS FOR PVC-INSULATED CABLES

1. Glands to be used for terminating PVC/PVC/SWA/PVC cables shall be of the adjustable type.
2. Glands shall be suitable for general purpose 600/1 000 V Grade cable with steel armouring.
3. The glands shall be made of nickel-plated cadmium plated or in coastal area bronze or brass.
4. 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.
5. 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.
6. 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.
7. Glands shall be provided with ISO threads and shall be suitable for the specified cable sizes.
8. Flameproof glands shall comply with SABS 808, Groups 1, 2a and 2b.
9. 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.
10. 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.

SECTION C6

CABLE TERMINATIONS AND JOINTS

1. HEAT-SHRINKABLE MATERIALS

1.1 General

- 1.1.1 Heat-shrinkable materials may only be used in exceptional circumstances with the written permission of the Department.
- 1.1.2 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.
- 1.1.3 An illustrated set of instructions for the installation of the materials shall accompany every kit.
- 1.1.4 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.
- 1.1.5 The materials shall comply with VDE 0278 and the supplier shall be called upon to confirm this aspect before acceptance of the materials or installation.
- 1.1.6 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.

1.2 Terminations with Heat-Shrinkable Materials

- 1.2.1 Terminations shall be made of a material that gives lasting protection against ultraviolet radiation.
- 1.2.2 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.
- 1.2.3 Outdoor terminations shall be designed to prevent flashover under wet or contaminated conditions and to ensure additional mechanical strength. This shall be achieved with shrunk-on insulating spacers and rain shields.

1.3 Joints with Heat-Shrinkable Materials

- 1.3.1 The electrical continuity of all the conductors, screens and armouring shall not be impaired by the joints and the earth continuity shall be accomplished within the joints, i.e. no external earth continuity conductor that will be subject to corrosion, is acceptable. The joints shall be completely covered by a watertight sheath to prevent corrosion.
- 1.3.2 In the case of joints in cables with an outer PVC anti-electrolysis sheath, the joints shall be subject to the same electrical insulation test as the outer sheath of the cable.

2. RESIN FILLED JOINTS

- 2.1 The resin filled joint kit shall comprise a self sealing plastic mould of high mechanical strength having sufficient connector space.
- 2.2 The exact amount of cold hardening resin shall be provided in a two-compartment plastic bag.

- 2.3 The resin shall have absolute minimum shrinkage.
- 2.4 The mould and resin shall be completely waterproof and non-hygroscopic and shall be resistant to ultraviolet radiation.
- 2.5 Joint kits shall be of "SCOTCHCAST", "CELLPACK" or similar.

3. CABLE JOINTS BOX

- 3.1 Cable joint boxes shall be manufactured of die cast aluminium material for normal conditions or glass fibre reinforced thermosetting compound where exposed to corrosive conditions.
- 3.2 The lid shall provide an absolute moisture barrier.
- 3.3 Boxes shall contain 2, 3 or 4 entries as required.
- 3.4 Unused entries shall be sealed with watertight blanking plugs.
- 3.5 Earth continuity shall be maintained through the box by means of the material of the box in the case of aluminium boxes or by means of earth straps and studs in the case of glass fibre reinforced boxes.

SECTION C9

WIRING TERMINALS

1. Terminal bodies and screws shall be of non-corrosive metal, enclosed in fire resistant, moulded plastic insulating bodies. Terminal bodies or screws shall not project beyond the insulating material and shall afford suitable protection against accidental contact by personnel and against short circuits and tracking.
2. The construction of the terminal block and mounting rail shall be such as to ensure a firm and positive location of the terminal blocks. It shall be possible to add additional terminal blocks within the terminal sequence without having to disconnect or dismantle the terminal strip. The terminal blocks shall be held in position by means of standard end clamps.
3. It shall be possible to intermix terminals of various sizes, i.e. for different sizes of conductors, whilst utilising the same mounting rail. Where smaller terminal blocks occur adjacent to larger terminal blocks, suitable shielding barriers shall be inserted to cover the terminals that might otherwise be exposed.
4. The terminal bodies and clamping screws shall be so constructed as to ensure that conductors are not nicked or severed when the clamping screws are tightened. Screws shall not come in direct contact with the conductors.
5. Terminals shall be sized and rated to match the conductors that are connected to them.
6. Each terminal block shall have provision for clip-in numbering or labelling strips to be installed, together with protective, clear caps over the sheets.

SECTION C10

LIGHT SWITCHES

1. GENERAL

This section covers the requirements for switches for use in general installations under normal environmental conditions.

2. FLUSH AND SURFACE MOUNTED SWITCHES

- 2.1 All switches shall be suitable for mounting in 100 x 50 x 50mm boxes shall comply with SABS 163 and shall bear the SABS mark.
- 2.2 Switches shall be of tumbler operated microgap type rated at 16A, 220/250V.
- 2.3 Switches shall have protected terminals for safe wiring.
- 2.4 Contacts shall be of silver material.
- 2.5 On multi-lever switches, it shall be possible to individually change any of its switches.
- 2.6 The yoke strap shall be slotted to allow for easy alignment.
- 2.7 The covers of surface mounted switches shall have toggle protectors.
- 2.8 Where light switches are installed in partitions, they shall, where possible, be of the special narrow type intended for installation into the mullions.

3. WATERTIGHT SWITCHES

- 3.1 Watertight switches shall be of the microgap type suitable for surface mounting and shall bear the SABS mark.
- 3.2 The housing shall be of galvanised cast iron or die cast aluminium with watertight cover plate and toggle.
- 3.3 The switch shall have a porcelain base and a quick acting spring mechanism and shall be rated at 16A, 220/250V.
- 3.4 The ON/OFF position shall be clearly marked on the switch housing.

4. CEILING SWITCHES

- 4.1 Ceiling switches shall be rated at 10A, 220/250V and shall be suitable for ceiling mounting on a round conduit box.
- 4.2 The switch shall be made of high impact strength nylon material.
- 4.3 Adequate space shall be provided within the unit for ease of wiring.
- 4.4 The switch colour shall be white and shall be fitted with a nylon cord 1,25m long.

5. COVER PLATES

- 5.1 Cover plates shall be finished in ivory coloured baked enamel, anodised bronze or aluminium unless otherwise specified.
- 5.2 Cover plates shall overlap the outlet to cover wall imperfections.
- 5.3 Cover plates shall comply with SABS 1084.

SECTION C11

UNSWITCHED AND SWITCHED SOCKET-OUTLETS

1. GENERAL

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

2. FLUSH AND SURFACE MOUNTED SWITCHED SOCKETS

- 2.1 All switched socket-outlets shall be suitable for mounting in 100 x 100 x 50mm or 100 x 50 x 50mm boxes, shall comply with SABS 164.
- 2.2 Switches shall be of the tumbler operated microgap type rated at 16A, 220/250V.
- 2.3 Terminals shall be enclosed for safe wiring.
- 2.4 Contacts shall be of silver material.
- 2.5 Safety shutters shall be provided on live and neutral openings.
- 2.6 The yoke strap shall be slotted to allow for easy alignment.
- 2.7 The covers of surface mounted switched socket shall have toggle protectors.
- 2.8 Miniature circuit-breakers shall be used in lieu of a switch where specified.
- 2.9 Where 13A flat pin switched socket-outlets are specified, these shall comply with BS 1363.

3. WATERTIGHT SWITCHED SOCKETS

- 3.1 The housing of watertight switched sockets shall be of galvanised cast iron or die cast aluminium with watertight machined joints.
- 3.2 The switch shall have a porcelain base and a quick-acting spring mechanism and shall be rated at 16A, 220/250V.
- 3.3 The ON/OFF positions shall be clearly marked on the switch housing.
- 3.4 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.

4. UNSWITCHED SOCKET-OUTLETS

- 4.1 Unswitched socket-outlets shall only be used in the case of 5A, 220/250V, 3-pin socket-outlets intended for the connection of recessed light fittings installed in false ceilings.
- 4.2 The socket-outlets shall have shuttered live and neutral openings.
- 4.3 The socket-outlets shall be suitable for installation in pre-punched wiring channels, deep round conduit boxes, 100 x 50 x 50mm or 100 x 100 x 50mm boxes.

5. THREE-PHASE SWITCHED SOCKET-OUTLETS

- 5.1 Three-phase switched socket-outlets shall have 5 pins, one for each phase, neutral and earth. The current rating shall be as specified in the Detail Technical Specification.

- 5.2 The units shall be interlocked to prevent switching on if the plug top is not installed.
- 5.3 The units shall be supplied complete with plug top.
- 5.4 The live terminals shall be shrouded and shall be completely safe when the plug top is removed.
- 5.5 Samples shall be submitted to the Department for approval prior to the installation.

6. SHAVER SOCKETS

- 6.1 Shaver sockets shall comprise a double wound isolating transformer rated at 20 VA.
- 6.2 A three hole system shall be provided to provide for 115 V or 230V systems and also to cater for various types of shaver plugs.
- 6.3 Insertion of a shaver plug shall automatically switch on the unit by energising the primary side of the isolating transformer. Removal shall switch it off.
- 6.4 The unit shall be protected against overload by a thermal overload device.
- 6.5 The unit shall comply with BS 3052.

SECTION C12

LUMINAIRES FOR INTERIOR AND EXTERIOR APPLICATIONS

C12.1

TUBULAR FLUORESCENT LAMP LUMINAIRES FOR INTERIOR APPLICATIONS

1. SCOPE

This specification covers the requirements for fluorescent luminaires using tubular fluorescent lamps for general indoor use. The types of luminaires covered are open-channel, industrial, decorative and recessed types and includes 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.

2. GENERAL

- 2.1 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%.
- 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.
- 2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.
- 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.
- 2.5 Lamps shall be delivered separately.

3. STANDARDS

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

- 3.1 SABS 1119: Interior luminaires for fluorescent lamps.
- 3.2 SABS 1250: Capacitors for use with fluorescent and other discharge lamp ballasts.
- 3.3 SABS 890: Ballast's for fluorescent lamps.
- 3.4 SABS 1464: Safety of luminaires.
- 3.5 SABS 1479: Glow starters for fluorescent lamps.
- 3.6 SABS IEC 400: Lamp holders for tubular fluorescent lamps.
- 3.7 SABS 1041: Tubular fluorescent lamps for general service.
- 3.8 SABS 1247: Coatings applied by the powder-coating process.
- 3.9 SABS 783: Baked enamels.
- 3.10 SABS 0142: The wiring of Premises
- 3.11 Any standard referred to in the above specifications.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

- 4.1 AREAS OF APPLICATION: The luminaires are intended for standard indoor use in buildings under the control of the Department of Public Works.
- 4.2 FIXING: The luminaires shall be suitable for mounting in or against ceilings as described in the project specification.

- 4.3 ENVIRONMENTAL: Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +25°C.
- 4.4 SAFETY: The luminaire shall bear the SABS 1464 safety mark.
- 4.5 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.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 GENERAL

- 5.1.1 Tubular fluorescent lamp luminaires shall comply fully with SABS 1119 and all amendments as well as the additional requirements of this specification. Luminaires shall bear the SABS mark, or at least have a SABS Certificate of Compliance.
- 5.1.2 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.

5.2 CONSTRUCTION

- 5.2.1 A luminaire shall consist of a ventilated body manufactured of cold rolled sheet steel not less than 0,8mm thick, suitably braced or stiffened to prevent distortion. The body shall be of sufficient strength for the mounting of the entire luminaire.
- 5.2.2 The luminaire shall be designed to accommodate the control gear, wiring, lamp holders and, where applicable, the diffuser and reflectors. It shall be possible to reach the control gear without disconnecting wiring or removing the luminaire.
- 5.2.3 Except for mounting holes and/or slots and the required openings in air-return luminaires, the back of the body channel shall be closed over the full length of the luminaire.
- 5.2.4 Suitable knockouts shall be provided in the rear of the luminaire body for wire entry.
- 5.2.5 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.

5.3 INTERNAL WIRING

- 5.3.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body.
- 5.3.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.
- 5.3.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.
- 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.
- 5.3.5 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.

5.4 LAMP HOLDERS

Lamp holders shall preferably be of the telescopic spring-loaded type. Where twist-lock type lamp holders are provided, the mounting of the holders shall be able to accommodate the tolerances experienced in the length of lamps and in the manufacture of luminaires.

5.5 CONTROL GEAR

- 5.5.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted. All luminaires shall operate on a switch-start basis.
- 5.5.2 Ballasts shall comply with SABS 890 and SABS 891, suitable for operation on 220V to 250V, 50Hz supplies.
- 5.5.3 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.
- 5.5.4 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.
- 5.5.5 Starters shall be accessible from the outside of the luminaire, and the replacement of the starter shall not necessitate the removal of lamps.

5.6 CAPACITORS

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

5.7 LAMPS

- 5.7.1 Fluorescent lamps shall be suitable for the control circuitry used. Lamps shall comply with SABS 1041.
- 5.7.2 If no colour is specified in the Detail Technical Specification, the light colour shall correspond to colour 2 (4 300K) of SABS 1041.
- 5.7.3 Lamps of the same colour shall be provided for an entire installation unless specified to the contrary.
- 5.7.4 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.

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.

7. TECHNICAL INFORMATION

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

8. CHANNEL LUMINAIRE

- 8.1 Channel luminaires shall consist of a ventilated, enclosed channel body with one or more lamps as specified in the project specification. The channel body shall house the ballast, capacitor, terminals and internal wiring.

- 8.2 Provision shall be made for the addition of reflector wings and/or diffusers.
- 8.3 Three sets of mounting slots and knock-outs suitable for mounting onto standard round conduit boxes and/or 20mm diameter conduit pendant rods, shall be provided in the rear of the channel, one in the centre and one approximately one sixth from each end.
- 8.4 A knockout suitable for a 20mm diameter conduit entry shall be provided at each end of the channel. The distance between the back of the luminaire and centre of the knockout shall be approximately 25mm.
- 8.5 The knockouts shall be positioned on the centre line of the channel.
- 8.6 The body channel shall incorporate a removable cover acting as a reflector, manufactured of cold rolled steel, not less than 0,8mm thick, designed and mounted to completely cover the interior of the body channel and its contents and extending over the full length of the luminaire up to the lamp holders.
- 8.7 The reflector shall be firmly held in position with a latching device consisting of knurled, coin slot, captive screws. Plastic, used as a spring mechanism, is not acceptable as a fixing device for reflectors. The action of the latching device shall not deteriorate due to use and/or ageing.

9. INDUSTRIAL LUMINAIRES

- 9.1 Industrial type luminaires shall consist of a basic channel luminaire fitted with detachable side reflectors.
- 9.2 The reflectors shall be manufactured of cold rolled steel, not less than 0,8mm thick.
- 9.3 The reflectors shall be designed to improve the downward light output ratio and decrease the upward light output ratio to a value of less than 2%.

10. DECORATIVE LUMINAIRES

- 10.1 Decorative luminaires shall incorporate an injection moulded prismatic acrylic diffuser or a high-grade optical reflector covering the entire reflecting surface of the luminaire.
- 10.2 The diffuser shall be hinged or easily removable for maintenance and lamp replacement. Optical reflectors shall be hinged.
- 10.3 Decorative luminaires with diffusers shall be constructed and so installed to prevent the ingress of dust and insects.
- 10.4 Highly polished reflectors shall be protected and carefully handled and to prevent fingerprints showing on the surface.
- 10.5 Surface mounted luminaires on suspended ceilings shall be arranged to suit the grid and shall fit tightly against the ceiling.

11. RECESSED LUMINAIRES

- 11.1 Recessed luminaires shall be suitable for mounting in the ceiling structure specified in the project specification.
- 11.2 The attachment of the prismatic diffuser or reflector shall be similar to that specified in paragraph 10 above.

- 11.3 The diffuser or reflector shall fit flush with the ceiling and the only visible portion shall be the reflector or diffuser.
- 11.4 Should the luminaire be so designed that a surrounding frame is visible, then this frame shall be manufactured of anodised aluminium. The frame shall form a neat trim with the ceiling. The corners of the surrounding frame shall be mitred and reinforced.
12. LOW-BRIGHTNESS LUMINAIRES
- 12.1 The luminaire shall be provided with an aluminium louver with V-shaped longitudinal vanes and extruded stepped cross-shielding plates.
- 12.2 Louvers shall be constructed from high purity aluminium (99,98%), chemically brightened and anodised.
- 12.3 The total Light Output Ratio (LOR) shall be 62% or better. In the plane between 60(and 90(from the vertical, the LOR shall be below 3%.
13. LOW GLARE LUMINAIRES
- 13.1 The luminaire shall be provided with a die-formed, bright anodised high-purity aluminium (99,98%) louver with parabolic reflecting surfaces in both directions.
- 13.2 The total LOR shall be 62% or better. In the plane between 60 and 90(from the vertical), the LOR shall be less than 1,3%
14. LUMINAIRES FOR USE IN AREAS WITH VISUAL DISPLAY TERMINALS
- 14.1 The luminaire shall have anodised specular louvers to provide the brightness control required for this type of application.
- 14.2 At angles between 60 and 90(from the vertical) the luminance shall not exceed 200cd/m².
- 14.3 At the above angles the LOR shall be less than 0,6%. At angle between the vertical and 60 the LOR shall be 61% or better.

SECTION C12.2

PRISON CELL LUMINAIRE

1. SCOPE

This specification covers the requirements for a fluorescent luminaire for use in prison cells and prison ablution areas. The luminaire shall be suitable for operation with 1 or 2 fluorescent lamps of 36W or 58W each, with an optional 9W compact fluorescent night-light. The exact requirements will be stated in the project specification.

2. GENERAL

- 2.1 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%.
- 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.
- 2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.

3. STANDARDS

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

- 3.1 SABS 1119: Interior luminaires for fluorescent lamps.
- 3.2 SABS 1250: Capacitors for use with fluorescent and other discharge lamp ballasts.
- 3.3 SABS 890: Ballasts for fluorescent lamps.
- 3.4 SABS 1464: Safety of luminaires.
- 3.5 SABS 1479: Glow starters for fluorescent lamps
- 3.6 SABS IEC 400: Lamp holders for tubular fluorescent lamps.
- 3.7 SABS 1041: Tubular fluorescent lamps for general service.
- 3.8 SABS 1247: Coatings applied by the powder-coating process.
- 3.9 Any other standards referred to in the above specifications.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

- 4.1 **AREA OF APPLICATION:** The luminaire is to be used inside prison cells and in the ablution areas of prison cells.
- 4.2 **FIXING:** The luminaire shall be of the surface-mounted type. The main body of the luminaire shall be rigid and so designed that it can be firmly fixed flush onto the mounting surface without exposing gaps into which flat objects can be inserted.
- 4.3 **TAMPERING:** Due to the location of the luminaire special attention is required to render the luminaire tamper-proof and materials used shall be vandal resistant.
- 4.4 **ENVIRONMENTAL REQUIREMENTS**
 - 4.4.1 The luminaire shall have an ingress protection rating of IP65 and this shall be substantiated by a certificate of the South African Bureau of Standards.
 - 4.4.2 The luminaire shall have no dust-collecting or sharp edges and corners on the accessible side of the luminaire.

4.4.3 The luminaire shape shall be designed so as to prevent the manual gripping of the luminaire to prevent persons from hanging onto the body of the luminaire.

4.5 THERMAL: The luminaire must be able to withstand an ambient temperature of 45°C. To this end internal electrical and mechanical components shall not be allowed to exceed their maximum temperature ratings. Test reports from an independent authorised testing facility proving this requirement shall be made available to the Department on request.

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

4.7 NOISE: Due to the sensitive environment in which the luminaire is used, the noise level emitted from the luminaire shall be kept as low as possible. The ballasts shall, therefore, comply fully with the requirements of the latest edition of SABS 890 Part 1.

5. CONSTRUCTION

5.1 BODY: Nominal dimensions shall be 1 310 x 140 x 120mm (for the 36W model) or 1610 x 140 x 120mm (for the 58W model). The luminaire shall have a rigid high-pressure die-cast aluminium body at least 1mm thick, or, alternatively shall be made from 0,8mm thick cold rolled mild steel. The body shall have a minimum of four holes for mounting flush to the mounting surface by means of expansion bolts. The body shall be suitable to house 2 fluorescent lamps of 36W or 58W each plus a 9W PL fluorescent lamp when fully equipped.

5.2 MOUNTING MATERIALS: Mounting studs and materials shall be provided with each luminaire, including installation instructions as necessary.

5.3 DIFFUSER

5.3.1 The diffuser shall consist of a one-piece injected moulding of clear ultra-violet-stabilised polycarbonate of high-impact resistance. The light control shall be achieved by internal prisms moulded longitudinally as part of the diffuser. The outer surface of the diffuser shall be completely smooth and shall be shaped to prevent persons from obtaining a firm handgrip on the diffuser.

5.3.2 The diffuser shall be provided with a replaceable neoprene gasket and the diffuser shall be fixed to the luminaire body by means of tamper-proof stainless steel bolts with stainless steel washers. The bolt-heads shall preferably be of a flat construction with two pinholes for the insertion of a special tool for fastening or loosening. Sunken hex-heads (for Allen keys) shall preferably not be used. Other tamper-proof proposals may be submitted to the Department for approval.

5.3.3 The diffuser and body shall be manufactured within close tolerances so that no gaps exist between the body and the diffuser when the diffuser is screwed down.

5.4 GEAR TRAY

5.4.1 The control gear tray shall also act as a reflector and shall be manufactured from sheet steel of at least 0,7mm thickness. The gear tray shall be white epoxy powder coated after all cutouts and holes have been prepared on the tray. Alternatively, the gear tray may be made from bright anodised extruded aluminium.

5.4.2 The gear tray shall be mounted to the body by means of identical tamper-proof bolts to those holding the diffuser. The mounting shall, however, be provided with a slide-in facility so that the gear tray can be easily removed without unscrewing the bolts completely. The gear tray shall be completely removable for workshop maintenance and interchangeability.

- 5.4.3 The gear-tray shall be provided with restraining devices to prevent the tray from falling when the gear-tray is slid out. These restraints shall be unhooked for removal of the tray.
- 5.4.4 The gear-tray shall house the ballast, capacitors and glow-starters in the top section, whilst the lamp holders and lamps must occupy the bottom side of the reflector plate.
- 5.4.5 The gear tray should be equipped with control gear and circuits to operate one or two 36W (or 58W) fluorescent lamps on a switch-start basis. However, the gear tray shall be pre-punched to accommodate one 9W PL fluorescent lamp and control gear that can be separately switched as a night light. Equipping for this option is specified in the detail specification if it is required.
- 5.4.6 Preparation of all metal surfaces for the painting or epoxy powder coating thereof shall be done in accordance with SABS 1274.

5.5 ELECTRICAL REQUIREMENTS

- 5.5.1 The luminaire shall be suitable for operation on a 230V, single-phase 50Hz mains supply.
- 5.5.2 Power factor capacitors shall be supplied to correct the power factor to at least 0,85 in the cases of operating either one 36W (or 58W) lamp alone or one 9W lamp alone or one 36W (or 58W) plus one 9W lamp together. Similarly a combination of two 36W (or 58W) lamps together or two 36W (or 58W) lamps plus one 9W lamp or one 9W lamp alone shall apply if the luminaire is fully equipped.
- 5.5.3 Each luminaire shall be supplied with all lamps required and specified in the project specification.
- 5.5.4 The luminaire shall be provided with a 20mm diameter back-entry for wiring access.
- 5.5.5 Internal wiring of the luminaire shall be in accordance with SABS 1119.
- 5.5.6 Terminals for connection of the mains supply and on ballasts and other internal equipment shall have screw-down plates bearing on the wires. Terminals where screws bear down directly on the wires will not be acceptable.
- 5.5.7 The luminaire shall be marked with identification labels stating the brand name and model and shall bear the SABS mark or shall at least have an SABS certificate of compliance.

6. LUMINAIRE PERFORMANCE

- 6.1 The luminaire diffuser shall be so designed as to reduce the luminance (glare) of the luminaire to maximise the comfort of the room occupants.
- 6.2 The total light output ratio of the luminaire shall be 56% or better.

7. MAINTENANCE REQUIREMENTS

- 7.1 For ease of maintenance it is imperative that the gear-tray should be completely removable with ease, including the disconnection of the electrical supply internally. Removal of the diffuser and gear tray must only be possible by means of a special unscrewing tool.
- 7.2 The connection between the gear tray equipment and the incoming mains shall preferably be via a suitable sturdy plug and socket for easy disconnection.

7.3 LAMP HOLDERS

Lamp holders shall preferably be of the telescopic spring-loaded type. Where twist lock type lamp holders are provided, the mounting of the holders shall be able to accommodate the tolerances experienced in the length of lamps and in the manufacture of luminaires.

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.

9. TECHNICAL INFORMATION

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

SECTION C12.3

BULKHEAD LUMINAIRES FOR USE WITH COMPACT FLUORESCENT OR TUNGSTEN FILAMENT LAMPS FOR INTERIOR AND EXTERIOR APPLICATIONS

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.

2. GENERAL

2.1 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%.

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.

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

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.

2.5 Lamps shall be delivered separately.

3. STANDARDS

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

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

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

3.3 SABS 890, IEC 920

and IEC 921 : Ballasts for fluorescent lamps.

3.4 SABS 1464: Safety of luminaires.

3.5 SABS 1479: Glow starters for fluorescent lamps.

3.6 SABS IEC 400: Lamp holders for tubular fluorescent lamps.

3.7 SABS 1041, IEC 81

and IEC 901 : Tubular fluorescent lamps for general service.

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

3.9 SABS 783: Baked enamels.

3.10 SABS 0142: The wiring of Premises

3.11 SABS 56: Incandescent lamps

3.12 Any standard referred to in the above specifications.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

- 4.1 AREAS OF APPLICATION: The luminaires are intended for standard indoor and exterior use in buildings under the control of the Department of Public Works.
- 4.2 FIXING: The luminaires shall be suitable for mounting against ceilings or walls as described in the project specification.
- 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.
- 4.4 SAFETY: The luminaire shall bear the SABS 1464 safety mark.
- 4.5 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.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 General

- 5.1.1 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.
- 5.1.2 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.
- 5.1.3 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.

5.2 Construction

- 5.2.1 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.
- 5.2.2 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.
- 5.2.3 Except for mounting holes and/or slots, the back of the body shall be closed over the full extent of the luminaire.
- 5.2.4 Suitable knockouts shall be provided in the rear of the luminaire body for wire entry.
- 5.2.5 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.
- 5.2.6 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.

5.3 Internal wiring

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

- 5.3.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.
- 5.3.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.
- 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.
- 5.3.5 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.

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:

5.4.1	<u>LAMP</u>	<u>HOLDER</u>	<u>LAMP</u>	<u>HOLDER</u>
	7W PL	2G11	13W PLC	G24d-1
	9W PL	2G11	16W 2D	GR10q
	11W PL	2G11	18W PLC	G24d-2
	60/100W GLS	E27, porcelain		

5.5 Control gear

- 5.5.1 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.
- 5.5.2 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.
- 5.5.3 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.
- 5.5.4 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.
- 5.5.5 Starters shall be accessible from the outside of the luminaire, and the replacement of the starter shall not necessitate the removal of lamps.
- 5.5.6 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.
- 5.5.7 The gear tray shall be equipped with the components suitable for the luminaires specified in the project specification.

5.6 Capacitors

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

5.7 Lamps

5.7.1 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.

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

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

5.7.4 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.

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

PL lamps:	7W, 9W AND 11W
PLC Lamps:	13W
2D Lamps:	16W
GLS Lamps:	60 and 100W

5.8 Diffuser

5.8.1 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.

5.8.2 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.

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.

7. TECHNICAL INFORMATION

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

SECTION C12.4

POST TOP LUMINAIRES FOR EXTERIOR APPLICATIONS

1. SCOPE

This specification covers the requirements for post top type luminaires, using tungsten filament, compact fluorescent, mercury vapour, sodium vapour or metal halide lamps, for general outdoor and indoor use. The luminaires covered are decorative types and include luminaires with one or more lamps with standard wattage ratings as specified in the project specification.

2. GENERAL

2.1 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%.

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.

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

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.

2.5 Lamps shall be delivered separately.

3. STANDARDS

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

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| 3.1 | SABS 1421: | High-pressure mercury vapour lamps. |
| 3.2 | SABS IEC 662: | High-pressure sodium vapour lamps |
| 3.3 | IEC 61167: | Metal Halide lamps |
| 3.4 | SABS 56: | Incandescent lamps |
| 3.5 | SABS 1250: | Capacitors for use with fluorescent and other discharge lamp Ballasts. |
| 3.6 | SABS 1464: | Safety of luminaires. |
| 3.7 | SABS IEC 922 and SABS IEC 923: | Ballasts for discharge lamps. |
| 3.8 | SABS IEC 926 and SABS IEC 927: | Starting devices (other than glow starters). |
| 3.9 | SABS 890, IEC 920 And IEC 921: | Ballasts for fluorescent lamps |
| 3.9 | SABS IEC 400: | Lamp holders for fluorescent lamps |
| 3.10 | SABS 1247: | Coatings applied by the powder-coating process. |
| 3.11 | SABS 783: | Baked enamels. |
| 3.12 | SABS 0142: | The wiring of Premises |
| 3.13 | SABS 1507: | Electric cables with extruded solid dielectric insulation for fixed installations. |
| 3.14 | SABS 165 and: VC 8011 | Lamp holders |
| 3.15 | SABS 1277: | Street lighting luminaires. |
| 3.16 | SABS 1088: | Luminaire entries and spigots |
| 3.17 | Any standard referred to in the above specifications. | |

4. **PHYSICAL AND ENVIRONMENTAL REQUIREMENTS**

- 4.1 AREAS OF APPLICATION: The luminaires are intended for standard exterior use on premises under the control of the Department of Public Works.
- 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).
- 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.
- 4.4 SAFETY: The luminaire shall bear the SABS 1464 safety mark.
- 4.5 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 920, 921, 922 and 923.

5. **GENERAL TECHNICAL REQUIREMENTS**

5.1 General

- 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.
- 5.1.2 The luminaire colour shall be as specified in the project specification.
- 5.1.3 The luminaire shall bear the SABS 1277 mark.

5.2 Construction

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

5.3 Internal wiring

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

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

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.

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.

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.

5.5 Control gear

5.5.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted

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.

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.

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.

5.5.5 The luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.

5.5.6 In those applications where ignitors are used, these shall be of the superposed pulse type.

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 0,7mm 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.

5.6 Capacitors

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

5.7 Lamps

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 50W, 80W and 125W	E27
Lamp	Lamp holder
Sodium Vapour 50W and 70W 100W and 150W	E27 E40

All lamps shall be of the elliptical coated type.

Metal halide lamps

70W and 150W (tubular)	RX7s
100W (elliptical)	E27

Fluorescent lamps

PL 24W	2G11
PL C 18W	G24d-2
PL C 26W	G24d-3

Incandescent lamps

100W	E27
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5.7.2 The lamps shall be prevented from loosening in the holders as a result of vibrations under normal working conditions.

5.8 Diffuser

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.

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.

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. PHOTOMETRIC DATA

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

7. TECHNICAL INFORMATION

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

SECTION C12.5

SECURITY LUMINAIRES FOR USE WITH DISCHARGE LAMPS OR COMPACT FLUORESCENT LAMPS FOR PRISON APPLICATIONS

1. SCOPE

This specification covers the requirements for bulkhead type luminaires and pole mounted luminaires, using sodium vapour or compact fluorescent lamps for outdoor use at prisons. The luminaires covered are of the decorative rectangular or polygonal surface-mounted type as well as streetlight and floodlight luminaires and include luminaires with one or more lamps with standard wattage ratings as specified in the project specification.

2. GENERAL

- 2.1 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%.
- 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.
- 2.3 A sample luminaire shall be provided for evaluation and approval by the Electrical Engineer prior to installation.
- 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.
- 2.5 Lamps shall be delivered separately.

STANDARDS

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

- 3.1 SABS 098: Code of practice for public lighting.
- 3.2 SABS 0142: The wiring of Premises.
- 3.3 SABS 165: Lamp holders
- and VC8011 Baked enamels.
- 3.4 SABS 783: Interior luminaires for fluorescent lamps (clauses applicable to compact fluorescent lamps).
- 3.5 SABS 1119: Enclosures for electrical equipment.
- 3.6 SABS 1222: Coatings applied by the powder-coating process.
- 3.7 SABS 1247: Capacitors for use with fluorescent and other discharge lamp ballasts.
- 3.8 SABS 1250: Street-lighting luminaires.
- 3.9 SABS 1277: Floodlighting luminaires.
- 3.10 SABS 1279: Safety of luminaires.
- 3.11 SABS 1464: Electric cables with extruded solid dielectric insulation for fixed
- 3.12 SABS 1507: Installation.
- 3.13 SABS IEC 662: High-pressure sodium vapour lamps.
- 3.14 SABS IEC 922 and SABS IEC 923: Ballasts for discharge lamps.
- 3.15 SABS IEC 926 and SABS IEC 927: Starting devices (other than glow starters).
- 3.16 Any standard referred to in the above specifications.

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

- 4.1 AREAS OF APPLICATION: The luminaires are intended for exterior use in establishments under the control of the Department of Public Works.
- 4.2 FIXING: The luminaires shall be suitable for mounting against horizontal or vertical surfaces, walls, perimeter fences or on poles as described in the project specification.
- 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 as indicated below and this shall be certified in a SABS report.
- 4.4 SAFETY: The luminaire shall bear the SABS 1464 safety mark.
- 4.5 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.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 General

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.

Bulkhead luminaires shall also be available with an optional wire guard and a decorative skirt of the same material and finish as the luminaire body.

6 Construction

6.1 Bulkhead or bracket-mounted light.

- 1. The luminaire shall consist of a body manufactured from high-pressure die-cast aluminium, with a transparent prismatic diffuser. The body shall be of sufficient strength for the mounting of the entire luminaire.
- 2. 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.
- 3. Except for mounting holes and/or slots, the back of the body shall be closed over the full extent of the luminaire. At least three mounting holes shall be provided.
- 4. 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.
- 5. The luminaire shall be provided with a cable entry at the back of the luminaire by means of a plastic gland. However, it shall be possible to provide 20mm diameter conduit entries or cable entries from the sides of the luminaire and suitable drilling indents or knockouts shall be furnished on the luminaire body.
- 6. A heavy gauge galvanised steel stirrup bracket for mounting the luminaire shall be supplied with the luminaire unless omitted in the project specification.

7. The luminaire shall be suitable for use with 2 x 24W PL or 2 x 26W PLC or 1 x 250W elliptical HPS lamp.
8. The luminaire shall have an ingress protection rating of at least IP55.

6.2 Flood-lights

1. The luminaire shall consist of a body manufactured from either high-pressure die-cast aluminium or ultra-violet stabilised glass-fibre reinforced polyester material. The body shall be hail-proof, weatherproof and corrosion and vandal resistant.
2. The housing shall be equipped with either a flat armoured glass fixed in a sturdy, hinged die-cast frame with a silicon-rubber gasket or a clear transparent high-impact resistant acrylic bowl, treated against discolouring due to UV and lamp radiation, with a silicon-rubber gasket. The glass frame or dome shall preferably be hinged and mounted with stainless steel clips.
3. The luminaire shall be equipped with integral control gear mounted internally. Alternatively, the control gear may be mounted in a separate control gear compartment, in which case the compartment shall have the same IP rating as the luminaire.
4. The luminaire shall be suitable for 2 x 24W PLC lamps or 1 x 250W tubular HPS lamp.
5. The luminaire shall have an ingress protection rating of at least IP43.
6. A heavy gauge hot-dipped galvanised steel mounting-stirrup with pre-punched holes shall be supplied with the luminaire unless otherwise specified in the project specification.

6.3 Street-light type luminaires

1. Luminaires must bear the SABS 1277 mark.
2. The luminaire shall consist of a high-pressure die-cast aluminium body or a body manufactured from UV stabilised filled polypropylene. The body shall be hail, weather and corrosion proof and shall be vandal resistant.
3. The body shall preferably consist of a single unit with two compartments, viz. a lamp compartment and a control gear compartment.
4. The luminaires' diffuser shall be suitable for Class B roads in terms of SABS 098. The clear high-impact acrylic bowl shall be hinged and attached to the body by means of at least three clips of either stainless steel or other durable material. The diffuser shall be sealed on the lamp compartment by means of a silicon-sponge rubber gasket in a tongue and groove arrangement.
5. The control gear compartment shall have a hinged cover for bottom access. The control gear, capacitor and ignite, where fitted, shall be mounted on a removable gear tray.
6. The light fitting shall be provided with a bottom spigot entry in compliance with SABS 1088, Table 1, Type 2: 76mm diameter x 75mm deep.

6.4 Internal wiring

- 6.4.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body or control gear trays.
- 6.4.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.

- 6.4.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.
- 6.4.4 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.
- 6.4.5 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 Lamp holders

- 6.5.1 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

6.6 Control gear

- 6.6.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted
- 6.6.2 Ballasts shall comply with SABS IEC 922 and 923 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.
- 6.6.3 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.
- 6.6.4 The luminaire control gear shall be mounted onto the inside of the control gear compartment of the body on a separate mounting plate. The gear-mounting tray shall be manufactured from sheet steel at least 0,7mm thick and shall be epoxy powder coated.
- 6.6.5 The gear tray and luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.
- 6.6.6 In those applications where ignitors are used, these shall be of the superposed pulse type.
- 6.6.7 The reflector shall be mounted on the luminaire body. The reflector shall be made from highly polished 99, 98% pure specular anodised aluminium plate and shall be manufactured to give optimum performance with the prismatic diffuser as applicable.

6.7 Capacitors

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

6.8 Lamps

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

1. LAMP	LAMP HOLDER
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Sodium Vapour 150W or 250W	E40 (All lamps shall be of the tubular clear type.)
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Compact fluorescent types:

24W PL

2G11

26W PLC

G24d-3

7. PHOTOMETRIC DATA

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

8. TECHNICAL INFORMATION

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

SECTION C12.6

STREET-LIGHT LUMINAIRES

1. SCOPE

This specification covers the requirements for street-light luminaires using sodium vapour, mercury vapour or compact fluorescent lamps with standard wattage ratings as specified in the project specification.

2. GENERAL

2.1 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%.

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.

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

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.

2.5 Lamps shall be delivered separately.

3. STANDARDS

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

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| 3.1 | SABS 098: | Code of practice for public lighting. |
| 3.2 | SABS 0142: | The wiring of Premises. |
| 3.3 | SABS 165: | Lamp holders |
| | and VC8011 | |
| 3.4 | SABS 783: | Baking enamels. |
| 3.5 | SABS 1119: | Interior luminaires for fluorescent lamps (clauses applicable to compact fluorescent lamps). |
| 3.6 | SABS 1222: | Enclosures for electrical equipment. |
| 3.7 | SABS 1247: | Coatings applied by the powder-coating process. |
| 3.8 | SABS 1250: | Capacitors for use with fluorescent and other discharge lamp ballasts. |
| 3.9 | SABS 1277: | Street-lighting luminaires. |
| 3.10 | SABS 1464: | Safety of luminaires. |
| 3.11 | SABS 1507: | Electric cables with extruded solid dielectric insulation for fixed installations. |
| 3.12 | SABS IEC 662: | High-pressure sodium vapour lamps. |
| 3.13 | SABS 1421 | Mercury vapour lamps |
| 3.14 | SABS IEC 922 and | |
| | SABS IEC 923: | Ballasts for discharge lamps. |
| 3.15 | SABS IEC 926 and | |
| | SABS IEC 927: | Starting devices (other than glow starters). |
| 3.16 | Any standard referred to in the above standards. | |

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

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

- 4.2 **FIXING:** The luminaires shall be suitable for mounting on brackets against horizontal or vertical surfaces, walls, perimeter fences or on poles as described in the project specification.
- 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 IP 65 for the lamp compartment and IP23 for the control gear compartment and this shall be certified in a SABS report.
- 4.4 **SAFETY:** The luminaire shall bear the SABS 1464 safety mark.
- 4.5 **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.

5. GENERAL TECHNICAL REQUIREMENTS

- 5.1 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.
- 5.2 All metal components shall be manufactured from corrosion-resistant materials or shall be treated to prevent corrosion.
- 5.3 All screws and other components must be easily reachable and must be mounted on the luminaire body.
- 5.4 Luminaires shall bear the SABS 1277 mark.

6. CONSTRUCTION

6.1 BODY

- 6.1.1 The luminaire shall consist of a high-pressure die-cast aluminium body or a body manufactured from UV stabilised filled polypropylene. The body shall be hail, weather and corrosion proof, it shall be vandal resistant and the ingress of insects shall be prevented. The body shall also be equipped with an effective air-filter.
- 6.1.2 The body shall preferably consist of a single body with two compartments, viz. a lamp compartment and a control gear compartment.
- 6.1.3 Provision shall be made for the effective dissipation of heat emanating from the lamp and the control gear.
- 6.1.4 The luminaire shall be provided with a spigot entry in compliance with SABS 1088 and shall nominally be 42mm with a length of 125mm for side entry and 76mm with a length of 75mm for bottom entry. The requirements shall be as mentioned in the project specification.

6.2 DIFFUSER

- 6.2.1 The diffuser shall be manufactured from heat-resistant glass or high-impact acrylic non-discolouring material.
- 6.2.2 The size and shape of the diffuser shall be designed so that it neatly fits onto the luminaire body and it shall be of sufficient size to house the lamp or lamps.

6.2.3 The diffuser shall preferably be mounted in a sturdy hinged metal frame, which prevents warping or cracking of the diffuser when the diffuser is sealed onto the body.

6.2.4 Prisms shall form an integral part of the diffuser itself.

6.2.5 The diffuser frame shall be hinged on one side and shall be attached to the body in the closed position by means of at least three quick-release clips made from stainless steel or other durable material.

6.2.6 The diffuser frame shall be sealed on the body by means of a silicon-sponge rubber gasket in a tongue and groove arrangement

6.3 REFLECTOR

6.3.1 The reflectors shall be manufactured from high-purity aluminium, anodised in accordance with BS 1615.

6.3.2 The reflector shall be sufficiently rigid to ensure that it does not bend or distort as a result of heat developed within the luminaire.

6.3.3 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.

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

6.4 CONTROL GEAR

6.4.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted

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

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

6.4.4 The luminaire control gear shall be mounted inside a separate control gear compartment. The gear-mounting tray shall be manufactured from sheet steel at least 0,7mm thick and shall be epoxy powder coated. The gear-mounting tray shall be hinged and shall open under gravitational force when the luminaire is in its normal mounted position.

6.4.5 The gear tray and luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.

6.4.6 In those applications where ignitors are used, these shall be of the superposed pulse type.

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

6.5 INTERNAL WIRING

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

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

- 6.5.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.
- 6.5.4 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. The terminal block shall be mounted in the control gear compartment.
- 6.5.5 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.
- 6.5.6 All circuits that require ignitors shall have an insulated wire between the ignitor and the lamp holder, suitable to withstand a voltage of at least 5kV.

6.6 LAMP HOLDERS

- 6.6.1 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.
- 6.6.2 Lamp holders shall be adjustable for cut-off or semi-cut-off light distribution characteristics.
- 6.6.3 Lamp holders shall not degenerate under normal working conditions and shall not work loose as a result of vibration.

6.7 LAMPS

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

<u>LAMP</u>	<u>LAMP HOLDER</u>
Sodium Vapour	
70W	E27 (This lamp shall be of the elliptical type)
150W	E40
250W	E40 (These lamps shall be of the tubular clear type.)
400W	E40
Compact fluorescent	
26W PLC	G24d-3
Mercury vapour	
80W	E27
125W	E27
250W	E40
400W	E40
(All mercury vapour lamps shall be of the elliptical coated type.)	

7. ELECTRICAL SUPPLY

- 7.1 The luminaires shall be suitable for connection to a single-phase electricity supply with a nominal voltage of 220V to 250V at 50Hz.
- 7.2 The actual voltage will be furnished in the project specification.

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.

9. TECHNICAL INFORMATION

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

SECTION C12.7

HIGH BAY LUMINAIRES

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.

2. GENERAL

2.1 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%.

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.

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

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.

2.5 Lamps shall be delivered separately.

4. STANDARDS

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

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|------|--|--|
| 3.1 | SABS 0142: | The wiring of Premises. |
| 3.2 | SABS 165:
and VC8011 | Lamp holders |
| 3.3 | SABS 783: | Baking enamels. |
| 3.4 | SABS 1222: | Enclosures for electrical equipment. |
| 3.5 | SABS 1247: | Coatings applied by the powder-coating process. |
| 3.6 | SABS 1250: | Capacitors for use with fluorescent and other discharge lamp ballasts. |
| 3.7 | SABS 1464: | Safety of luminaires. |
| 3.8 | SABS 1507: | Electric cables with extruded solid dielectric insulation for fixed Installations. |
| 3.9 | SABS IEC 662: | High-pressure sodium vapour lamps. |
| 3.10 | SABS 1421 | Mercury vapour lamps |
| 3.11 | IEC 61167 | Metal halide lamps |
| 3.12 | SABS IEC 922 and
SABS IEC 923: | Ballasts for discharge lamps. |
| 3.13 | SABS IEC 926 and
SABS IEC 927: | Starting devices (other than glow starters). |
| 3.14 | Any standard referred to in the above standards. | |

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

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

- 4.7 **FIXING:** The luminaires shall be suitable for mounting against horizontal surfaces or beams or as described in the project specification.
- 4.8 **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.
- 4.9 **SAFETY:** The luminaire shall bear the *SABS 1464* safety mark.
- 4.10 **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.

5. GENERAL TECHNICAL REQUIREMENTS

- 5.5 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.
- 5.6 All metal components shall be manufactured from corrosion-resistant materials or shall be treated to prevent corrosion.
- 5.7 All screws and other components must be easily reachable and must be mounted on the luminaire body.
- 5.8 Luminaires shall preferably bear the SABS mark.

6. CONSTRUCTION

- 6.1 **BODY**
- 6.7.2 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.
- 6.7.3 Provision shall be made for the effective dissipation of heat emanating from the lamp and the control gear.
- 6.7.4 The overall height of the luminaire shall not exceed 550mm.
- 6.7.5 The mass of the complete luminaire shall not exceed 12kg.
- 6.8 **REFLECTOR**
- 6.8.1 The reflector shall be of a spun-aluminium construction. The aluminium shall be of high purity and shall be brightened and anodised.
- 6.8.2 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.
- 6.8.3 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.
- 6.8.4 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.

6.8.5 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.

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

6.9 CONTROL GEAR

6.9.1 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.

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

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

6.9.4 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.

6.9.5 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.

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

6.9.7 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.

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

6.10 INTERNAL WIRING

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

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

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

6.10.3 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.

6.10.4 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.

6.10.5 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.

6.11 LAMP HOLDERS

6.11.1 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.

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

6.12 LAMPS

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

LAMP	LAMP HOLDER
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

7. ELECTRICAL SUPPLY

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

7.4 The actual voltage will be furnished in the project specification.

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.

9. TECHNICAL INFORMATION

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

SECTION C12.8

FLOODLIGHT LUMINAIRES

1. SCOPE

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

2. GENERAL

2.1 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%.

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.

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

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

2.5 Lamps shall be delivered separately.

5. STANDARDS

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

- | | | |
|------|--|--|
| 3.1 | SABS 0142: | The wiring of Premises. |
| 3.2 | SABS 165:
and VC8011 | Lamp holders |
| 3.3 | SABS 783: | Baking enamels. |
| 3.4 | SABS 1222: | Enclosures for electrical equipment. |
| 3.5 | SABS 1247: | Coatings applied by the powder-coating process. |
| 3.6 | SABS 1250: | Capacitors for use with fluorescent and other discharge lamp ballasts. |
| 3.7 | SABS 1279: | Floodlighting luminaires. |
| 3.8 | SABS 1464: | Safety of luminaires. |
| 3.9 | SABS 1507: | Electric cables with extruded solid dielectric insulation for fixed installations. |
| 3.10 | SABS IEC 662: | High-pressure sodium vapour lamps. |
| 3.11 | SABS 1421: | Mercury vapour lamps |
| 3.12 | IEC 61167: | Metal halide lamps |
| 3.13 | SABS IEC 922 and
SABS IEC 923: | Ballasts for discharge lamps. |
| 3.14 | SABS IEC 926 and
SABS IEC 927: | Starting devices (other than glow starters). |
| 3.15 | Any standard referred to in the above standards. | |

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

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

- 4.12 **FIXING:** The luminaires shall be suitable for mounting against horizontal or vertical surfaces, walls, perimeter fences or on poles as described in the project specification.
- 4.13 **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 as indicated below and this shall be certified in a SABS report.
- 4.14 **SAFETY:** The luminaire shall bear the *SABS 1464* safety mark.
- 4.15 **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.

5. GENERAL TECHNICAL REQUIREMENTS

5.9 General

- 5.9.1 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.
- 5.1.2 The luminaire shall bear the SABS 1279 and SABS 1464 marks.

5.10 Construction

A. Floodlight for use with 150/100/70W HPS or 125/80W MV lamps.

1. The luminaire shall consist of a body manufactured from high-pressure die-cast aluminium, or from filled ultra-violet stabilised glass-fibre reinforced polyester with a transparent prismatic diffuser.
2. The housing shall be equipped with a clear transparent high-impact resistant acrylic bowl, treated against discolouring due to UV and lamp radiation, with a silicon-rubber gasket. The dome shall preferably be hinged and mounted with stainless steel clips.
3. 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.
4. The reflector shall be mounted on the luminaire body. The reflector shall be made from highly polished 99,98% pure specular anodised aluminium plate and shall be manufactured to give optimum performance with the prismatic diffuser as applicable. For wider beam spread, a hammered finish shall be provided.
5. 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. The luminaire shall be provided with a cable entry at the back of the luminaire by means of a plastic gland. However, it shall be possible to provide 20mm diameter conduit entries or cable entries from the sides of the luminaire and suitable drilling indents or knockouts shall be furnished on the luminaire body.
7. A heavy gauge galvanised steel stirrup bracket for mounting the luminaire shall be supplied with the luminaire unless omitted in the project specification.
8. The luminaire shall be suitable for use with 1 x 150W (tubular) or 100W or 70W (both elliptical) high-pressure sodium vapour lamp or 1 x 125W or 80W (both elliptical) mercury vapour lamp. The lamps required shall be as specified in the project specification.
9. The luminaire shall have an ingress protection rating of at least IP43.

Flood-lights for use with 400/250/150W HPS or 400/250W MH or 400/250W MV lamps

1. The luminaire shall be consisting of a body manufactured from high-pressure die-cast aluminium. The body shall be hail-proof, weatherproof and corrosion and vandal resistant.
2. The housing shall be equipped with a flat armoured glass fixed in a sturdy, die-cast frame with a silicon-rubber gasket. The glass frame shall be hinged and mounted with stainless steel screws and mounting plates.
3. The luminaire shall be equipped with integral control gear mounted in a separate control gear compartment.
4. The reflector shall be mounted on the luminaire body. The reflector shall be made from highly polished 99, 98% pure specular anodised aluminium plate and shall be manufactured to give optimum performance with the prismatic diffuser as applicable. For wider beam luminaires, a hammered finish shall be provided.
5. The luminaire shall be suitable for the following lamps, the replacement of which shall be by means of a removable side-mounted cast aluminium lamp holder housing with a heat-resistant water-proof gasket :

High-pressure sodium: 400W, 250W or 150W tubular type and 400W, 250W and 150W Elliptical type

Metal-halide lamps: 400W or 250W tubular type and 400W or 250W elliptical type

Mercury vapour lamps: 400W or 250W elliptical type

The lamps required shall be as stated in the project specification.

6. The luminaire shall have an ingress protection rating of at least IP65.
7. A heavy gauge hot-dipped galvanised steel mounting-stirrup with pre-punched holes shall be supplied with the luminaire unless otherwise specified in the project specification.

5.11 Internal wiring

- 5.11.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body or control gear trays.
- 5.11.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.
- 5.11.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.
- 5.11.4 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.
- 5.11.5 Where circuits requiring the use of ignitors are used the wire between the ignitor and the lamp holder shall be insulated to withstand at least 5kV.
- 5.11.6 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.

5.12 Lamp holders

- 5.12.1 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.

5.13 Control gear

5.13.1 The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted

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

5.13.3 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.

5.13.4 The luminaire control gear shall be mounted onto the inside of the control gear compartment of the body on a separate mounting plate. The gear-mounting tray shall be manufactured from sheet steel at least 0,7mm thick and shall be epoxy powder coated.

5.13.5 The gear tray and luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.

5.13.6 In those applications where ignitors are used, these shall be of the superposed pulse type.

5.14 Capacitors

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

5.15 Lamps

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

<u>LAMP</u>		<u>LAMP HOLDER</u>	<u>LAMP TYPE</u>
HP Sodium Vapour 400W, 250W, 150W or 100W 70W	E40	Tubular clear or coated	elliptical
		E27	Coated elliptical
Metal halide 400W or 250W	E40		Tubular clear or coated elliptical
Mercury vapour 400W and 250W 125W and 80W	E40		Coated elliptical
	E27		Coated elliptical

5.7.2 The actual lamp ratings and types shall be as specified in the project specification.

6. LIGHT DISTRIBUTION

The floodlights shall be available with at least three types of symmetrical light distribution characteristics. These shall be:

- 6.1 Wide beam
- 6.2 Medium beam
- 6.3 Narrow beam

7. PHOTOMETRIC DATA

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

8. **TECHNICAL INFORMATION**

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

SECTION C12.9

PENDANT LUMINAIRES FOR USE WITH COMPACT FLUORESCENT OR TUNGSTEN FILAMENT LAMPS FOR INTERIOR APPLICATIONS

1. SCOPE

This specification covers the requirements for pendant type luminaires, using compact fluorescent or tungsten filament lamps, operating at a nominal voltage of 230V, for general indoor use. The types of luminaires covered are decorative types with metal, acrylic and glass shades and include luminaires with one or more lamps with standard wattage ratings as specified in the project specification.

2. GENERAL

2.1 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%.

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.

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

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.

2.5 Lamps shall be delivered separately.

6. STANDARDS

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

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

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

6.3 SABS 890, IEC 920

and IEC 921: Ballasts for fluorescent lamps.

6.4 SABS 1464: Safety of luminaires.

6.5 SABS 1479: Glow starters for fluorescent lamps.

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

6.7 SABS 783: Baking enamels.

6.8 SABS 0142 : The wiring of Premises

6.9 SABS 56: Incandescent lamps

6.10 SABS 165: Lamp holders

And VC8011

6.11 Any standard referred to in the above standards.

7. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

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

7.2 FIXING: The luminaires shall be suitable for mounting against ceilings as described in the

project specification.

- 7.3 ENVIRONMENTAL : Unless otherwise specified in the detail specification the luminaires shall be suitable for operation in ambient temperatures between -10°C and +45°C.
- 7.4 SAFETY: The luminaire shall bear the SABS 1464 safety mark.
- 7.5 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.

8. GENERAL TECHNICAL REQUIREMENTS

8.1 General

- 8.1.1.1 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.
- 8.1.2 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.
- 8.1.3 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.

8.2 Construction

- 8.2.1 The luminaire shall consist of the following basic parts:

- 5.2.2 A mounting bracket which fits onto a standard round conduit ceiling box by means of two screws.
- 5.2.3 A suspension hook from which the luminaire cable is suspended to prevent the luminaire from hanging from the connector block.
- 5.2.4 A connector block for wiring the luminaire to the mains wiring.
- 5.2.5 A ceiling cup which can be moved upwards over the luminaire cable to cover the connections at the ceiling.
- 5.2.6 A white heat-resistant three-core flexible cable with a nominal length of 1,5m connected onto the terminal block in the ceiling box, and the other end factory-connected to the lamp holder or control circuit of the luminaire.
- 5.2.7 A shade of either metal, non-discolouring acrylic material or glass as specified in the project specification.
- 5.2.8 All components, including screws, bolts and nuts utilized in the construction of the luminaire or fixing of its components, shall be corrosion proof. Cadmium plated, brass or stainless steel materials are preferred.
- 5.2.9 Where the mass of the luminaire exceeds 1,5kg a separate stainless steel suspension cable to support the luminaire shall be provided.

5.3 Internal wiring

- 5.3.1.1 Luminaires shall be completely wired internally. Conductors shall be protected with grommets

where they pass through holes in metal parts.

- 5.3.2 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.
- 5.3.3 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.
- 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.
- 5.3.5 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.

5.4 Lamp holders

Lamp holders shall be of the type suitable for the relevant compact fluorescent or general lighting service lamp. For incandescent lamps brass holders with porcelain galleries shall be provided. The following standard lamps and lamp holders shall apply:

5.4.1	<u>LAMP</u>	<u>HOLDER</u>
	7W PL	2G11
	9W PL	2G11
	13W PLC	G24d-1
	60/100W GLS	E27 or Bayonet Cap, porcelain

5.5 Control gear

- 5.5.1 Where applicable, 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.

5.6 Lamps

- 5.6.1 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 for fluorescent lamps shall correspond to colour 2 (4 300K) of SABS 1041.
- 5.6.2 Lamps of the same colour shall be provided for an entire installation unless specified to the contrary.
- 5.6.3 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.
- 5.6.4 The following standard lamps shall be used for the purposes of this specification:

PL lamps:	7W, and 9W
PLC Lamps:	13W
GLS Lamps:	60 and 100W

5.7 Lamp Shades

5.7.1 Metal Lamp Shades:

The metal shade shall be manufactured from aluminium and shall be spun into a pleasing decorative shape which shall provide a circular distribution pattern with an angle of approximately 60° to the vertical in all directions.

5.7.1.1 The shade shall be epoxy-powder coated inside and outside and shall be white on the inside. The outside colour shall be as described in the project specification.

5.7.1.2 The shade shall be suitable ventilated to prevent the building-up of excessive heat.

5.7.2 Acrylic Lamp Shades:

5.7.2.1 The shade shall consist of a high-impact resistant ultra-violet stabilised acrylic moulding which will not discolour as a result of the heat or the particular radiation of the lamp used in the luminaire. The shade shall be either transparent or opaque as described in the project specification and shall have a pleasing decorative shape.

5.7.2.2 The shade shall provide sufficient upward light to make full use of ceiling reflection.

5.7.3 Glass lamp shades:

5.7.3.1 The shade shall be made from frosted opaque white glass (unless otherwise specified in the project specification) and shall be manufactured with a pleasing shape.

5.7.3.2 The shade shall provide sufficient upward light to make full use of ceiling reflections.

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.

7. **TECHNICAL INFORMATION**

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

SECTION C12.10

INFRA-RED ENERGY SOURCES FOR USE IN POULTRY APPLICATIONS

1. SCOPE

This specification covers the requirements for infra-red units or luminaires used as heating sources in the rearing of broiler chickens in enclosed chicken pens, with wattage ratings as specified.

2. GENERAL

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

2.2 If the equipment 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.

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

2.4 Units/luminaires and associated equipment shall be new and unused and shall be supplied complete with infrared source/lamp, mounting brackets, etc. and shall be delivered to site in a protective covering.

2.5 Lamps, where applicable, shall be delivered separately.

3 STANDARDS

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

- | | | |
|-----|--|---|
| 3.1 | SABS 0142: | The wiring of Premises. |
| 3.2 | SABS 165:
and VC8011 | Lamp holders |
| 3.3 | SABS 1222: | Enclosures for electrical equipment. |
| 3.4 | SABS 1247: | Coatings applied by the powder-coating process. |
| 3.5 | SABS 1464: | Safety of luminaires. |
| 3.6 | SABS 1507: | Electric cables with extruded solid dielectric insulation for fixed
Installations. |
| 3.7 | Any standard referred to in the above standards. | |

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

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

4.2 FIXING: The units/luminaires shall be suitable for mounting on brackets against horizontal or vertical surfaces, or for suspension from chains or cables from roof structures as described in the project specification.

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

To enable cleaning of the enclosures by means of water spraying, the unit/luminaire shall preferably be splash proof. Where luminaires are offered, these shall have an ingress protection rating of at least IP 23.

- 4.4 SAFETY: If luminaires are offered, these shall bear the SABS 1464 safety mark.

5. GENERAL TECHNICAL REQUIREMENTS

- 5.1 The internal components of the unit or 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.
- 5.2 All metal components shall be manufactured from corrosion-resistant materials or shall be treated to prevent corrosion.
- 5.3 All screws and other components must be easily reachable and must be mounted on the unit/luminaire body.

6. CONSTRUCTION

6.1. GENERAL:

The energy source required may be either a heat source making use of an open IR source or a luminaire utilising an infrared lighting source.

6.2. OPEN SOURCE DEVICES:

- 6.2.1 The body shall consist of an enclosed connection box, manufactured from epoxy powder-coated or galvanised sheet-metal, equipped with an aluminium reflector and a wound IR source.
- 6.2.2 The connection box shall be provided with an eyebolt or hook for suspension and mounting of the unit.
- 6.2.3 The unit shall be provided with 2 metres of cable and a connected 15A plug-top.
- 6.2.4 The unit shall have a maximum height of 210mm and the reflector shall have a diameter of not more than 390mm. The mass of the unit shall not exceed 1,7kg.
- 6.2.5 The reflector shall be manufactured from high-purity anodised aluminium.
- 6.2.6 The infrared source shall be on a porcelain base and shall have a maximum rating of not more than 550W on a 230V power supply.
- 6.2.7 The IR source shall emit infrared radiation with more than 60% in the 3 700nanometre range.
- 6.2.8 To facilitate cleaning, it shall be possible to immerse the whole unit in water when the power supply is disconnected.

6.3 LIGHT SOURCE DEVICES

- 6.3.1 The luminaire shall consist of a non-corrosive metal body shaped as to house the infrared lamp. The inside and outside of the housing shall preferably be epoxy powder coated and shall be of a neutral colour such as grey.
- 6.3.2 The housing shall be suitable for use with PAR 38 lamps with E27 bases.
- 6.3.3 The housing shall be equipped with a heat-resistant lamp holder, capable of withstanding the operating temperature of the lamp in the ambient conditions as described in clause 4 above.

- 6.3.4 The housing shall be equipped with a wire grille to prevent accidental contact with the lamp.
- 6.3.5 The luminaire shall be provided with a suitable suspension hook for vertical mounting of the luminaire or as described in the project specification.
- 6.3.6 The luminaire shall be provided with an integral connection box and 2m of cable with a 15A plug-top mounted on the free end.
- 6.3.7 The lamp shall be constructed from hardened glass to withstand water droplets while in operation. The lamp rating shall be 100W at 230V.
- 6.3.8 Luminaires shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body or control gear trays.
- 6.3.9 The wiring shall be totally metal enclosed to prevent any possible contact with live components while changing lamps.
- 6.3.10 The conductor insulation shall be rated to withstand the temperature inside the luminaire body without deterioration.
- 6.3.11 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.
- 6.3.12 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.

7. ELECTRICAL SUPPLY

- 7.5 The luminaires shall be suitable for connection to a single-phase electricity supply with a nominal voltage of 220V to 250V at 50Hz.
- 7.6 The actual voltage will be furnished in the project specification.

8. TECHNICAL INFORMATION

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

SECTION C12.11

BULKHEAD LUMINAIRES FOR USE WITH DISCHARGE LAMPS FOR INTERIOR AND EXTERIOR APPLICATIONS

1. SCOPE

This specification covers the requirements for bulkhead type luminaires, using mercury vapour, sodium vapour or metal halide lamps, for general outdoor and indoor use. The luminaires covered are decorative rectangular or polygonal surface-mounted 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.

2. GENERAL

2.1 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%.

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.

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

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.

2.5 Lamps shall be delivered separately.

3. STANDARDS

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

- | | | |
|------|---|--|
| 3.1 | SABS 1421: | High-pressure mercury vapour lamps. |
| 3.2 | SABS IEC 662: | High-pressure sodium vapour lamps. |
| 3.3 | IEC 61167: | Metal Halide lamps. |
| 3.4 | SABS 1250: | Capacitors for use with fluorescent and other discharge lamp ballasts. |
| 3.5 | SABS 1464: | Safety of luminaires. |
| 3.6 | SABS 1278: | Interior luminaires for low pressure sodium vapour and high intensity Discharge lamps. |
| 3.7 | SABS IEC 922 and SABS IEC 923: | Ballasts for discharge lamps. |
| 3.8 | SABS IEC 926 and SABS IEC 927: | Starting devices (other than glow starters). |
| 3.9 | SABS 1247: | Coatings applied by the powder-coating process. |
| 3.10 | SABS 783: | Baked enamels. |
| 3.11 | SABS 0142: | The wiring of Premises |
| 3.12 | SABS 1507: | Electric cables with extruded solid dielectric insulation for fixed installations. |
| 3.13 | SABS 165: and VC8011 | Lamp holders |
| 3.14 | Any standard referred to in the above specifications. | |

4. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

- 4.1 AREAS OF APPLICATION: The luminaires are intended for standard indoor and exterior use in buildings under the control of the Department of Public Works.
- 4.2 FIXING: The luminaires shall be suitable for mounting against horizontal or vertical surfaces and walls as described in the project specification.
- 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 IP66.
- 4.4 SAFETY: The luminaire shall bear the SABS 1464 safety mark.
- 4.5 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.

5. GENERAL TECHNICAL REQUIREMENTS

5.1 General

- 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.
- 5.1.2 The luminaire shall also be available with an optional wire guard and a decorative skirt of the same material and finish as the luminaire body.

5.2 Construction

- 5.2.1 The luminaire shall consist of a body manufactured from high-pressure die-cast aluminium, with a transparent prismatic diffuser. The body shall be of sufficient strength for the mounting of the entire luminaire.
- 5.2.2 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.
- 5.2.3 Except for mounting holes and/or slots, the back of the body shall be closed over the full extent of the luminaire. At least three mounting holes shall be provided.
- 5.2.4 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.
- 5.2.5 The luminaire shall be provided with a cable entry at the back of the luminaire by means of a plastic gland. However, it shall be possible to provide 20mm diameter conduit entries or cable entries from the sides of the luminaire and suitable drilling indents or knockouts shall be furnished on the luminaire body.

5.3 Internal wiring

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

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

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.

5.5 Control gear

- 5.5.1 The control gear, Ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted
- 5.5.2 Ballasts shall comply with SABS IEC 922 and 923 as applicable and shall be suitable for operation on 220V to 250V, 50Hz supplies.
- 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.
- 5.5.4 The luminaire control gear shall be mounted onto the inside of the body and not on a separate mounting plate.
- 5.5.5 The luminaire body shall be equipped with the components suitable for the luminaires and lamps specified in the project specification.
- 5.5.6 In those applications where ignitors are used, these shall be of the superposed pulse type.
- 5.5.7 The reflector shall be mounted on a white epoxy powder coated steel mounting plate at least 0,7mm thick, which is mounted to the body by means of four screws. The reflector shall be made from highly polished anodised aluminium plate and shall be manufactured to give optimum performance with the prismatic diffuser.

5.6 Capacitors

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

5.7 Lamps

- 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 (50W, 80W and 125W)	E27
Sodium Vapour	
50W and 70W	E27
100W and 150W	E40

NB. All lamps shall be of the elliptical coated type.

<u>LAMP</u>	<u>LAMP HOLDER</u>
Metal halide lamps	
70W and 150W (tubular)	RX7s
100W (elliptical)	E27

5.8 Diffuser

- 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.
- 5.8.2 The diffuser shall be mounted to the body by means of an external mounting ring and at least four Allen screws, which should preferably not pass through the diffuser body as well. The diffuser shall be attached to the mounting frame by means of screw-down holding plates.
- 5.8.3 A silicon sponge gasket which fits into a groove on the body shall be used to allow breathing of the luminaire whilst prohibiting the ingress of insects.

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.

7. TECHNICAL INFORMATION

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

SECTION C17

SWITCHBOARDS (Up to 1 kV)

1. GENERAL

1.1 Scope

This section covers the manufacturing and testing of flush mounted, surface mounted and floor standing switchboards for general installations in normal environmental conditions and for system voltages up to 1 kV.

1.2 Size

All switchboards shall be of ample size to accommodate the specified switchgear and provide space for future switchgear. For every 4 (or part of 4) 5kA circuit-breakers on a switchboard, space for an additional 5kA circuit breaker shall be allowed unless future space requirements are clearly specified. For circuit breakers above 5kA, this factor shall be 15 %. The clearance between adjoining switchgear openings shall be as specified in par. 6.2.

1.3 External Dimensions

The maximum allowable height of free standing switchboards is 2,2 m. Cubicle type boards may be up to 2,4 m high if they can be fully dismantled into individual cubicles. Where, due to space restrictions, a board exceeds 2,4m in height, equipment not normally requiring access, shall be installed in the top section, enabling equipment normally requiring access to be installed lower down in the board. All other specified external dimensions for switchboards shall be strictly adhered to. If the clearances specified in par. 6.2 cannot be adhered to as a result of restricting external dimensions, the Contractor shall obtain the approval of the Department before manufacturing the switchboards.

1.4 Moisture and Vermin

All switchboards shall be rendered moisture proof and vermin proof and shall be adequately ventilated. Refer to par. 4.10 and 4.11.

1.5 Load Balance

The load shall be balanced as equally as possible across multiphase supplies.

2. CONSTRUCTION OF FLUSH MOUNTED SWITCHBOARDS

2.1 Standard

Flush mounted switchboards shall comply fully with SABS 1180, part I. Unless the depths of the switchboards are specified, the depths shall be determined in accordance with par. 6.

2.2 Expanded Metal

Where switchboards are to be built into 115 mm thick walls, expanded metal shall be spot-welded to the rear of the bonding trays. The expanded metal shall protrude at least 75 mm on each tray side to prevent plaster from cracking.

2.3 Knock-outs

Knock-outs shall be provided in the top and bottom ends of each switchboard tray to allow

for the installation of conduits for the specified and future circuits. Knock-outs shall be provided for an equal number of 20 mm and 25 mm dia. conduits.

2.4 Panel

Front panels shall have machine punched slots for housing the specified and future flush mounted switchgear. The distance between the inside of the closed doors and the panel shall not be less than 20 mm. No equipment may be mounted on the panel unless the panel is permanently hinged to the switchboard frame.

2.5 Fixing of Front Panels

The front panel shall be secured to the architrave frame by means of 6mm studs and chromium-plated hexagonal domed nuts, hank nuts or captive fasteners. Alternatively the panel may be secured to the architrave frame by means of two pins at the bottom and a latch or lock at the top of the panel. Self-tapping screws will not be allowed. All front panels shall be provided with a minimum of one chrome plated handle.

2.6 Door Handles and Catches

Switchboard doors shall be equipped with handles and catches. Locks shall only be provided when specified. In all cases where lockable doors are required and in all cases where the switchboard doors are higher or wider than 450 mm, handles consisting of a push-button-and-handle combination with spring loaded catch or rotary handle-and-catch combination shall be installed. Switchboard doors smaller than 450 mm in height and width may be equipped with spring loaded flush mounted ring type latches. Square key operated catches are not acceptable unless specified.

3. CONSTRUCTION OF SURFACE MOUNTED SWITCHBOARDS

3.1 Standard

Surface mounted switchboards shall comply with SABS 1180, Part II.

3.2 Switchboard Tray

Surface mounted switchboards shall be equipped with a 1,6mm minimum sheet steel reinforced tray, suitably braced and stiffened to carry the chassis, door and equipment. Lugs to secure the switchboard to a vertical surface shall be provided.

3.3 Construction

All joints shall be welded or securely bolted. The tray shall be square and neatly finished without protrusions. The front tray sides shall be rounded with an edge of at least 20mm to accommodate flush doors.

3.4 Chassis

A sheet steel chassis for the mounting of equipment shall be bolted to the tray and shall comply with the requirements of par. 6.1 and 6.3.

3.5 Front Panel and Door

The front panel and door shall comply with par. 2.4 to 2.6 above. Doors shall fit flush in the tray when closed.

3.6 Dimensions

Unless the depth of the switchboards is specified, the dimensions shall be determined in accordance with the requirements of par. 6.2 and 6.3.

4. CONSTRUCTION OF FREE STANDING SWITCH BOARDS

4.1 Framework

A metal framework for free standing switchboards shall be manufactured from angle iron, channel iron or 2mm minimum folded metal. A solid U-channel base frame, sufficiently braced to support all equipment and span floor trenches and access holes shall be provided. Switchboards shall be of cubicle design with 2mm side panels forming divisions between cubicles. The maximum allowable cubicle width is 1,5m. (Refer also to par. 4.7). Joints shall be non-continuously butt-welded. Welds shall be ground smooth and the joint wiped with plumber's metal in order to provide a smooth finish. Switchboards wider than 2m shall be fitted with screwed eye-bolts attached to the framework to facilitate loading and transportation of the board.

4.2 Rear and Side Panels

The rear panels shall be removable and shall be manufactured from 2mm minimum sheet steel. The panels shall have returned edges which are recessed in the frame or which fit over lips on the switchboard frame. The panels shall be secured to the frame by means of studs and chromium-plated hexagonal domed brass nuts or hank nuts or captive fasteners equal or similar to "DZUS" or "CAMLOC". Where switchboards are intended for installation in vertical building ducts or against walls, the rear and side panels may consist of a single folded sheet which is either bolted or welded to the frame or which forms part of the folded metal frame.

4.3 Front Panels

- 4.3.1 The front panels of floor standing switchboards shall preferably be hinged except where flush mounted equipment prevents this. Alternatively, panels shall be secured by means of the methods described in par. 2.5. The panels shall be arranged in multi-tiered fashion to allow for the logical grouping of equipment in accordance with par. 6.
- 4.3.2 The hinged front panels shall have a dished appearance with 20mm upturns which fit over a lip on the switchboard frame. Alternatively the hinged panels shall have folded edges and shall be fitted flush or slightly recessed in the switchboard frame. The latter method shall be used where doors are required. (Also refer to par. 4.6). Corners shall be welded and smoothed.
- 4.3.3 The panels shall be of 2mm minimum sheet steel with machine punched slots to allow for the flush mounting of instrumentation, switchgear toggles and operating handles. A minimum clearance of 50mm shall be maintained between the rear of equipment mounted on the panels (taking into account terminals or other projections) and the frame and chassis of the switchboard. Separate panels shall preferably be provided for the mounting of instrumentation and for covering flush mounted switchgear. Enclosed switchgear with front panels e.g. combination fuse-switch units, may be flush mounted in the board in lieu of separate hinged panels.
- 4.3.4 Hinged panels shall be suitably braced and stiffened to carry the weight of flush mounted equipment and to prevent warping.
- 4.3.5 Hinged panels with flush mounted equipment and panels higher than 600mm shall be supported by hinges of adequate strength to ensure smooth and reliable operation. 16mm pedestal or similar heavy duty hinges with single fixing bolts may be used on panels smaller than 600mm. On the larger panels long pedestal type hinges with two fixing bolts

per hinge are preferred. Piano hinges are not acceptable for this application.

- 4.3.6 A tubular chromium-plated handle shall be fitted on each panel. The handle may be omitted if "DZUS" or "CAMLOC" fasteners are used.
- 4.3.7 Blanking plates shall be fitted over slots intended for future equipment. These plates shall be fixed in a manner which does not require the drilling of holes through the front panel. Dummy circuit-breakers may be fitted where applicable.
- 4.3.8 Front panels containing live equipment such as instrumentation or control switches, shall be bonded to the switchboard frame with a braided copper earth trap with an equivalent cross-sectional area of at least 4mm².

4.4 Securing of Front Panels

Hinged panels shall be secured in position by means of square key operated non-ferrous fasteners designed to draw the panels closed or similar quick-release fasteners. Self-tapping screws are not acceptable. Where non-hinged removable panels are specified, they shall be secured in position by means of 6mm studs and hexagonal chromed brass dome nuts and washers or hank nuts. Non-hinged removable panels may alternatively be secured in position by means of two pins at the bottom and a latch or lock at the top.

4.5 Chassis

A suitably braced chassis for the mounting of switchgear and equipment shall be firmly secured to the frame of the switchboard. The chassis shall be designed so that the switchgear can be installed in accordance with par. 6. Circuit-breakers and isolating switches which are not of the moulded-case air-break type and the insulators of busbars for ratings of 200 A and more may be secured directly to the framework. (Refer to par. 6.1).

4.6 Doors

- (a) Doors need only be provided when specified. Doors shall be arranged in multi-tiered fashion to allow for the logical grouping of equipment in accordance with par. 6.
- (b) Doors shall have a dished appearance with a minimum of 20 mm upturns which fit over a lip on the switchboard frame or shall fit flush in the switchboard frame. Corners shall be welded and smoothed.
- (c) Doors shall be of aluminium sheet steel with machine punched slots to allow for the flush mounting of instrumentation, control and protection equipment. Switchgear shall be flush mounted in the front panels behind the doors unless specified to the contrary. A minimum clearance of 50mm shall be allowed between the rear of equipment mounted on doors (including terminals and projections) and the frame, front panel and chassis.
- (d) Doors shall be suitably braced and stiffened to carry the weight of the equipment and to prevent warping.
- (e) Hinges for doors shall be provided as described in par. 4.3.5. At least three hinges shall be provided on doors higher than 1,2m.
- (f) Doors shall be fitted with handles consisting of a pushbutton-and-handle combination with springloaded catch or a rotary handle-and-catch combination. Flush mounted ring type handles or square key operated latches are not acceptable. The same key shall fit all locks on the switchboard in cases where locks are required.
- (g) Doors shall be fitted with hypalon or neoprene seals.

- (h) Doors containing any electrical equipment shall be bonded to the switchboard frame with a braided copper earth wire with an equivalent cross-sectional area of at least 4mm².

4.7 Sections

For ease of transportation and to facilitate access to the allocated accommodation, switchboards may be dismantled into cubicles or sections. Each section shall be rigidly manufactured to ensure that damage to the switchgear will not occur during transportation and handling. Where required, switchboards shall have temporary wood or steel bracing to protect switchgear and facilitate handling.

4.8 Grouping of Switchgear

The switchgear shall be logically arranged and grouped as described in par. 6. Depending upon the number and size of components, a common front panel may be installed over one or more groups of equipment. All equipment shall be installed in accordance with the requirements of par. 6.

4.9 Cable Gland Plate

A cable gland plate shall be installed across the full width of each power cubicle at a minimum height of 300mm above the bottom of the switchboard to house the cable glands. A Steel cable channel or other approved support shall be provided to carry the weight of the cable and remove mechanical stress from the cable glands. A minimum distance as required by the bending radius of outgoing cables shall be provided between the lowest terminals of major equipment and the gland plate.

4.10 Ventilation

Switchboards shall be properly ventilated, especially cubicles containing contactors, transformers, motor starters, lighting dimmers and other heat producing equipment. Louvres shall be fitted to provide adequate upward or cross ventilation. All louvres shall be vermin proofed with 1,5mm brass mesh or perforated steel plate internally spot welded over the louvres. The internal ambient temperature shall not exceed 40 C.

4.11 Vermin Proofing

Free standing boards shall be protected against vermin, especially from below- Where cables have to pass through the gland plate, rubber grommets shall be provided and enough non-hardening compounds shall be delivered with the board so that these holes can be sealed properly after installation of the cables.

5. CONSTRUCTION OF MAIN LOW TENSION SWITCHBOARDS

Main low tension switchboards and sub-main low tension switchboards heavily equipped shall comply with par. 4.1 to 4.11 as well as the following exceptions or additions:

- (a) These boards shall be fully extensible with removable busbar cover plates in the side panels.
- (b) Doors shall not be supplied unless specifically called for.
- (c) Switchgear and equipment shall be installed in accordance with the requirements of par. 6.
- (d) Provision for metering equipment shall be made in accordance with requirements of local authorities where applicable.

6. MOUNTING OF EQUIPMENT

- 6.1 The mounting of equipment shall comply with SABS 1180 where applicable. Equipment to be mounted on the chassis shall be mounted by bolts, washers and nuts or by bolts screwed into tapped holes in the chassis plate. In the latter case the minimum thickness of the chassis plate shall be 2,5 mm. The latter method shall not be used where boards will be subject to vibration or mechanical shocks. Self-tapping screws will not be accepted.

6.2 Space Requirements

In designing the switchboards the following requirements shall be strictly adhered to:-

- (a) A minimum of 50 mm between any piece of equipment and the frame or internal partitioning. This minimum space is required on all sides of the equipment. In the case of a single row of single-pole circuit-breakers the spacing on one side of the row may be reduced to 25 mm if the incoming side of the circuit-breakers is busbar connected.
- (b) A minimum of 75 mm between horizontal rows of equipment. The maximum outside dimensions of equipment shall be considered.
- (c) Circuit-breakers up to a fault rating of 10 kA may be installed adjacent to each other. For higher ratings a minimum of 40 mm shall be allowed between circuit-breakers or isolators.
- (d) Sufficient space shall be provided for wiring allowing for the appropriate bending radius.
- (e) Space for future equipment shall be allowed as described in par. 1.2.

6.3 Mounting of Chassis

The chassis of flush mounted and smaller surface mounted boards shall be mounted in accordance with SABS 1180. For all free standing switchboards and surface mounted switchboards where the main switch rating exceeds 100 A (triple-pole), space for wiring shall be provided between the chassis and tray. This space shall be adequate to install the supply cable behind the chassis and terminate on the main switch without sharp bends in the cable cores.

6.4 Grouping of equipment

- 6.4.1 Equipment shall be arranged and grouped in logical fashion as follows:

- (a) Main switch - to be installed either at the top or bottom of the board.
- (b) Short circuit protection equipment - fuse gear or fuse-switches.
- (c) Change-over contactors or other contactors controlling the supply.
- (d) Motor supplies.
- (e) Fuse-switches for outgoing circuits.
- (f) Other circuits and equipment.

- 6.4.2 Where a portion of the equipment on the switchboard is supplied from a standby power source, the change-over contactor and the associated equipment shall be grouped in a separate compartment.

- 6.4.3 Where earth leakage units are required, the associated circuit-breakers shall be installed adjacent to the unit.

6.5 Mounting of Circuit-Breakers

All moulded-case circuit-breakers shall be flush mounted with only the toggles protruding. Miniature circuit-breakers may be installed in clip-in trays mounted on the frame. All other circuit-breakers shall be bolted to the chassis. Special provision shall be made for large main switches when designing the framework. Care shall be exercised that the rear studs of circuit-breakers are properly insulated from the steel chassis. Where necessary, insulating material shall be installed between the rear studs and the chassis. Circuit-breakers shall be installed so that the toggles are in the up position when "ON" and down when "OFF".

6.6 Instrumentation

All metering instruments shall be flush mounted in the front panel or door. The rear terminals of instruments mounted on doors shall be covered with an insulating material to prevent accidental contact. Current transformers for metering shall be mounted so that the rating plate is clearly visible. Fuses for instrumentation shall be mounted in an easily accessible position and clearly marked.

6.7 Mounting of Fuses

- 6.7.1 Fuse holders shall be mounted semi-recessed in the front panel so that fuses can readily be changed without removing the front panel. Busbar mounted fuses for instrumentation shall be used as far as possible.

- 6.7.2 Where equipment requiring fuses is specified on a board (fuse switches etc), a ruling shall be obtained from the Department on the quantity of spare fuses to be provided.

6.8 Equipment in Main Boards

Equipment in main low tension switchboards and sub-main boards shall be grouped in individual compartments. Equipment shall be installed as follows:

- 6.8.1 Rack-out type air circuit-breakers shall be mounted in the bottom section, flush behind the panel with the handle only protruding. If this is not possible, the panel shall be omitted and the air circuit-breakers installed behind a door.
- 6.8.2 If the main switch is a moulded-case circuit-breaker or isolator it shall be flush mounted.
- 6.8.3 Contactors controlling the supply shall be installed behind separate front panels.
- 6.8.4 All metering, protection and indicating equipment shall be clearly visible from the front of the board. Current transformer ratios and multiplication factors shall be clearly marked. Where doors are specified the equipment shall be installed flush in the doors and covered as described in par. 6.6.
- 6.8.5 All circuit-breakers and fuses (with the exception of fuse-switches) may be grouped together behind one or more panels as described in par. 4.8.
- 6.8.6 Fuses or fuse-switches providing back-up protection for circuit breakers shall be grouped with the associated circuit-breakers. Exposed surfaces of fuse-switches shall be of the same finish and colour as the rest of the board where practical.

6.9 Standby Supplies

6.9.1 Where standby power from a diesel-generator set or other sources is available and has to be connected to some of the equipment on a switchboard, the switchboard shall be divided into separate sections with sheet metal divisions to isolate standby power and mains power sections.

6.9.2 Standby and normal supply shall each have its own incoming isolator or circuit-breaker.

6.9.3 The two sections of the switchboard shall be labelled "ESSENTIAL" and "NON-ESSENTIAL" respectively.

6.9.4 The front panels of standby and no-break supply sections shall be painted in distinctive colours as follows:

(a)	Normal supply	"LIGHT ORANGE", colour B26 of SABS 1091
(b)	Standby power	"SIGNAL RED", colour A11 of SABS 1091
(c)	No-break supply	"DARK VIOLET", colour F06 or "OLIVE GREEN", colour H05 of SABS 1091

7. BUSBARS IN SWITCHBOARDS

7.1 Application

7.1.1 Busbars shall be manufactured of solid drawn high conductivity copper with a rectangular cross-section in accordance with SABS 784, SABS 1195 and BS 159 and BS 1433, where applicable.

7.1.2 Although SABS 784 refers only to overhead or rising busbars, busbars in switchboards shall comply with applicable sections of this specification especially as far as insulation and clearance values, creepage distance, joints, insulation resistance, dielectric strength, deflection test, absorption resistance and rated short time withstand current are concerned.

7.1.3 Busbars shall be supplied for the following applications :

- (a) Distribution of supply voltage.
- (b) Connection of equipment with ratings exceeding the current rating of 70mm² conductors (par. 8.6).
- (c) Connection of outgoing circuits with current ratings in excess of that allowed for 70mm² conductors (par. 7.8).
- (d) Collector bars for parallel cables (par. 8.1).
- (e) Connection bars for neutral conductors (par. 7.9).
- (f) Earth busbars (par. 7.10).
- (g) Connections to miniature circuit-breakers (par. 8.6).

7.2 See Part C15 for further details.

8. WIRING

8.1 Cabling

Cables connected to incoming or outgoing circuits shall be terminated on the gland plate supplied for this purpose. (Refer to par. 4.9). Power cables up to and including 70 mm²

may terminate on clamp type terminals where the clamping screws are not in direct contact with the conductor. Connection to the equipment can then be made with cables that are similarly connected to the clamp terminal. All power cables larger than 70mm² terminate on busbars that are connected to the associated equipment. Parallel incoming or outgoing cables shall be connected to a collector busbar without crossing the conductors.

8.2 Terminal Strips

External wiring for low voltage, control, interlocking, alarm, measuring and DC circuits shall terminate on numbered wiring terminals complying with the Department's standard specification for "WIRING TERMINALS", Section C9. The correct terminal size as recommended by the manufacturer for each conductor to be connected shall be used throughout. The terminal numbers shall appear on the wiring diagrams of the switchboard. Terminals for power wiring shall be separated from other terminals. Terminals for internal wiring shall not be interposed with terminals for external circuits. All connections to terminals shall be identified as described in par. 8.8. Where switchboards consist of separate sections, the control wiring passing between sections shall be terminated on strips in each section so that control wiring can be readily re-instated when reassembling the board.

8.3 Current Ratings

The current rating of conductors for the internal wiring shall be sufficient for 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.

TABLE 17.3

CURRENT RATING FOR INTERNAL WIRING

Nominal cross-section mm ²	CONDUCTOR RATING (A)				
	Number of conductors in bunch				
	1	2 - 3	4 - 5	6 - 9	10 and more
2,5	28	25	22	19	16
4	37	33	30	26	22
6	47	42	38	33	28
10	64	54	51	44	38
16	85	76	68	59	51
25	112	101	89	78	67
35	138	124	110	96	88
50	172	154	137	120	103
70	213	191	170	149	127

The above table shall be applied for ambient temperatures up to 30 C. (Refer to table 41.2 in VDE 0100). For higher ambient temperatures the values shall be derated as prescribed by SABS 0142, Table 10.

8.4 Internal Wiring

- (a) Standard 600/1 000 V grade PVC-insulated stranded annealed copper conductors to SABS 150 shall be employed for the internal power wiring of switchboards. The smallest conductor size to be used for power wiring in switchboards shall be 2,5mm². Flexible cord of minimum size 1,0mm² may be used for control wiring.

- (b) Where heat generating equipment is present and the internal temperature of the board is likely to exceed 50 C, silicon-rubber insulated stranded conductors shall be used.
- (c) Wiring shall be arranged in horizontal and vertical rows and shall be bound with suitable plastic straps or installed in PVC wiring channels. Under no circumstances may PVC adhesive tape be used for the bunching of conductors or for the colour identification of conductors.
- (d) Bunched conductors shall be neatly formed to present a uniform appearance without twisting or crossing the conductors. Conductors leaving the harnesses shall be so arranged that they are adjacent to the chassis.
- (e) Conductors to hinged panels and doors shall be secured on both the door and the frame and shall be looped between the two points. The loop shall be arranged to produce a twisting motion when the door is opened or closed. A flexible protection sleeve shall be installed over the conductors.
- (f) Where wiring channels are used, they shall be installed horizontally and vertically. Under no circumstances may power and control circuit wiring be installed in the same wiring channels. Channel shall not be more than 40% full.
- (g) All wiring between different Panels within the same switchboard shall be installed in wiring channels.
- (h) Grommets shall be installed in each hole in the metalwork through which conductors pass.
- (i) All 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.
- (j) Conductors may be jointed at equipment terminals or numbered terminal strips only. No other connections are allowed.
- (k) Where conductors change direction, smooth bends shall be formed with a radius of at least 5 times the outside diameter of the conductor or harness.
- (l) Where screened cables are specified, the screening shall be earthed in the switchboard or control board only unless clearly specified to the contrary, Screened cables entering control boxes through pressed knock-outs, shall terminate in compression glands. Conductors shall as far as possible remain inside the screening at terminations. Where conductors have to separate from the screen, the braiding shall be separated and the conductors drawn through the braid without damaging the braiding. The conductors shall then be connected to their respective terminals and the screening smoothed and connected to the earth terminal.
- (m) Where neutral connections are looped between the terminals of instruments, it is essential that the two conductor ends be inserted into a common lug or ferrule and are crimped or soldered together in order that the neutral connection is not broken when the conductors are removed from one of the instruments.
- (n) Wiring should as far as possible be confined to the front portions of switchboards for ease of access. This requirement is important for wiring between smaller circuit-breakers and the associated main circuit-breaker as well as the wiring from circuit-breakers to lighting and socket-outlet circuits.

- (o) A maximum of two conductors will be allowed per equipment terminal. Where more conductors must be connected to the same equipment terminal (e.g. a main circuit-breaker feeding other circuit-breakers), stub busbars shall be provided for the various conductors. Refer also to par. 8.6.

8.5 Load End Connections

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

8.6 Wiring to Circuit-breakers

Equipment with a rating exceeding the current rating of 70mm² conductors shall be connected by means of busbars to the main busbars. Looped connections may only be installed for a maximum of two outgoing circuits. Where there are more than two outgoing circuits, busbars shall be used and equipment connected individually to the busbars. Where miniature circuit-breakers are mounted in continuous rows and supplied by busbars connected to each MCB, each busbar shall be supplied by a separate conductor. This conductor shall be connected to the busbar by means of a separate lug and not via an MCB terminal.

8.7 Conductor Terminations

Conductors connected to terminals complying with the Department's standard specification for "WIRING TERMINALS", Section C9, need not be soldered or ferruled. Connections to circuit-breakers, isolators or contactors shall be made by one of the following methods:

- (a) A ferrule of the correct size,
- (b) Soldering the end of the conductor, or
- (c) winding a conductor strand tightly around the end to totally cover the end.

All conductors terminating on meters fuse holders and other equipment with screwed terminals shall be fitted with lugs. The lugs shall be soldered or crimped to the end of the conductor. The correct amount of insulation shall be stripped from the end to fit into the terminal. Strands may not be cut from the end of the conductor.

8.8 Identification

8.8.1 The colour of the conductors for all 220/250 V circuits shall correspond to the colour of the supply phase for that circuit. Neutral conductors shall be black.

8.8.2 All other conductors in the board, supplying control circuits, etc. shall be coded in colours other than those specified above. A colour code shall be devised for each board and the colour code shall be shown on the wiring diagrams.

8.8.3 All conductors that terminate at wiring terminals and all conductors used for the internal wiring of the switchboard, shall further be identified at both ends by means of durable cable marking ferrules. PVC or other tape is not acceptable.

8.8.4 The numbers on the markers shall be shown on the wiring diagrams.

9. PAINT FINISH

Metal components of the framework, panels and chassis shall be painted in accordance with the Department's "STANDARD PAINT SPECIFICATION", Section C39.

10. LABELLING

- 10.1 Care shall be taken to ensure that all equipment is fully labelled and that accurate descriptions and safety warning notices appear in both official languages.

10.2 Material

Engraved plastic or ivory sandwiched strips shall be used throughout. The strips shall bear white lettering on a black background for normal labels and red letters on a white or yellow background for danger notices.

10.3 Main Switchboards

Main switchboards and sub-main switchboards shall be supplied with the following bilingual labels:

- (a) Number and allocation of switchboard.
Example:

CONTROL BOARD A4
BEHEERBORD A4

Lettering: at least 10 mm high. prominent position. Label on the outside in a prominent position.

- (b) Designation of busbar sections.
Example:

BUSBAR SECTION 2
GELEISTAMSEKSIE 2

Lettering: at least 10mm high. Label on the outside in a prominent position.

- (c) Designation of all switchgear including circuit-breakers, isolators, contactors, etc. If the current rating of circuit-breakers is not clearly marked on the equipment, the value shall be indicated on the engraved label.
Example:

SUPPLY TO BOARD C3
TOEVOER NA BORD C3

PUMP SUPPLY
POMPTOEVOER

Letters at least 5mm high. Label on the outside of the switchboard.

- (d) All other equipment including meters, instruments, indicator lights, switches, push-buttons, circuit-breakers, fuses, contactors, control relays, protection relays, etc. shall be identified. The function of the equipment and circuits shall be clearly indicated. The main switch shall be labelled as such and designated :

"SWITCH OFF IN CASE OF EMERGENCY"
"SKAKEL AF IN NOODGEVAL"

Flush mounted equipment within doors or front panels shall be identified with labels fixed to the doors or front panels respectively. The labels for equipment installed behind panels, shall be fixed to the chassis close to the equipment. If this equipment is positioned too close together to accommodate descriptive engraved labels, the equipment may be identified by a code or number on an engraved label which shall be fixed close to the equipment. The code number shall be identified on a legend card which shall be installed on the switchboard behind a plastic or other protective

cover.

10.4 Other Switchboards

All equipment on switchboards shall be identified with the necessary bilingual labels. The circuit numbers shall appear at grouped single-pole circuit-breakers. The circuit numbers shall correspond to the circuit numbers on the final installation drawings. The above-mentioned circuits shall be identified on a legend card, which shall be installed on the inside of the switchboard door, or in any other position where it can conveniently be observed. All fuses, including instrument fuses, shall have labels stating function, fuse rating and duty or type where applicable. All other equipment shall be identified separately and their functions shall be clearly indicated.

10.5 Fixing of Labels

10.5.1 Labels shall not be fixed to components or trunking but to doors, panels, chassis or other permanent structures of the switchboard.

10.5.2 Engraved strips shall be secured to facilitate a neat alteration of the designation of the labels. Sufficient fixing points shall be provided to prevent labels from warping. Labels in slotted holders shall be secured in position to prevent unauthorised removal. Labels may be secured by the use of brass bolts and nuts, self-tapping screws, slotted label holders or pop-rivets.

11. TESTS

11.1 The Department shall be notified when the mechanical construction of the switchboard, i.e. frame, panels and base frame, is complete in order that it may be inspected at the factory.

11.2 Function tests of all equipment, control and interlocking circuits shall be conducted to the satisfaction of the Department. Testing equipment and facilities including instruments, dummy loads and additional switchgear and cables shall be provided by the Contractor at no extra cost. The Department shall be notified in writing two weeks in advance of any test to be conducted, to allow its representative to be present at such tests. A complete report on the tests shall be handed to the Department.

DRAWINGS

12.1 Drawings for Approval

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

- (a) A complete wiring diagram of the equipment on the boards.
- (b) A complete layout of the arrangement of the switchboards indicating all equipment dimensions and the construction of the boards. The positions and method of fixing and sizes of busbars shall be shown.
- (c) All labelling information in both the official languages on a separate sheet.
- (d) The make, catalogue number and capacity of all equipment such as isolators, circuit-breakers, fuses, contactors, etc.

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

12.2 Final Drawings

A complete set of "as-built" transparent drawings of all switchboards shall be submitted to the Department within two weeks after delivery of the boards. The following information shall be presented:

- (a) Item (a) to (d) of the previous paragraph.
- (b) Terminal strip numbers, numbers and colours of conductors connected to the terminal strips and numbers and colours of the conductors utilised for the internal wiring.
- (c) A separate schedule of all equipment.

12.3 Manuals

Three sets of manuals for all specified main and sub-main switchboards shall be supplied to the Department at no extra cost. These manuals shall include the following information :

- (a) Complete information on the operation of the equipment.
- (b) Complete information for maintenance of the equipment.
- (c) Brochures and ordering information.
- (d) A complete equipment list indicating quantities and relevant catalogue numbers.

12.4 Completion

The supply contract shall be regarded as incomplete until all tests have been conducted successfully and all drawings and manuals have been handed to the Department

SECTION C18

LOW VOLTAGE DISTRIBUTION CUBICLES (KIOSKS)

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, 400/231V, 50 Hz systems.

2. SIZE

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

3. MOISTURE AND VERMIN

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

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

4. VENTILATION

4.1 Two ventilation grilles or slots, approximately 150 x 125mm, vermin proofed and insect proofed by means of 1,5mm brass mesh or perforated steel plate spot-welded on the inside, shall be provided on the top and bottom of both side panels.

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

5. FIBREGLASS CANOPIES

5.1 Application

Where specified and for all kiosks to be installed within 50 km of the coast and in corrosive industrial atmospheres, the canopy and doors shall be manufactured of fibreglass.

5.2 Construction

5.2.1 The laminate shall be constructed to SABS 141.

5.2.2 An outer isophalec resin gelcoat with a minimum thickness of 0,4mm and ultraviolet absorption properties to prevent degradation of the surface from exposure to the sun shall be provided.

5.2.3 The gelcoat shall be backed by multiple layers of chopped strand mat glass rendering not less than 1,2 kg/m². The strength shall be increased to 1,35 kg/m² on kiosks with panelling larger than 500 x 500mm.

5.2.4 The fibreglass shall be thoroughly impregnated with polyester resin. The resin should preferably be clear.

5.2.5 The resin to fibreglass ratio shall not be less than 2,5 : 1 and not more than 3,0 : 1.

- 5.2.6 Air entrapped between the glass mat layers shall be thoroughly worked out. The laminate must be free of air bubbles and voids.
- 5.2.7 All edges shall be reinforced with an additional 700 g/m² of fibreglass.
- 5.2.8 All large surfaces, wider than 300 mm, shall be reinforced or panelled to improve stiffness and rigidity.
- 5.2.9 A resin coat shall be applied to the inside of the kiosk to cover the fibre pattern.
- 5.2.10 Brass or steel backing plates shall be laminated into the fibreglass at hinge points, locking mechanism catch support areas, door restraint fixing points and all other points which will be subjected to mechanical stresses.
- 5.2.11 Doors shall be adequately braced, reinforced, ribbed or double laminated with an air gap between the two layers of laminate to ensure rigidity.
- 5.2.12 The fibreglass canopy shall be fixed to the internal equipment support frame with bolts accessible through the door only.
- 5.3 Finish and Colour of Fibreglass Kiosks
- 5.3.1 The outside surface of the kiosk shall have a glossy, smooth finish to ensure good weathering. To obtain this the manufacturer shall ensure that the mould is smooth, free of voids, hairline cracks, pores or other defects.
- 5.3.2 Compound rubbing or sanding of the outside surface will not be permitted.
- 5.3.3 Pigments shall be added to the outer gelcoat to obtain a matching colour to SABS 1091 "AVOCADO GREEN" colour C12 or "LIGHT STONE", colour C37.
- 5.3.4 Fibreglass kiosks shall not be painted.

6. SHEET STEEL CANOPIES

- 6.1 Where specified the canopy and doors shall be manufactured of either mild steel as 3Cr12 stainless steel to the following requirements:
- 6.1.1 A metal framework shall be manufactured from solid angle iron, channel iron or 2,5mm minimum folded sheet steel.
- 6.1.2 Joints shall be non-continuously butt welded. Welds shall be ground smooth and the joint wiped with plumber's metal in order to provide a smooth finish.
- 6.1.3 Side panels, doors and the roof shall be manufactured from 2 mm minimum sheet 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.
- 6.1.4 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.
- 6.1.5 All panels and doors shall be suitably braced and stiffened to ensure rigidity and to prevent warping.
- 6.1.6 The steel canopy and framework shall be fixed to the base frame by four M16 high tensile steel bolts.
- 6.2 Finish and Colour of Sheet Steel Kiosks

6.2.1 Metal components of the framework, panels and doors shall be painted in accordance with the Department's "STANDARD PAINTING SPECIFICATION", Section C39.

6.2.2 The colour shall be "AVOCADO GREEN", colour C12 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.

7. CAST IRON KIOSKS

7.1 Where specified the cubicle panels and doors shall be manufactured from cast iron to the following requirements :

7.1.1 A metal framework shall be manufactured from solid angle iron or channel iron.

7.1.2 Cast iron panels shall be bolted to the frame work and shall be replaceable with standard cast iron panels.

7.1.3 The panels shall be bolted to the frame from the inside of the cubicle. Bolts or nuts on the outside of the cubicle are not acceptable.

7.1.4 The roof of the cubicle shall be one casting and shall be bolted in position from inside the cubicle.

7.1.5 The minimum thickness of the cast iron panels and doors shall be 6 mm.

7.1.6 All cast iron panels and doors shall be fettled prior to painting.

7.2 Finish and Colour of Cast Iron Kiosk :

7.2.1 Metal components of the framework, panels and doors shall be painted in accordance with the Department's "STANDARD PAINTING SPECIFICATION", Section C39.

7.2.2 The colour shall be "AVOCADO GREEN", colour C12 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.

8. DOORS

8.1 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 700mm shall be provided with double doors.

8.2 Doors shall have well returning edges to fit into the channel of the door entry surrounds. Refer to par. 3.1 and 6.1.3.

8.3 Doors shall swivel through 135°.

8.4 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.

8.5 Doors shall be fitted with lever locks 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 lockable by padlocks. Padlocks will be provided by the Department.

- 8.6 The locking mechanism shall be made of brass or stainless steel.
- 8.7 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.
- 8.8 At least three hinges shall be supplied on steel doors higher than 1, 2 m.
- 8.9 Doors shall be fitted with neoprene or equivalent seals.
- 8.10 Metal doors shall be earth bonded to the frame by means of a copper braided strap, tooth washers, bolts and nuts.

9. EQUIPMENT SUPPORT FRAME

- 9.1 A free standing, angle iron or similar type rigid support framework shall be provided.
- 9.2 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.
- 9.3 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.
- 9.4 The gland plate shall be suitably punched to accept the number and size of cables specified.
- 9.5 All steelwork shall be hot-dip galvanised in accordance with SABS 763.
- 9.6 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.
- 9.7 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.

10. CONCRETE BASES AND BASE FRAMES

- 10.1 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 into the bottom of the cable trench.
- 10.2 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.
- 10.3 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.
- 10.4 The base frame shall protrude to a maximum height of 200mm 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.

- 10.5 The base frame shall be secured by at least four M16 bolts to the support frame of the kiosk and four M16 anchor bolts and nuts to the concrete base. The bolts, nuts and washers shall be galvanised and supplied with the kiosk.
- 10.6 All galvanising shall be to SABS 763.
- 10.7 The kiosk manufacturer shall supply a detailed drawing of the base frame and the concrete base required.
- 10.8 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 Department.

11. BUSBARS

See Section C15 for details.

12. WIRING

See Section 17.8 for details

13. MOUNTING OF EQUIPMENT

- 13.1 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 self locking nuts with washers. Self-tapping screws are not acceptable.
- 13.2 Equipment shall be arranged and grouped in a logical fashion.
- 13.3 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 6mm studs and hexagonal chromed brass dome nuts and washers or hank nuts fasteners. Self-tapping or similar screws are not acceptable.
- 13.4 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.

14. 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.

15. LABELLING

- 15.1 All equipment shall be fully labelled and accurate descriptions shall be given in both official languages.
- 15.2 Engraved brass shall be used for labels. The labels shall be riveted to the kiosks.
- 15.3 The following labels shall be supplied as a minimum requirement:
- 15.3.1 Number and allocation of kiosk, e.g. KIOSK B26
- (Lettering: At least 10mm high. Label on the outside in a prominent position).
- 15.3.2 Designation of circuit i.e. circuit-breaker, isolator, meter, etc. e.g.

HOUSE 473

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

- 15.3.3 The main switch shall be marked in accordance with the regulations.
- 15.3.4 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.
- 15.3.5 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.
- 15.3.6 All label designations shall be confirmed with the Department before manufactured.

16. NOTICES

At least one with the words "DANGER/INGOZI/GEVAAR" shall be mounted outside on the front of the kiosk. This notice shall be riveted to the steel or cast iron 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.

17. INSPECTION

The Department 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.

18. DRAWINGS

18.1 Drawings for Approval

- 18.1.1 A set of three prints of the shop drawings of the cubicles shall be submitted to the Department 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 method of fixing of busbars shall be shown.
 - (c) All labelling information in both the official languages 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.
- 18.1.2 The approval of drawing shall not relieve the Contractor of his responsibility to the Department to supply the cubicles according to the requirements of this Specification.

18.2 Final Drawings

A complete set of "as built" drawings of the cubicles shall be submitted to the Department within two weeks after delivery of the kiosks. The information contained in par.18.1.1 shall be provided.

18.3 Completion

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

SECTION C20

MOULDED-CASE CIRCUIT-BREAKERS

1. This section covers single or multi pole moulded case circuit breakers for use in power distribution systems, suitable for panel mounting, for ratings up to 1 000 A, 600 V, 50 Hz.
2. The circuit breakers shall comply with SABS 156.
3. The continuous current rating, trip rating and rupturing capacity shall be as specified.
4. The contacts shall be silver alloy and shall close with a high pressure wiping action.
5. Where specified, the circuit breaker shall be capable of accommodating factory fitted shunt trip or auxiliary contact units or similar equipment.
6. The operating handle shall provide clear indication of "ON", "OFF" and "TRIP" positions.
7. The mechanism shall be of the TRIP-FREE type preventing the unit from being held in the ON position under overload conditions.
8. All moulded case circuit breakers in a particular installation shall as far as is practical be supplied by a single manufacturer.
9. The incoming terminals of single pole miniature circuit breakers shall be suitable for connection to a common busbar.
10. The circuit breaker shall have a rating plate indicating the current rating, voltage rating and breaking capacity.
11. Extension type operating handles shall be provided for units of 600 A rating and above.

SECTION C23

DIRECT ACTING INDICATING INSTRUMENTS

This section covers direct acting indicating instruments suitable for flush mounting in switchboards or instrument panels.

1. GENERAL REQUIREMENTS

- 1.1 Instruments shall be suitably rated for the supply voltage and frequency to be applied, which shall be 400/230 V, 50 Hz unless specified to the contrary.
- 1.2 All the instruments used for a particular application or a specific project shall be from the range of a single reputable supplier and shall have the same face dimensions. The face dimensions shall be square and not less than 96 x 96 mm.
- 1.3 All instruments shall comply with BS 89 and/or IEC 51.
- 1.4 Instruments shall be screened against magnetic interference and shall have anti static, impact-resistant glass faces.
- 1.5 Preference will be given to locally manufactured instruments.
- 1.6 Instruments shall be insulated to achieve a 2 kV insulation resistance to earth.
- 1.7 All instruments shall be splash proof and dustproof unless more stringent requirements are specified for hazardous locations.
- 1.8 Instruments shall be sufficiently resistant to vibration that may be encountered in the specific application.
- 1.9 For normal environmental and supply conditions, instruments shall be suitable for use inside the limits specified in Tables III and VI of IEC 51.
- 1.10 All instruments shall be capable of withstanding overloads of continuous or short duration in accordance with section 8.3 of IEC 51.
- 1.11 Instruments shall be provided with studs for rear connection. Shrouds shall be provided to prevent accidental contact where instruments are to be installed in hinged panels of switchboards.

2. VOLTMETERS AND VOLTMETER SELECTOR SWITCHES

- 2.1 Unless specified to the contrary, voltmeters shall be scaled from 0 - 250V in the case of LV applications.
- 2.2 Voltmeters shall be of the moving iron type with class 1,5 accuracy as specified in IEC 51.
- 2.3 A zero adjustment screw shall be provided.
- 2.4 Unless specified to the contrary, a single voltmeter and selector switch shall be provided. The voltmeter switch shall have an "OFF" and three metering positions to indicate readings between neutral and each of the three phases.
- 2.5 The markings shall be indicated clearly on the face plate of the selector switch and the handle position shall be accurate in relation to the markings on the face plate.
- 2.6 The selector switch shall be of the cam-actuated or wiping air break type with two breaks per pole.

3. AMMETERS

- 3.1 Ammeters shall have a moving coil element to indicate instantaneous values.
- 3.2 Direct reading ammeters up to a maximum rating of 60 A may be used. Current transformer operated ammeters shall be 5 A full scale, calibrated to read actual primary circuit currents. The current transformer ratio shall be indicated on the face plate.
- 3.3 A zero adjustment screw shall be provided.
- 3.4 Where combined maximum demand and indicating ammeters are specified, a bimetallic spiral element shall be provided in the same housing to indicate mean value over a 15 minute period.
- 3.5 The bimetal element shall drive a residual pointer to indicate maximum mean current between resettings. This pointer shall operate on the main scale and shall be of a distinctive colour. The pointer shall be resettable from the face of the meter.
- 3.6 The bimetal element shall be designed to compensate for limits of ambient temperature between -20 C and 70 C.
- 3.7 Full load or rated current shall be clearly indicated, preferably with a red line. Unless specified to the contrary, a 100 % condensed over scale shall be provided for instantaneous reading instruments and no over scale for combined maximum demand ammeters.
- 3.8 The intrinsic error, expressed in terms of the fiducial value in accordance with IEC 51, shall be class 1,5 for the instantaneous readings and class 2,5 for the mean maxima.
- 3.9 Where saturation current transformers are required, these shall form an integral part of the meter. Separate saturation current transformers are unacceptable to the Department.

4. KILOWATT-HOUR METERS

- 4.1 Unless specified to the contrary, kilowatt-hour meters shall be suitable for operation on 220/250 V, 50 Hz systems.
- 4.2 Meter elements shall be of the inductor disc type and designed to carry the rated current continuously.
- 4.3 Kilowatt-hour meters shall comply with the relevant parts of BS 37 and BS 5685.
- 4.4 The integrating period on maximum demand meters shall be 30 minutes unless specified to the contrary.
- 4.5 The registering mechanism shall be of the cyclometer type, providing a six digit readout with the sixth digit indicating one-tenth of a unit.
- 4.6 Unless specified to the contrary, the meters shall conform to accuracy Class 1 as specified in IEC 51.
- 4.7 Kilowatt-hour meters shall be graded and calibrated for the specific application to avoid the application of multiplication factors where possible. Where multiplication factors are unavoidable this shall be clearly indicated in unit form and not as a combination of several factors. Current transformer ratios shall be incorporated in the factor.
- 4.8 The kilowatt-hour meter shall preferably be provided with a magnetic type of bearing for the disc spindle.

4. 9 Facilities for a security seal shall be provided on the fixing screws of the cover.

5. FREQUENCY METERS

5.1 Frequency meters may be of the vibrating reed type or the direct indicating type consisting of a moving coil milli-ammeter and a current/frequency transducer.

5.2 Unless specified to the contrary, the indicating range shall be 45 HZ - 55 Hz.

5.3 The accuracy class shall be class 0,5 in accordance with IEC 51 unless otherwise specified.

5.4 Where required an adjustable speed alarm contact shall be provided, adjustable over the complete scale length.

6. RUNNING HOUR-METERS

6.1 Running hour-meters shall be of the electrically operated cyclometer type, suitable for flush mounting.

6.2 Numerals shall be clearly defined white on a black background.

6.3 The range of hour-meters shall be five digits, the fifth digit indicating one-tenth of an hour, i.e. from 0 to 9999,9 hours.

6.4 The accuracy class shall be class 1 in accordance with IEC 51 unless otherwise specified.

SECTION C24

EARTH LEAKAGE RELAYS

1. Earth leakage relays shall be single or three-phase units with a sensitivity of 30mA, with associated circuit breaker or on-load switch for use on 220/250V single phase or 380/433 V three phase, 50 Hz, supplies.
2. The units shall be suitable for installation in switchboards in clip-in trays or bolted to the chassis.
3. The earth leakage relay shall function on the current balance principle and shall comply with SABS 767 as amended, and shall bear the SABS mark. Integral test facilities shall be incorporated in the unit.
4. 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.
5. 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.
6. The fault current rating of the unit shall be 2,5kA or 5kA as required, when tested in accordance with SABS 156.

SECTION C25

MICRO-GAP SWITCHES

1. Micro-gap switches shall be suitable for ratings up to 400 A at 660 V (triple pole) and may be used for main and distribution switches in domestic applications, offices, small factories and similar applications.
2. Double pole switches shall be suitable for voltages up to 230V \pm 10%.
3. The switches shall comply with SABS 152.
4. Micro-gap switches may be used on AC circuits only.
5. Metal clad and moulded casings are acceptable.
6. Micro-gap switches shall be capable of carrying rated current continuously and making and breaking rated current.
7. Heavy, fully accessible, brass terminals with two screws each shall be provided to facilitate easy wiring. Contacts shall have large contact surfaces, made from high quality material such as solid silver.
8. The "ON" and "OFF" positions and the rating of the switch shall be clearly and indelibly marked.

SECTION C26

CURRENT TRANSFORMERS

1. GENERAL

Current transformers shall comply with the requirements of BS 3938 and IEC 185 with the exception of the required impulse test level, par.6 below.

2. RATINGS

- 2.1 Current transformers shall be suitable for the primary currents listed hereunder and their decimal multiples:

10, 12.5, 15, 20, 25, 30, 40, 50, 60 and 75.

The preferred values are:

10, 15, 20, 30, 50 and 75.

- 2.2 Current transformers shall have secondary ratings of 1, 2 and 5A, with 5A being preferred.

- 2.3 Current transformers shall have standard outputs of 2, 5, 5, 10, 15 or 30 VA as applicable in terms of the burden of the instruments and interconnecting wiring. The current transformer output shall match the actual instrument burden as closely as possible in order not to introduce unnecessary errors.

3. ACCURACY CLASS

- 3.1 For metering applications, accuracy classes of 0.1, 0.2, 0.5, 1, 3 or 5 are applicable. Where no accuracy class has been specified, the following table may be used as a guide:

Application	Primary Current	Suggested Class
Indicating Instruments	All	5
Metering Applications	Up to 200 A	1
Metering Applications	250 to 600 A	0.5
Metering Applications	800 A and above	0.2

- 3.2 Where ring type current transformers are specified, the aperture shall not be unnecessarily large as accuracy is thereby reduced.

- 3.3 The classes for protection are 5P, 10P, 15P, 20P or 30P with 5P and 10P being standard. Turns compensation shall not be employed on protection current transformers for ratios greater than 150/5.

- 3.4 Class X current transformers shall be used in differential protection systems.

- 3.5 Manufacturers shall supply the magnetisation curve details and saturation factors for each different transformer ratio.

4. MARKINGS

All current transformers shall come complete with a label on which the following information is indelibly stamped:

Manufacturer.

Serial No. or Type.

Rated primary and secondary current.

Rated frequency.

Rated output and accuracy class.

Highest system voltage.

Rated insulation level.

5. FAULT CURRENT

Current transformers shall be capable of withstanding the dynamic forces resulting from the maximum through-fault current which may be encountered at the point where they are installed. The short time current rating of current transformers shall be at least equal to that of the associated circuit breaker.

6. IMPULSE LEVEL

Current transformers used in system voltages in excess of 660 V shall withstand an impulse test level of 95 kV. Impulse levels for current transformers used in system voltages up to 660 V shall comply with BS 3938.

7. TESTS

7.1 One protection current transformer of each type used in a contract shall be tested to confirm the estimated characteristics. The following results shall be submitted:

- (a) Magnetisation Curve
- (b) Secondary resistance
- (c) Secondary leakage reactance, if not negligible or if required by the Department.

7.2 The power frequency, secondary to earth and over voltage inter-turn tests in accordance with BS 3938 shall be conducted on all current transformers. Impulse tests shall be conducted on all current transformers intended for use in system voltages in excess of 660 V.

SECTION C28

TRIPLE POLE ON-LOAD ISOLATORS

1. 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.
2. The switches shall be of the triple pole, hand operated type complying with SABS 152.
3. The switches shall have a high speed closing and opening feature.
4. 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.
5. 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".

SECTION C30

TIME SWITCHES

1. Time switches shall be of single-pole type, suitable for 220/250 V systems, with contacts rated for the duty to be performed with a minimum rating of 15A. Contacts shall be of high quality material, e.g. silver-plated or solid silver.
2. The clock shall be driven by a self-starting, hysteresis synchronous motor, keeping accurate mains time. All clocks shall be controlled by an electrically wound escapement providing the main spring with a minimum of 15 hours reserve in case of a power failure. The main spring shall be kept fully wound without the use of slipping clutch devices that may wear and fall out of adjustment.
3. The main spring shall have a minimum of 15 hours reserve under full load and if fully discharged, shall be completely rewound within 15 minutes of the restoration of power.
4. An external manual bypass switch shall be provided to permit the circuit to be switched "ON" or "OFF" manually without affecting the operation of the time switch.
5. The time switch shall have a 24 hour dial, with day and night indication, that can be set to switch in 30 minute steps. The dial shall be fitted with 48 tappets corresponding to 48 change-over operations in a 24 hour period.
6. The time switch shall be fitted with a day omission dial comprising a total of 14 tappets which can be set to switch in 12 hour steps.
7. The time switch shall be housed in a dust-tight moulded plastic or metal case, consisting of a plastic clip-on front cover and a moulded plastic or metal base. Time switches to be used for surface mounting on walls shall be provided with a suitably positioned 20mm conduit knock-out.

SECTION C31

CONTACTORS

1. Contactors shall be of the open or totally enclosed, triple- or double-pole, electromechanically operated, air-break type suitable for 380/433 V or 220/250 V supplies and shall comply with SABS 1092.
2. Contactors shall have the following characteristics:
 - (a) Enclosed coil easily replaceable.
 - (b) A permanent air gap in the magnetic circuit to prevent sticky operation.
 - (c) Provision for quick and simple inspection of contacts.
 - (d) Clearly marked main and auxiliary terminals.
3. All parts shall be accessible from the front.
4. Contactors which are not located in switchboards shall be housed in enclosures which comply with IP 54 of IEC 144.
5. The current rating of the contactor shall be as specified for the circuit with a switching duty in accordance with the SABS 1092 or IEC 158-1, utilisation category AC1 for lighting and power circuits and utilisation category AC3 for motor starting.
6. In addition to the required current carrying capacity and switching duty of a contactor, the contactor chosen for a particular application shall be rated for the maximum through fault current allowed by the back-up protection devices at the point where the contactor is installed. Careful co-ordination of short circuit devices shall take place.
7. All laminations of the magnetic system of the contactor shall be tightly clamped. Noisy contactors will not be accepted.
8. Non-current-carrying metallic parts shall be solidly interconnected and a common screwed earth terminal shall be provided. The contactor shall be earthed to the switchboard earth bar.
9. Latched contactors shall be provided with a trip coil and a closing coil. The contactor shall remain closed after de-energising the closing coil and shall only trip on energising the trip coil.
10. Contactor operating coils shall have a voltage rating as required by the control circuitry and shall have limits of operation and temperature rise as specified in Clause 7.5 and Table IV of IEC 158-1. Latched contactors shall be capable of being tripped at 50 % of the rated coil voltage.
11. Contactors for normal/standby changeover circuits shall be electrically and mechanically interlocked. Contactors in star-delta starters shall be electrically interlocked.
12. Contactors with provision to add auxiliary contacts and convert auxiliary contacts on site are preferred. Contactors with permanently fixed auxiliary contacts shall have at least 1 x N/O and 1 x N/C spare auxiliary contacts in addition to the contacts specified for control purposes and in addition to contacts required for self-holding operations or economy resistances. Where the number of auxiliary contacts required is greater than the number of contacts that can be accommodated on the contactor, an auxiliary relay or additional contactor shall be provided to supply the additional contacts.
13. It shall be possible to replace main contacts without disconnecting wiring.

14. Auxiliary contacts shall be capable of making, carrying continuously and breaking 6A at 230V AC, unity power factor for contactors used on 380-433/220-250 V systems.
15. Auxiliary contact functions required e.g. "lazy" contacts, late-make, late-break, make-before-break, etc. shall be inherent in the contact design. Under no circumstances may these functions be improvised by bending contacts, loading contacts, etc. These functions shall be available in all contactors.
16. Spare auxiliary contacts shall be wired to numbered terminal strips in the switchboard and shall appear on the switchboard drawings.
17. All contactors on a specific project shall be from a standard range of one single manufacturer, unless specified to the contrary.

SECTION C33

INDOOR SURGE ARRESTORS

1. Surge arrestors shall comply with the requirements of SABS 171 or VDE 0675.
2. Surge arrestors shall be suitable for installation at altitudes of up to 1800m above sea level.
3. The unit shall be contained within a thermoplastic or cast resin housing and all internal components shall be fully sealed in.
4. The unit shall be supplied complete with a galvanised steel mounting bracket for convenient mounting onto the metalwork or tray of a switchboard.
5. Alternatively, the unit shall be of the type which can be mounted into the clip-tray of a switchboard.
6. Surge arrestors shall be provided in all cases where a switchboard is supplied directly from an overhead line.
7. In other cases, surge arrestors, if required, will be specified in the Detail Technical Specification.

SECTION C39

STANDARD PAINT SPECIFICATION

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, electrostatically applied powder coating or similar proven methods shall be used.

2. CORROSION RESISTANCE

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

3. EDGES

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

4. SURFACE PREPARATION

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

5. BAKED ENAMEL FINISH

- 5.1 Immediately after cleaning all surfaces shall be covered by a rust inhibiting, tough, unbroken metal-phosphate film and then thoroughly dried.
- 5.2 Within forty eight (48) hours after phosphatising, 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.
- 5.3 The enamel finish on metal luminaire components shall comply with SABS 783, Type III.
- 5.4 Other metal parts e.g. switchboard panels, etc., shall comply with SABS 783, Type IV with a minimum paint thickness after painting of 0,06mm. In coastal areas, the dry film thickness shall be increased to at least 0,1mm.
- 5.5 The paint shall have an impact resistance of 5,65 J on cold-rolled steel plate and a scratch resistance of 2 kg.

6. POWDER COATED FINISH (NOT TO BE USED LESS THAN 50km FROM SEASIDE)

- 6.1 Immediately after cleaning the metal parts shall be pre-heated and then covered by a microstructure paint powder applied electrostatically.
- 6.2 The paint shall be baked on and shall harden within 10 minutes at a temperature of 190 C.
- 6.3 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 a scratch resistance of 2kg.

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.

8. COLOURS

- 8.1 The colour of HV switchboards and HV switchgear enclosures shall be "DARK ADMIRALTY GREY", colour G12 of SABS 1091.
- 8.2 The colour of LV switchboards and equipment enclosures in buildings shall be "LIGHT ORANGE", colour B26 of SABS 1091 as recommended in SABS 0140, Part II unless specified to the contrary.
- 8.3 The colour of LV distribution kiosks and miniature substations shall be "AVOCADO GREEN", colour C17 or "LIGHT STONE", colour C37 of SABS 1091.
- 8.4 The standby power section of LV switchboards in buildings shall be coloured "SIGNAL RED", colour A11 of SABS 1091.
- 8.5 Switchboards for No-Break Power Supplies or sections of switchboards containing No-break power supplies, shall be coloured "DARK VIOLET", colour FO6 or "OLIVE GREEN", colour HO5 of SABS 1091.**

VRYHEID MAGISTATE COURT ELECTRICAL INSTALLATION

1. RETURNABLE SCHEDULES

ITEM 1: ELECTRICAL WORK - MATERIAL SCHEDULE

The contractor shall complete the following schedules and submit them with his tender.

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.

NB: **Only one manufacturer's name to be inserted for each item.**

[illegible]

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: _____

2. TENDERER DETAILS

2.1. SCHEDULE OF HISTORY AND EXPERIENCE OF TENDERER

ITEM	PARTICULARS	INFORMATION FROM TENDERER
1	Company Details:	
	Name:	
	Address:	
	Type of Company:	
	Directors/Owners:	
	Established:	
	Staff Skilled	
	Staff Labour:	
	Staff Professional:	
	Bank:	
	Bank Manager:	
	Bank Manager Phone No:	
	Credit Rating:	
2	Experience with this type of work over the last 12 months:	
	Fire contracts: and size:	
	Security contracts and size:	
	Current contracts and their value:	
3	List of contracts completed and reference contact person	
	1	
	2	
	4	
	5	
	6	
4	List of experienced skilled personnel proposed for this contract:	
	1 Name and phone No	
	2 Name and phone No	
	3 Name and phone No	

SUB-CONTRACTOR

DATE:

2.2. MAJOR RATES FOR COSTING VARIATIONS

The following rates may be applicable for costing alterations by the issue of revised drawings and instructions

1. Labour Rates

Day work rates (including profit, overheads, design and drawing office time, etc)

Artisan and two assistants : R...../h

Labourer : R...../h

Multiplier factor for: weekend rates
night rates

2. Vehicle Rates

i) Mileage rate for vehicles not exceeding 1 tonne capacity R...../km

ii) Mileage rate for vehicles exceeding 1 tonne capacity
R...../km

The above are to include all profit, overheads etc. but excluding VAT

3. Bought-Out Items (including all costs and profit etc)

Nett cost plus% (excl. VAT)

SUB-CONTRACTOR

DATE:

SCOPE OF WORK FOR AIRCON

- 1.1 This work to be carried out under this contract includes the supply, delivery, installation, connecting, testing, energizing and leaving in service condition to the satisfaction of the National Department of Public Works & Infrastructure, the installation of air conditioner at Vryheid DOJ
- 1.2 The air-conditioning units that are supplied must be SABS approved and new, delivered to site in its original packaging. The size of units and the area of installation are listed and will be communicated by the PM.
- 1.3 The units must be "off the shelf" items and readily available in stores. Only make with proven maintenance backup will be acceptable. All units tendered will be for heating & cooling. The units must be of the highest quality. The units must be treated against rust corrosion.
- 1.4 The installation of the units must be done strictly according to the manufacturer's instructions.
- 1.5 The distance between the blower unit and the condensing unit may not be more than 20m apart. Drain outlet to the nearest gulley.
- 1.6 All types of air-conditioning units must offer the following functions:
 - Remotely operated
 - Auto-swing function
 - 24hr on/off timer
 - Air purifying filters
 - Washable front grill
 - Selectable memory auto-start
 - Engineering plastic cabinet
- 1.7 Each air conditioning unit must be electrically connected, separately from the nearest distribution board. The wiring must be rated as per the kw/amps of the aircon unit and in a conduit. This air conditioner must be wired with an isolator and a breaker from the nearest Distribution Board.

PRELIMINARIES
&
BILLS OF QUANTITIES

BILL NO. 1 PRELIMINARY AND GENERAL					
	NOTES	UNIT	QUANTITY	RATE	AMOUNT
i)	The agreement is to be the General Conditions of Contract for Works of Civil Engineering Construction (2010) (Second Edition) , published by the S. A. Institution Of Civil Engineering.				
ii)	The Preliminaries are to be the Construction and management requirements for works contracts - Part 1: General engineering and construction works (SANS 1921-1: 2004 Edition 1) prepared by Standards South Africa and shall be deemed to be incorporated herein.				
iii)	Tenderers are referred to the abovementioned documents for the full intent and meaning of each clause thereof (hereinafter referred to by heading and clause number only) for which such allowance must be made as may be considered necessary.				
iv)	Where standard clauses or alternatives are not entirely applicable to this contract such modifications, corrections or supplements as will apply are given under each relevant clause heading.				
v)	Where any item is not relevant to this specific contract such item is marked N/A (signifying "not applicable").				
vi)	Adjustment of the preliminaries: each item priced, is to be allocated to one or more of the three categories, where "F" denotes a fixed amount (amount not to be varied), "V" denotes an amount variable in proportion to value and "T" denotes an amount in proportion to time.				
vii)	Time (T) related Preliminaries will only be adjusted for omissions or additions, issued by the Employer, or delays caused by the Employer, for which variation and extension of time has been granted. See Contract Data .				
	SECTION A: GENERAL CONDITIONS OF CONTRACT				
A1	General (clause 1) F:..... V:..... T:.....	Item			
A2	Basis of Contract (clause 2) F:..... V:..... T:.....	Item			
A3	Engineer (clause 3) F:..... V:..... T:.....	Item			
A4	Contractor's General Obligation (clause 4) F:..... V:..... T:.....	Item			
A5	Time and Related Matters (clause 5) - As referred to in the Contract Data under Special Condition of Contract. The Contract Period shall be deemed to include all Non – Working Days, Special Non – Working Days and the year-end Builders Annual Industry Holiday Periods. F:..... V:..... T:.....	Item			
	Carried forward to collection			R	

		UNIT	QUANTITY	RATE	AMOUNT
A6	Payment and Related Matters (clause 6) F:..... V:..... T:.....	Item			
A7	Quality and Related Matters (clause 7) F:..... V:..... T:.....	Item			
A8	Risk and Related Matters (clause 8) F:..... V:..... T:.....	Item			
A9	Termination of Contract (clause 9) F:..... V:..... T:.....	Item			
A10	Claims and Disputes (clause 10) F:..... V:..... T:.....	Item			
SECTION B: SANS 1921-1:2004 (Edition 1): CONSTRUCTION AND MANAGEMENT REQUIREMENTS FOR WORKS CONTRACTS: PART 1					
Refer to the SCOPE OF WORK for detail requirements:					
B1	Scope F:..... V:..... T:.....	Item			
B2	Normative references F:..... V:..... T:.....	Item			
B3	Definitions F:..... V:..... T:.....	Item			
B4	Requirements for construction and management F:..... V:..... T:.....	Item			
B4.1	General F:..... V:..... T:.....	Item			
B4.2	Responsibilities for design and construction F:..... V:..... T:.....	Item			
B4.3	Planning, programme and method statements F:..... V:..... T:.....	Item			
Carried forward to collection				R	

		UNIT	QUANTITY	RATE	AMOUNT
B4.4	Quality assurance F:..... V:..... T:.....	Item			
B4.5	Setting out F:..... V:..... T:.....	Item			
B4.6	Management and disposal of water F:..... V:..... T:.....	Item			
B4.7	Blasting F:..... V:..... T:.....	Item			
B4.8	Works adjacent to services and structures F:..... V:..... T:.....	Item			
B4.9	Management of the Works and site F:..... V:..... T:.....	Item			
B4.10	Earthworks F:..... V:..... T:.....	Item			
B4.11	Testing F:..... V:..... T:.....	Item			
B4.12	Materials, samples and fabrication drawings F:..... V:..... T:.....	Item			
B4.13	Equipment F:..... V:..... T:.....	Item			
B4.14	Site establishment F:..... V:..... T:.....	Item			
B4.15	Survey control F:..... V:..... T:.....	Item			
B4.16	Temporary works F:..... V:..... T:.....	Item			
	Carried forward to collection			R	

		UNIT	QUANTITY	RATE	AMOUNT
B4.17	Existing services F:..... V:..... T:.....	Item			
B4.18	Health and safety F:..... V:..... T:.....	Item			
B4.19	Environmental requirements F:..... V:..... T:.....	Item			
B4.20	Alterations, additions, extensions and modifications to existing works F:..... V:..... T:.....	Item			
B4.21	Inspection of adjoining structures, services, buildings and property F:..... V:..... T:.....	Item			
B4.22	Attendance on nominated and selected subcontractors F:..... V:..... T:.....	Item			
	SECTION C: SCOPE OF WORK in accordance with SANS 10403 <i>(The reference to Clauses refer to Table B.1 of SANS 1921-1:2004)</i>				
C1	Certification by recognised bodies - CLAUSE 4.4 F:..... V:..... T:.....	Item			
C2	Agreement certificates - CLAUSE 4.5 F:..... V:..... T:.....	N/A			
C3	Other services and facilities - CLAUSE 4.8 F:..... V:..... T:.....	Item			
C4	Recording of weather - CLAUSE 5.2 F:..... V:..... T:.....	Item			
C5	Management meetings - CLAUSE 5.3 F:..... V:..... T:.....	Item			
C6	Daily records CLAUSE 5.6 F:..... V:..... T:.....	Item			
C7	Bond and guarantees - CLAUSE 5.7 F:..... V:..... T:.....	Item			
	Carried forward to collection			R	

		UNIT	QUANTITY	RATE	AMOUNT
C8	Permits - CLAUSE 5.9 F:..... V:..... T:.....	Item			
C9	Proof of compliance with the law - CLAUSE 5.10 F:..... V:..... T:.....	Item			
SECTION D: SPECIFICATION DATA ASSOCIATED WITH SANS 1921-1:2004 (Table A.1)					
D1	Requirements for drawings, information and calculations for which the contractor is responsible CLAUSE 4.1.7 F:..... V:..... T:.....	Item			
D2	The responsibility strategy assigned to the contractor for the works CLAUSE 4.2.1 F:..... V:..... T:.....	Item			
D3	The planning, programme and method statements - CLAUSE 4.3 F:..... V:..... T:.....	Item			
D4	Samples of materials, workmanship and finishes - CLAUSE 4.12.1 F:..... V:..... T:.....	Item			
D5	Fabrication drawings that the contractor is to provide and deliver to the employer - CLAUSE 4.12.2 F:..... V:..... T:.....	Item			
D6	Office for the foreman CLAUSE 4.14.3 F:..... V:..... T:.....	Item			
D7	Telephone - CLAUSE 4.14.3 F:..... V:..... T:.....	Item			
D8	Office for inspector of works - CLAUSE 4.14.3 F:..... V:..... T:.....	Item			
D9	Telephone in office for inspector of works - CLAUSE 4.14.3 F:..... V:..... T:.....	Item			
D10	Sheds - CLAUSE 4.14.3 F:..... V:..... T:.....	Item			
Carried forward to collection				R	

		UNIT	QUANTITY	RATE	AMOUNT
D11	Provision and erection of signboards - CLAUSE 4.14.6 F:..... V:..... T:.....	Item			
D12	Termination, diversion or maintenance of existing services - CLAUSE 4.17.1 F:..... V:..... T:.....	Item			
D13	Services which are known to exist - CLAUSE 4.17.3 F:..... V:..... T:.....	Item			
D14	Detection apparatus - CLAUSE 4.17.4 F:..... V:..... T:.....	Item			
D15	Additional health and safety requirements - CLAUSE 4.18 F:..... V:..... T:.....	Item			
	SECTION E: SPECIFIC PRELIMINARIES <u>Section E contains Specific Preliminary Items which apply to this contract except where "N/A" (Not Applicable) appears against the item.</u>				
E1	PROPRIETARY BRANDED PRODUCTS The contractor shall take delivery of, handle, store, use apply and/or fix all proprietary branded products in strict accordance with the manufacturers' instruction after consultation with the manufacturer's authorised representative. F:..... V:..... T:.....	Item			
E2	OVERTIME Should overtime be required to be worked for any reason whatsoever, the costs of such overtime are to be borne by the Contractor unless the Engineer/Principal Agent has specifically authorised in writing, prior to the execution thereof, that costs for such overtime are to be borne by the Employer. F:..... V:..... T:.....	Item			
E3	AS BUILT DRAWINGS The position of construction breaks and the extent of individual concrete pours are to be recorded by the Contractor on the Structural Engineer's drawings and are to be submitted to the Engineer/Principal Agent and the Structural Engineer for their records. F:..... V:..... T:.....	Item			
	Carried forward to collection			R	

SECTION E: SPECIFIC PRELIMINARIES		UNIT	QUANTITY	RATE	AMOUNT
E4	SITE INSTRUCTIONS Site Instructions issued on site are to be recorded in triplicate in a Site Instruction book which is to be maintained on site by the Contractor. F:..... V:..... T:.....	Item			
E5	LABOUR RECORD At the end of each week the Contractor shall provide the Engineer/Principal Agent with a written record, in schedule form, reflecting the number and description of tradesmen and labourers employed by him and all sub-contractors on the works each day. F:..... V:..... T:..... <i>Note: In the event that the contractor fails to satisfy the requirements of this specification, the Employer (Head: Public Works) may apply any of the sanctions provided in the contract. Sanctions may include the application of a financial penalty of .04% of the Contract Sum per calendar day of which the required report has not been submitted.</i>	Item			
E6	PLANT RECORD At the end of each week the Contractor shall provide the Engineer/Principal Agent with a written record, in schedule form, reflecting the number, type and capacity of all plant, excluding hand tools, currently used on the works. F:..... V:..... T:.....	Item			
E7	NON CESSION OF MONIES The Contractor shall not cede nor assign his rights or claims to any monies due or to become due under this contract. F:..... V:..... T:.....	Item			
E8	SECTIONAL COMPLETION When it is required that the contract be executed in sections or portions, the tenderer shall allow for all costs in this regard as no claim for additional costs will be entertained. F:..... V:..... T:.....	Item			
E9	LOCAL LABOUR It is a general requirement of this contract that persons normally resident in the locality of the works (Local Labour) be given preference for employment on the contract. Provided, however, that should adequate and appropriate Labour not be available within the locality, others may be employed subject to satisfactory proof being provided that every reasonable endeavour has been made to employ Local Labour. The Contractor shall identify the local community leaders with the purpose of negotiating with them regarding the utilization of Local Labour in the construction process. In this regard, the Contractor shall furthermore give preference, wherever possible to the employment of single heads of households, women and youth. The Contractor shall, in general, maximize the involvement of the local community. F:..... V:..... T:.....	Item			
Carried forward to collection				R	

		UNIT	QUANTITY	RATE	AMOUNT
E10	IMPORT PERMITS AND DUTIES <p>The responsibility for obtaining the necessary import permits shall rest with the successful Tenderer. No foreign exchange will be arranged or provided by the Administration.</p> <p>Tenderers are to allow in their tenders and pay the ordinary levy imposed on imported items in terms of item 196.10 of Part 8 of Schedule No. 1 of the Customs and Excise Act, 1984 with effect from 1 October 1989.</p> <p>F:..... V:..... T:.....</p>	Item			
E11	CONTRACT PRICE ADJUSTMENT PROVISIONS (CPAP) <p>Notwithstanding anything to the contrary contained in the GCC for Construction Works 2010 2nd Edition, this Contract shall only when the Construction Period exceeds 6 months and the Contract sum exceeds R1,000,000,00 be subject to the Contract Price Adjustment Provisions Indices Application Manual for use with P0151 indices (CPAP) (Revised 1 January 2013) as published by Statistics South Africa. Tenderers are advised that with reference to Clause 3.4.6 of the Contract Price Adjustment Provisions (CPAP) Indices Applications Manual, the Head: Public Works <u>will not accept the submission by Tenderers of lists of additional items.</u></p> <p>Where this contract is a Lump Sum contract, the contract will be subject to Contract Price Adjustment Provisions (CPAP) only where the contract period equals or exceeds 6 calendar months. The applicable work group shall be WG 180 for domestic buildings or WG 181 for commercial and industrial buildings.</p> <p>F:..... V:..... T:.....</p>	Item			
E12	EPWP CONDITIONS AND SPECIFICATIONS 12.1 EMPLOYMENT TARGETS E12.1 a Employment Targets <p>The contractor needs to provide a realistic estimate on the number of jobs that the project has the potential to create throughout the project duration as the project will be implemented using labour intensive construction methods on elements where it is economical and feasible for this construction method.</p> <p>No of jobs to be created = [Contractor to fill in an estimated number] F:..... V:..... T:.....</p> E12.1 b Employment requirements <p>Tenderers are advised that this contract will be subject to the Expanded Public Works Program (EPWP) aimed at alleviating and reducing unemployment.</p> <p>Tenderers must allow for any costs for the employment of unskilled labour as per the requirements of the EPWP program;</p> <ol style="list-style-type: none"> 1. 55% of unskilled labour to be women 2. 55% of unskilled labour to be youth aged between 18 and 35 years 3. 2% of unskilled labour to be people living with disability 4. 100% Unskilled labour utilised must reside within the boundaries of the Municipality Ward where this contract is executed, with preference to the local community closest or at the walking distance to the contract site. Wherever possible local skilled tradesmen are to be employed on this contract with the view to maximize utilization of local resources. <p>F:..... V:..... T:.....</p>	Item			
	Carried forward to collection			R	

	UNIT	QUANTITY	RATE	AMOUNT
<p>E12.1 c Labour rate and payment intervals</p> <p>The contractor should ensure that labour rate paid to unskilled local labour is commensurate to the daily task. When determining the rate, consideration should be given to that EPWP beneficiaries are mostly bread winners in their families, as the program intends alleviating poverty. There should also be consideration that the labour rate promotes creation of expanded number of jobs created and person days of work.</p> <p>Contractors should make endeavours to ensure that labourers, particularly unskilled are remunerated on fortnight basis and prior notification be made should there be a shortfall on their wages.</p> <p>The labour rate for local unskilled shall also be determined in consideration of the location of the project, i.e. for projects implemented in urbanized municipalities will not be the same as that for rural municipalities.</p> <p>F:..... V:..... T:.....</p>	Item			
<p>12.2 LABOUR INTENSIVE CONSTRUCTION METHOD</p> <p>E12.2 a Labour Intensive Construction (LIC) method</p> <p>On site there must a person(s) having competency in managing and implementing LIC methods.</p> <p>*Foreman @ NQF Level 4 the Unit Standard on Implementing LIC methods on site.</p> <p>*Site Agent/ Managers @ NQF level 5 the Unit Standard on Manage Labour-Intensive Skills Programme both must be CETA accredited</p> <p>F:..... V:..... T:.....</p>	Item			
<p>E12.2 b Labour Intensive Construction Method</p> <p>Those parts of the contract to be constructed using Labour Intensive methods will be marked in the BoQ with letter LI (indicating Labour Intensive) against every item so designated. Such works will only be constructed using method so indicated.</p> <p>Reference to be made to Guidelines for the implementation of Labour Intensive Infrastructure projects under EPWP. "Scope of Work in Respect of Work Relating to the Expanded Public Works Programme (EPWP)"</p> <p>F:..... V:..... T:.....</p>	Item			
<p>E12.3 RECORD KEEPING</p> <p>12.3.1 Every employer must keep in the project site office the following minutes of site progress minutes; contractors' monthly site progress reports; accurately recorded attendance register; proof of payment as means to verify authenticity of data in the EPWP Beneficiary form submitted with payment certificates. Copies of submitted EPWP beneficiary data forms should also be kept in the site office.</p> <p>F:..... V:..... T:.....</p>	Item			
<p>12.3.2 The employer must keep this record for a period of at least three (3) years after the completion of the project in his/her office as the project site office would have been relocated.</p> <p>This should be safely kept for job creation data verifications and periodical audits on projects conducted by National and Provincial Department of Public Works after one (1) or two (2) quarters of submitting captured EPWP Data to the National EPWP coordinating Department.</p> <p>F:..... V:..... T:.....</p>	Item			
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	UNIT	QUANTITY	RATE	AMOUNT
<p>E12.4 EPWP REPORTING as per EPWP DATA FORM</p> <p>At the end of each month as part of site progress report and to be attached to every contractors' progress payment certificate; the contractor shall provide the principal agent & Public Works with a written records, as per EPWP data form; which will be reflecting, beneficiaries full name & surname; ID No and job description of labour employed by main contractor and sub-contractors on site. At the end of each month the contractor must submit the following documents to be attached to the Progress payment certificate:</p> <ol style="list-style-type: none"> 1. EPWP monthly data collection form 2. Worker monthly payment upload 3. Worker monthly proof of payment i.e <ol style="list-style-type: none"> 3.1 Acknowledgement of receipt of payment or 3.2 Payslips 3.3 Bank statement highlighted the workers paid 4. Worker monthly training form 5. Monthly attendance register 6. Certified copies of ID's (once off) 7. ID size photos (once off) 8. Proof of UIF 9. Proof of COIDA <p>F:..... V:..... T:.....</p> <p>E12.5 EPWP PROMOTION</p> <p>12.5.1 EPWP signage board</p> <p>EPWP Program at the project level shall always be promoted through have the projects signage board that embrace EPWP logo at the bottom, correct measurement for this signage board will be provided by the project leader during the site handing over meeting. the standard "HELVETICA MEDIUM " letters are to be used . Professional title to be 10 mm above line . Line thickness to be 8 mm thick . Space between bottom of the line and bottom of the lettering below the line has to be 100 mm. Letter sizes are as follows : Helvetica medium 100 mm black upper case to be for project name and owner . Helvetica medium 75mm black upper case only to be used for professional titles. Project name and owner shall be black lettering on white background. board sizes are as follows : Board to be minimum 2000mm from ground level and to be constructed from reinforced formed chromadek panels minimum 0,6mm thick chromadek. The contractor is responsible for ensuring that the project board remains neatly and safely erected for the full duration including maintenance period, after which the project board and post are to be dismantled and handed to the client in good order.</p> <p>F:..... V:..... T:.....</p> <p>12.5.2 Branding of labour apparel</p> <p>Contractor & Sub-contractors' labourers shall be provided with EPWP branded Personal Protective Equipment (PPE), reflector vest with EPWP wording at the back is an ideal and cost effective means of promoting program on site.</p> <p>The contractor is then advised to price for both item 17.5.1 and 17.5.2</p> <p>F:..... V:..... T:.....</p>	Item			
	Item			
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<p>E12.6 COMMUNITY LIAISON OFFICER (CLO) UTILISATION OF A COMMUNITY LIAISON OFFICER In addition to the requirements of Clause E9, contained in this document; The Contractor shall allow for and pay any and all costs necessary for the engagement of the services of a Community Liaison Officer (CLO) for the full duration of this contract In the interest of providing a sound service to both the community and the Contractor, a CLO may only manage one project at a given time. A CLO will be identified by the local structures of the ward areas and appointed following fair and transparent interviewing process, to be conducted in the presence of local structures and the contractor representative, in order to assist the Contractor in the procurement of any local labour, etc. required for this project. The Contractor is to liaise with the CLO and afford him any assistance needed in ensuring sound working relations with the local community.</p> <p>Key Responsibilities of the CLO are envisaged to include and not necessary be limited to: 1. Assisting local leadership in conducting skills and resources audit which facilitates sourcing labour from within the ward or targeted areas for employment, as required by contractor. 2. Assisting in sourcing labour-only domestic sub-contractors and the procurement of materials from local resources, as required by the contractor. 3. Assisting the contractor by identifying areas of potential conflict and or threats to the project or to stakeholders in the project and recommend appropriate action to the contractor. 4. Assisting contractor and stakeholders in the project in the resolution of any conflict which may arise. 5. Establishing and ensuring that sufficient and open communication channels between the contractor and the work force are maintained. 6. Establish and ensuring that efficient and open communication channels between the contractor and the community are maintained 7. Identifying and reporting to the Contractor regarding issues where communication between stakeholder is necessary, recommend courses of action and facilitate such communications</p>				
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	UNIT	QUANTITY	RATE	AMOUNT
<p>8. Assisting the Contractor and the work force in the establishment of grievance procedures and necessary recommendation to the Contractor regarding the grievances and solution thereto.</p> <p>9. Attending to site meetings and project implementation meetings as required by the Contractor and prepare periodic reports as may be required by the Contractor from time to time.</p> <p>10. Attending to such other duties which are consistent with the functions of a CLO, as may be required by the Contractor from time to time.</p> <p>Tenderers are to price twice the rate of unskilled local labour rate against this item for any and all costs arising out of compliance with the foregoing and in the event of a Tenderer failing to price against this item or making inadequate financial provision against this item for compliance as aforesaid, then no claim for costs or additional cost incurred will be entertained by the Head: Works</p> <p>F:..... V:..... T:.....</p> <p>E12.7 SKILLS DEVELOPMENT ON SITE</p> <p>Contractor in conforming to the object of EPWP that its beneficiaries need to be capacitated with skills that will render them employable in the future. It is then the responsibility of the Contractor that mandatory life skills are provided to 100% of workforce on site and on the job training to labourers from whom the potential for further development has been identified. The latter is not mandatory to all as it covers technical skills.</p> <p>Contractor should also make provision for the possibility that there might be local youth that will need to be placed on the project with an intention to be provided support towards improving their level of competency and productivity.</p> <p>Contractor shall also provide all necessary on-the-job training to targeted labour to enable such labour to master and advance on techniques required to undertake the work in accordance with requirements of the contract in a manner that does not compromise workers health and safety.</p> <p>F:..... V:..... T:.....</p> <p>E12.8 LABOUR ONLY Sub Contracting for local emerging enterprises</p> <p>Tenderer's are advised that this contract is subject to the Expanded Public Works Programme (EPWP) and the following criteria will apply:</p> <p><u>African Equity Ownership</u></p> <p>a) The Tenderer is to allow for 5% of the total value of works to be undertaken by a Priority Population Group. This percentage excludes the costs of employing local unskilled labour. The allocation of this percentage from the Project, the screening of people, the selection of skills, will be for the Contractor to adjudicate.</p> <p>b) The Priority Population Group consists of women, youth and disabled people.</p> <p>c) The Contractor is to give first option for prospective PPG's from the surrounding areas of the Project. Should there be insufficient suitable people fitting the criteria of PPG's, the Contractor may hire people from further afield. This is to be done only after consultation with the Department of Works EPWP Co-ordinator and the Community Liaison Officer (CLO).</p> <p>d) A Mentor is to be employed by the Contractor, in consultation with the Department of Works for the purposes of quality control and liaison between the Contractor and the selected PPG's on site. The mentor will be responsible for ensuring an acceptable level of quality workmanship and that such work carried out by the PPG's is executed within the time frames stipulated.</p> <p>In so far as possible, the Contractor is encouraged to expand the PPG's skills, knowledge and performance levels.</p> <p>F:..... V:..... T:.....</p>	Item			
	Item			
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	UNIT	QUANTITY	RATE	AMOUNT
<p><u>TENDERER'S TO NOTE CONDITIONS</u></p> <p>a) The contract to be entered into between the Contractor and the PPG's will be a LABOUR ONLY sub-contract.</p> <p>b) The Contractor will be responsible for ensuring that all materials for use by the PPG's in the works are to be on site timeously. The Contractor shall liaise with The Mentor and PPG to determine the nature and extent of materials required and the lead time necessary.</p> <p>c) The Contractor shall be responsible for the overall programming of the Works and he is to allow for monitoring the PPG's programme and progress.</p> <p>d) In conjunction with the Mentor, he is to allow for the supervision and mentoring (where necessary) of the PPG to ensure quality and adherence to standard building practice</p> <p>e) The Contractor is to allow for extra storage facilities on site for the PPG's tools and equipment.</p> <p>f) Basic tools shall be provided by the PPG's and where these are not available; the Contractor will supply him with the necessary tools and equipment and deduct the costs thereof from the interim claims made by the PPG.</p> <p>g) Work requiring specialized tools will be provided free of charge by the Contractor with the provision that these be returned upon completion of the Work.</p> <p><u>CO-ORDINATION</u></p> <p>The Contractor is to co-ordinate the work of all the PPG's, Sub-Contractors and Nominated Sub- Contractors appointed direct by the Employer in such a manner and at all times as will suit the building programme and he is to allow adequate access, for the PPG's, where required, to carry out their work in an efficient manner as no claims for extras in this connection will be entertained.</p> <p>F:..... V:..... T:.....</p> <p><u>ATTENDANCE</u></p> <p>The Contractor may allow for attendance upon the PPG's concerned to execute the work. The Contractor is to allow the PPG's the use of any scaffolding belonging to him while it remains so erected on the site.</p> <p>Where scaffolding is necessary for the use by any PPG and the Contractor has not erected any for his own use or has removed same after his own use, the Contractor shall supply sufficient scaffolding to the PPG to be erected and dismantled by the PPG and returned to the Contractor.</p> <p>This attendance upon PPG's to execute the work is to include for the scaffolding provisions as aforesaid and, in addition, is to include for co-operating to the fullest extent with all the parties, attending on off-loading materials, providing suitable storage for tools and materials used by the PPG's, use of general facilities such as latrines, etc., supply and cost of power, lighting, water and the like.</p> <p>F:..... V:..... T:.....</p> <p>E12.9 EPWP CONTRACT FOR LABOUR</p> <p>It is compulsory that shortly after the contractor and or sub contractor has appointed local labour, the employment contract should be signed by both parties, prior to commencement with works on site. The employment contract forms part of the Ministerial Determination or from the regional EPWP officials. Each contract will lapse at the end of each financial year therefore requiring the Contractor to do a renewal of each contract should the need of employment still exist for that particular labourer.</p> <p>F:..... V:..... T:.....</p>	Item			
	Item			
Carried forward to collection			R	

	UNIT	QUANTITY	RATE	AMOUNT
<p>E12.10 EPWP SCOPE of WORK</p> <p>Note: Contractors are to price any item on the Bill of Quantities having below, bearing in mind that they are regarded as main sources of job creation, whether sub contracted or undertaken by the main contractor.</p> <p>Elements on the scope of work where application of Labour Intensive Construction methods as will indicated with letters (LI) are regarded feasible are as follows;</p> <p>i) Excavating trenches for foundations and any other civil works with the depth not more than 1.5 m</p> <p>ii) All masonry works which include concrete mixing on site; brickwork; plastering; screed works; jointing; etc.</p> <p>iii) Painting, Plumbing, Ironmongery; roof cladding; glazing; tiling; carpentry; flooring; waterproofing; etc.</p> <p>F:..... V:..... T:.....</p> <p>Note: It is a general requirement of this contract that persons normally resident in the ward of the works (local labour) be given preference for employment on the contract. Provided, however, that should adequate and appropriate labour not be available within the ward, others may be employed subject to satisfactory proof being provided that every reasonable endeavour has been made to employ local labour (Local Sub-contractor(s); Skilled; Semi-Skilled and Unskilled). The contractor shall in consultation with the local community leaders with the purpose of negotiating with them regarding the utilization of local resources in the construction process. In this regard, the contractor shall furthermore give preference, wherever possible to the employment of single heads of households, women and youth as well as families declared as most indigent by War on Poverty/ Sukuma Sakhe program profiling process. The contractor should aim, in general, to maximise the involvement of the local community, however workers from other communities should not exceed 20% of all persons working on the project, where local employees possess skills at level of competency that meet contractors requirements.</p> <p><u>Payment for the labour-intensive component of the works</u> Payment for works identified in the Scope of Work as being labour-intensive shall only be made in accordance with the provisions of the Contract if the works are constructed strictly in accordance with the provisions of the Scope of Work. Any non-payment for such works shall not relieve the Contractor in any way from his obligations either in contract or in delict.</p> <p><u>Linkage of payment for labour-intensive component of works to submission of project data</u> The Contractor's payment invoices shall be accompanied by labour information for the corresponding period in a format specified by the employer. If the contractor chooses to delay submitting payment invoices, labour returns shall still be submitted as per frequency and timeframe stipulated by the Employer. The contractor's invoices shall not be paid until all pending labour information has been submitted.</p> <p><u>Applicable labour laws</u> The current Ministerial Determination (also downloadable at www.epwp.gov.za) Expanded Public Works Programmes, Issued in terms of the Basic Conditions of Employment Act of 1997 by the Minister of Labour in Government Notice , shall apply to works described in the scope of work as being labour-intensive and which are undertaken by unskilled or semi-skilled workers.</p> <p>F:..... V:..... T:.....</p>	Item			
Carried forward to collection			R	

		UNIT	QUANTITY	RATE	AMOUNT
E13	HIV/AIDS AWARENESS Tenderers are to price against the following items for compliance with the SPECIFICATION FOR HIV/AIDS AWARENESS bound into this document (The clauses referred to are those of the Specification for HIV/AIDS)				
E13.1	Provide and maintain a condom dispenser in terms of Clause 5.1a) F:..... V:..... T:.....	Item			
E13.2	Provide and maintain HIV/AIDS awareness posters terms of Clause 5.1b) F:..... V:..... T:.....	Item			
E13.3	HIV /Aids Awareness Programme on Site for not less than 90% of workers inclusive of all direct and indirect costs; Engage a qualified service provider as described in the scope of works to conduct an HIV Awareness Programme in terms of Clause 5.2.1a) F:..... V:..... T:.....	Item			
E13.4	Arrange for workers to attend the HIV Awareness Programme in terms of Clause 5.2.1b) F:..... V:..... T:.....	Item			
E13.5	Reporting Prepare and attach to claims for payment a brief report in terms of Clause 5.3 (see also HIV/STI Compliance Report included with this document). F:..... V:..... T:..... <i>Note: In the event that the contractor fails to satisfy the requirements of this specification, the employer (Head: Public Works) may apply any of the sanctions provided for in the contract. Sanctions may include the application of a financial penalty of .04% of the Contract Sum per calendar day of which the required reports has not been submitted.</i>	Item			
E14	OCCUPATIONAL HEALTH AND SAFETY ACT NO. 85 OF 1993 Tenderers are to allow for costs in providing a project specific ' Construction Phase Safety, Health and Environmental Plan' in accordance with "Section 2 - Specification Data associated with SANS 1921-1:2004" clause C4.18 in "Part C3 - Scope of Work" F:..... V:..... T:.....	Item			
E15	NOTICE BOARD, SITE OFFICE, ETC. Bidders are to allow for the provision and removal of a project notice board and a site office in accordance with the Principal Agent's requirements. F:..... V:..... T:.....	Item			
E16	IMPORTED MATERIALS AND EQUIPMENT Where imported items are listed in the tender documents, the tenderer shall provide all information called for, failing which the price of any such item, material or equipment shall be excluded from currency fluctuations. (Refer to T2.14 - Schedule of Imported Materials and Equipment. F:..... V:..... T:.....	Item			
E17	CONTRACT DOCUMENTS The drawings issues with these Bid documents do not comprise the complete set but serves as a guide only for Biding purposes and for indicating the scope of works to enable the Bidder to acquaint him with the nature and extent of the works and the manner in which they are to be executed. Should any part of the drawings not be clearly legible to the Bidder he shall, before submitting his Bid, obtain clarification in writing from the principal agent. F:..... V:..... T:.....	Item			
	Carried forward to collection			R	

		UNIT	QUANTITY	RATE	AMOUNT
E18	GENERAL PREAMBLES The Document Preambles will be the "ASAQS Model Preambles for Trades – 2008" and is obtainable from the various Regional Office's of the Department of Public Works and shall be read in conjunction with the Bills of Quantities and be referred to for the full descriptions of work to be done and materials to be used. F:..... V:..... T:.....	Item			
E19	TRADE NAMES Wherever a Trade Name for any product has been described in the Bills of Quantities the Bidder's attention is drawn to the fact that any other product of equal quality may be used subject to the written approval of the Principal Agent being obtained prior to the closing date for submission of Bids. F:..... V:..... T:.....	Item			
E20	EXISTING PREMISES OCCUPIED Refer to Scope of Works Part C3 of this Bid Document for information on the occupation of existing buildings. F:..... V:..... T:.....	Item			
E21	INACCURATE AND DEFECTIVE WORK EXECUTED UNDER PREVIOUS CONTRACT The contractor shall, after taking possession of the site and before commencing the work, check all levels, liners, profiles and the like and satisfy himself as to the dimensional accuracy of all work executed under the previous contract which may affect his work. Should any inaccurate or defective work be found, the contractor shall immediately notify the principal agent in writing requesting his instructions with regard thereto and afford every facility to those rectifying such inaccurate or defective work. F:..... V:..... T:.....	Item			
E22	VIEWING THE SITE IN SECURITY AREAS If the site is situated in a security area and the Bidder must arrange with the Authorities to obtain permission to enter the site for Bidding purposes. F:..... V:..... T:.....	Item			
E23	COMMENCEMENT OF WORKS IN SECURITY AREAS If the works falls within a security area, the contractor must arrange with the Authorities and give the necessary notices before commencement of the works. Should the contractor fail to make such arrangements, admission to the site may be refused and any additional costs will be for the contractor's account. F:..... V:..... T:.....	Item			
E24	ENTRANCE PERMITS TO SECURITY AREAS If the works fall within a security area, the contractor shall obtain entrance permits for his personnel and workmen entering the area and shall comply with all regulations and instructions which may be issued from time to time regarding the protection of persons and property under control of the Authority. F:..... V:..... T:.....	Item			
Carried forward to collection				R	

		UNIT	QUANTITY	RATE	AMOUNT
E25	<p>SECURITY CHECK OF PERSONNEL</p> <p>The principal agent may require the contractor to have his personnel and workmen, or a certain number of them, security classified.</p> <p>In the event of the principal agent requesting the removal of a person or persons from the works for security reasons, the contractor shall do so forthwith and shall thereafter ensure that such person or persons are denied access to the works and the site and/or to any document or information relating to the works.</p> <p>F:..... V:..... T:.....</p>	Item			
E26	<p>PROHIBITION ON TAKING PHOTOGRAPHS</p> <p>In terms of article 119 of the Defence Act, 44 of 1957, it is prohibited to sketch or to take photographs of any military site or installation or any building or civil works thereon or to be in possession of a camera or other apparatus used for taking photographs, except when authorised thereto by or on behalf of the Minister.</p> <p>The same prohibition is also applicable to all Correctional Institutions in terms of article 44.1(e) of the Correctional Services Act 8 of 1959.</p> <p>F:..... V:..... T:.....</p>	Item			
E27	<p>Management of Water</p> <p>Water for Construction purposes must be obtained from alternative water sources (i.e. supply other than water that is produced and distributed by a regulated water service authority from a licenced water treatment works for human consumption), eg dams, rivers, boreholes, springs, rainwater harvesting, recycled sewerage water, etc. The alternative water source shall not be of an inferior quality / standard than that required for construction purposes. The client reserves the right through his agents to test such supplies or request certificates confirming the grade and nature of the water supply. Relevant knowledge of the respective area will be an advantage.</p>				
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Bill No. 1

**SUMMARY – PRELIMINARY & GENERAL
Collection**

	Page No.	Amount
	1	R
	2	R
	3	R
	4	R
	5	R
	6	R
	7	R
	8	R
	9	R
	10	R
	11	R
	12	R
	13	R
	14	R
	15	R
	16	R
	17	R
Carried forward to Final Summary		R
Section No. 1 Preliminary & General Summary		

Item No.	BILL NO. 1				Quantity	Rate	Amount
	INSTALLATION OF AIR CON UNITS AT VRYHEID MAG. COURT						
	<u>PREAMBLES</u>						
	Tenderers are referred to the project specification for full description of materials, etc. to be used. All work shall be done strictly in accordance with specifications and manufacturer's instructions and to be left in perfect working order after completion.						
	<u>AIR CON UNITS</u>						
	Supply and install mid wall splits units air con units with in various offices which has the following funtions: remotely operated, auto-swing function, 24hr on/off timer, air purifying filters, washable front grill, selectable memory auto-start and engineering plastic cabinet						
1	18000 BTU at Regional Magistrate	Room A1	No	1			
2	12000 BTU at Control Prosecutor	Room A2	No	1			
3	12000 BTU at Court Manager	Room A3	No	1			
4	18000 BTU at Clerk Court	Room A4	No	1			
5	12000 BTU at Magistrate Office	Room A5	No	1			
6	9000 BTU at Access Control Office	Room A6	No	1			
7	9000 BTU at Office	Room A8	No	1			
8	9000 BTU at Regional Cout Prosecutor	Room A18	No	1			
9	9000 BTU at Children's Room	Room A22	No	1			
10	9000 BTU at Regional Prosecutor	Room A27	No	1			
11	18000 BTU at Office	Room A32	No	1			
12	9000 BTU at Interpreter	Room A34	No	1			
13	9000 BTU at Judges Office	Room A35	No	1			
14	12000 BTU at Judges Office	Room A36	No	1			
15	18000 BTU at Office	Room B1	No	1			
16	12000 BTU at Office	Room B2	No	1			
	Total Carried to next page						

Item No.	BILL NO. 1			Quantity	Rate	Amount
	Balance brought forward					
	<u>AIR CON UNITS</u>					
17	23000 BTU at Criminal Court	Room B3	No	1		
18	12000 BTU at Office	Room B4	No	1		
19	12000 BTU at Maintenance office	Room B5	No	1		
20	18000 BTU at office	Room B6	No	1		
21	12000 BTU at Estate	Room B7	No	1		
22	12000 BTU at Prosecutor	Room B8	No	1		
23	12000 BTU at office	Room B9	No	1		
24	18000 BTU at Senior Public Prosecutor	Room B10	No	1		
25	12000 BTU at office	Room B12	No	1		
26	12000 BTU at Interpreters office	Room B20	No	1		
27	23000 BTU at Court rooms	Room A19 - A21	No	4		
28	23000 BTU at Court rooms	Room A14, A15 & A23	No	4		
29	12000 BTU at offices	Room A8, A10 & A11	No	3		
30	18000BTU at offices	Room A25,B3, B17	No	5		
31	12000 BTU at offices	Room B11 & B13	No	2		
32	Clean off and Service the Central Ducted units including re-gas and clean filters and flush all ducts to remove dust and clean all defusers		Item			
	Total Carried to Summary					

Item No.			Quantity	Rate	Amount
	<u>BILL NO. 2</u>				
	<u>Electrical Installations: Low Voltage Cabling</u>				
	Supply and install PVC/ SWA/ PVC copper laid in trenches (trenching and backfilling measured elsewhere), draw into risers and sleeves and terminals.				
23	150mm ² x 4C PVC SWA ECC	M	65		
24	35mm ² x 4C PVC SWA ECC	M	140		
25	16mm ² x 4C PVC SWA ECC	M	80		
26	120mm ² x insulated earth cable	M	220		
27	25mm ² x insulated earth cable	M	140		
28	10mm ² x insulated earth cable	M	60		
	<u>Termination of PVC/ SWA/ PVC Copper Cables</u>				
29	150mm ² x 4C PVC SWA ECC	ea	4		
30	35mm ² x 4C PVC SWA ECC	ea	6		
31	16mm ² x 4C PVC SWA ECC	ea	8		
32	120mm ² x insulated earth cable	ea	4		
33	25mm ² x insulated earth cable	ea	4		
34	10mm ² x insulated earth cable	ea	6		
	<u>Switched socket outlets, etc., complete with cover plate fixed in flush box type.</u>				
35	16A Three-pin single switched socket outlet wall mounted.	No	2		
36	20 DP isolator in weather proof enclosure IP65 with sprag and glands for aircons	No	25		
37	60 DP isolator in weather proof enclosure IP65 with sprague and gland for aircons	No	20		
38	Timer for lighting circuit	No	2		
39	PVC Trunking P900 with elbows and joiners	M	100		
40	Circuit breaker blanks for DB	No	35		
	Total Carried to Next page				

Item No.		Quantity	Rate	Amount
	BILL NO. 2			
	Balance brought forward from previous page			
	Electrical Installations: Low Voltage Cabling			
	Cable Joint Kits			
41	25mm 4 core with earth	No 2		
42	16mm 4 core with earth	No 2		
	Conductors			
	PVC insulated stranded copper conductor drawn into conduit			
	conduit including terminations and connections.			
43	2,5mm ² Conductor	M 2400		
44	4,0mm ² Conductor	M 1000		
45	6,0mm ² Conductor	M 500		
	Sleeves			
	Unplasticised polyvinyl chloride (UPVC) sleeve piping including			
	including short lengths and joining, laid in trench			
	(trench and backfilling measured elsewhere).			
46	160mm Diameter Sleeve with draw wire.	M 60		
47	160mm Bends	No 6		
	Power and Lighting (Coudits Power)			
	Rigid PVC conduit including bends, draw boxes with covers, etc.			
	fixed.			
48	20mm Diameter conduit	M 200		
49	25mm Diameter conduit	M 150		
	Steel bosal conduit with adaptors and couplings			
50	20mm Diameter 1000mm long complete with connectors at both ends	ea 100		
52	25mm Diameter 1000mm long complete with connectors at both ends	ea 20		
	Luminaries			
	Luminaires complete as specified and indicated in schedule of			
	luminaires supplied and fitted as described to structure or ceilings.			
	Including lamps, tubes, connections, brackets & plug tops.			
53	Light fitting type A	No 10		
	Cable Joint Kits			
53	25mm 4 core with earth	No 2		
54	16mm 4 core with earth	No 2		
	Total Carried to net page			

Item No.			Quantity	Rate	Amount
	BILL NO. 2				
	Balance brought forward from previous page				
	Electrical Installations				
55	Allow for Municipal Electrical Connection Fee for upgrading of the power supply	Sum		R	850 000.00
56	Supply and Install maximum demand type meter box on the boundary. Box must be raised and floor standing. Box must have busbars, 250 Amp breaker , neutral bar and earth bar. Must be according to Municipal specification, will be provided by the Engineer	Sum	1	R	35 000.00
57	Installation of on Load Meter movable on DB to measure, kwh, volts, amps, with recordings and download onto PC. (Fluke 1738) with software and download feature.	No	1	R	
	Distribution Boards				
	<u>Distribution Boards fitted complete with equipment, wired as per Schematic Diagram. Install as shown of drawings. The contractor must take into account all the breakers and fault levels when pricing the Distribution Board at Justice. Use 3 CR12 mild Steel and allow for 30% spare capacity.</u>				
58	Main Distribution Board Floor Standing (Next to room A8)	No	1		
59	Sub-distribution Board A1 (Next to room A6)	No	1		
60	Sub -Distribution Board A2 (Next to room A1)	No	1		
61	Sub -Distribution Board B (Next to room B7)	No	1		
62	Sub -Distribution Board C (Next to room A34)	No	1		
63	Allow for interface with other contractors	Item	1		
64	Lightning & Earthing Protection Mains & Distribution Boards	Item	5		
65	Co-Ordination connection supply with Municipality	Sum	1	R30 000.00	R 30 000.00
66	Allow for As Built Drawings for the new installation	Item	1		
67	Allow for testing and compliance certificate for the new electrical installation & boards for Justice/COC per DB as well.	Item	6		
	Total Carried to Summary				

Item No.		Quantity	Rate	Amount
	<u>BILL NO. 3</u>			
	<u>Civil and Building Works</u>			
	<u>Excavations" for trenching and including backfilling compacting and danger tape.</u>			
68	Cable or sleeves trenches not exceeding 1m deep Soft.	m3 20		
69	Cable or sleeves trenches not exceeding 1m deep Hard.	m3 35		
70	Cable or sleeves trenches not exceeding 1m deep Rock.	m3 10		
71	Back Fill River Sand	m3 55		
72	Backfill Trenches / Compaction	m3 55		
73	Concrete cable markers	No 10		
	<u>Manholes</u>			
74	Building of Main Supply manholes 800mm x 800mm x 600mm deep complete with case iron covers.	No 1		
75	Supply and install 300mm cable tray including the necessary supports, clamps, hangers, fixing material, bends, angles, junction, reducers, etc.	No 55		
	<u>Warning Tape</u>			
76	Cable warning tape placed 150mm above cable in excavations.	M 60		
	<u>Building Work</u>			
77	Plastering of Wall	M2 45		
78	Under coat and paint wall/ceilings to match the existing	M2 150		
79	Re-Concrete of Surfaces to match existing	M3 6		
80	Re-paving of surfaces with bricks	M2 20		
81	Replacement of ceiling and painting to match existing	M2 100		
82	Tarring of surfaces to match the existing	M2 20		
Total Carried to Summary				

Bill
No

SUMMARY

ELECTRICAL & MECHANICAL INSTALLATIONS

- A PRELIMINARIES AND GENERALS
- 1 AIR CON UNITS
- 2 ELECTRICAL WORK
- 3 CIVIL AND BUILDING WORKS

Page No

Amount

2
5
6

Sub Total

Add VAT @ 15%

Total Carried to Form of Offer & Acceptance. DPW-07

“HEALTH AND SAFETY FILE”

FOR

**PROJECTS AND MAINTENANCE
(BUILDING/ELECTRICAL/MECHANICAL)**

MANAGED ON BEHALF OF

**THE NATIONAL DEPARTMENT OF
PUBLIC WORKS & INFRASTRUCTURE**

(DEPARTMENT OF JUSTICE)

PROJECT:

**(Installation of the emergency water tanks and booster pump
In various Magistrates Offices)**

This document serves as a guide to Principle Contractors and Contractors (and their agents) to assist them in complying with the requirements of the Act and more specifically the Construction Regulations and to ensure a most comprehensive Health and Safety File. Kindly note the following extractions from the Construction Regulations:

“Every contractor shall ensure that a health and safety file, which shall include all documentation required in terms of the provisions of the Act and the Regulations, is opened and kept on site and made available to an inspector, client, client’s agent or principle contractor upon request. [CR 5(7)]

A Principal Contractor shall hand over a consolidated health and safety file to the client upon completion of the construction work and shall, in addition to the documentation referred to in sub regulation (7) [above], include a record of all drawings, designs, materials used and other similar information concerning the completed structure. [CR 5(8)]

A Principal Contractor shall ensure that in addition to the documentation required in the health and safety file as determined in the two sub regulations above, a comprehensive and updated list of all the contractors on site accountable to the Principal Contractor, the agreements between the parties and the type of work being done are included and available. [CR 5(9)]”



The information, documentation and lists required to be included in the Health and Safety File as contemplated in the Construction Regulations [CR 5(7)], shall be suitably and sufficiently documented in terms of the following items listed below to ensure compliance with the Act as far as is reasonably practicable.

Note: In the event that any of the items listed below may not have reference to the planning, implementation and completion of the work to be done pertaining to the project on the construction site, it must clearly be indicated as such with a proper statement e.g. ‘Not Applicable’. All other relevant references or items below shall relate to the information required as contemplated in the Act and Regulations.

IMPORTANT - This Health and Safety File shall be regarded as the property of the Client as it has to be consolidated and handed over to the Client upon completion of the project. The Principal Contractor shall ensure that this file is adequately protected against any form of damage, abuse or fraud.

Registers as follows:

- * Accident/Incident Register (Annexure 1 of the General Administrative Regulations)
- * H&S Representatives ('SHE - Reps') Inspection Register
- * Arc & Gas Welding & Flame Cutting Equipment Inspections
- * Inspection of Cranes
- * Inspection of Ladders
- * Inspection of Vessels under Pressure plus all other excluded under VUP regulations
- * Fire fighting equipment

The H&S Representatives (SHE-Reps) will be required to submit the abovementioned registers as well as other legally required registers, also from the list below, on a monthly basis to the chairman of the H&S committee for submission to, and endorsement by the H&S Committee. Also refer to the suggested Agenda for the H&S Committee under 12.8.3

Documents as follows:

Copy of OH&S Act (updated) (General Administrative Regulation 4.)
 Proof of Registration and good standing with a COID Insurer (Construction Regulation 4(1)(g))
 Appointments – in terms of the Construction Regulations * [See references Page 4]
 Notification of Construction Work – Annexure 1 [CR 3]
 H&S Specifications [CR 4]
 H&S Plan – Principal Contractor, Contractor & Sub-contractors [CR 5(1) & (4)]
 Proof of Periodic Audits [CR 4, 5 & 6]
 List of all Contractors (accountable to Principal Contractor) on site [CR 5(9)]
 Contractor Agreements [CR 5(9)]
 Type of work done on site [CR 5(9)]
 Records of drawings, designs, materials used and similar information concerning the completed structure [CR 5(8)]
 Input by Construction Safety Officer [CR 6(7)]
 Risk Assessment [CR 7(1)]
 Copy of Risk Assessment [CR 7(2)]
 Proof of H&S Induction Training [CR 7(4) & (7) & (9)(b)]
 Proof of training on Hazards and Work Related Procedures [CR (7)(4)]
 Fall Protection Plan [CR 8]
 Designer notice to contractor of dangers and hazards relating to construction work [CR 9(2)(b)]
 Drawings design of structure [CR 9(3)]
 Records of Inspections of Structure [CR 9(4)]
 Maintenance records – structure safety [CR 9(5)]
 Record Excavation Inspection [CR 11(3)(h)]
 Method Statement [CR 11(3)(k)]
 Method Statement [CR 12(2)]
 Method Statement [CR 12(11)]
 Operational Compliance Plan [CR 15(2)(c)]
 Certificates, design calculations, sketches and test results [CR 15(3)]
 Examination results [CR 15(9)]
 Suspended Platform Inspection and Performance Test records [CR 15(11)]

- Medical Certificate of Fitness [CR 15(12)(b)]
- Proof of Training [CR 15(12)(c)]
- Material Hoist Inspections [CR17(8)(c)]
- Maintenance Records Material hoist [CR17(8)(d)]
- Record Batch Plant Maintenance & Repair [CR18(9)]
- Register for control of cartridges/nails studs – explosive powered tools [CR19(2)(g)(ii)]
- Medical Certificates of Fitness [CR 20(g)]
- Medical Certificates of Fitness [CR 21(1)(d)(ii)]
- Findings of daily inspections Construction Vehicles & Mobile Plant [CR21(1)(j)]
- Record of Temporary Electrical Installation Inspections [CR22(d)]
- Record of Electrical Machinery Inspections [CR22(d)]
- Proof of Training [CR 27(i)]
- Evacuation Plan [CR 27(l)]
- H&S Rep & Committee Members details
- H&S Committee Meetings' Minutes
- Other appointments in terms of OHASA

The following further identified requirements in terms of the Act and other Regulations of the Act are similarly applicable as part of the contents of the 'Health and Safety File':

- Details of Inspections (by DoL)
- Recording and Investigation of Incidents – Annexure 1 [GAR 9(1-3)]
- Action taken on all incidents [GAR 9(4)]
- Certificates of Competency in First Aid [GSR 3(4)]
- Record of Medical Surveillance required in terms of OHASA
- Proof of compliance with Asbestos Regulation requirements
- Proof of compliance with Major Hazard Installation requirements

****The Appointments to be made in writing with job descriptions as per the Construction Regulations may include some or all of the following:***

PRINCIPAL CONTRACTORS - [CR 4(1)(c)]

CONTRACTORS – [CR 5(3)(b) + (11)]

COMPETENT PERSONS - [CR 6(1) + (2)]

- [CR 6(6)]
- [CR 7(1) + (4)]
- [CR 8(1)(a)]
- [CR 10(a) + (e) + (f)]
- [CR 11(1) + (3)(b)(ii)(b) + (3)(k)]
- [CR 12(1) + (2) + (3) + (11)]
- [CR 14(2)]
- [CR 15(1) + (2)(c) + (8)(c) + (13)]
- [CR 17(8)(a)]
- [CR 18(1) + (7)]
- [CR 19(2)(b) + (2)(g)(i)]
- [CR 20(f)]
- [CR 21(1)(d)(i) + (1)(j)]
- [CR 22(d) + (e)]
- [CR 26(a)]
- [CR 27(h)]

CONSTRUCTION SAFETY OFFICER - [CR 6(6)]

DESIGNER - [CR 9(2)]

☐ ☐ ☐

IMPORTANT:

A copy of the following certification in terms of the **“SAFETY AND SWITCHING PROCEDURES FOR ELECTRICAL INSTALLATIONS”** (Document attached) signed by the prospective tenderer / contractor is to be included in the Health and Safety File:

“ I hereby certify that I have taken cognisance of the content of the document titled ‘SAFETY AND SWITCHING PROCEDURES FOR ELECTRICAL INSTALLATIONS’, and have included the relevant elements of the document applicable to the above project in my Health and Safety Plan and shall ensure adherence and compliance to the requirements thereof.”

NATIONAL DEPARTMENT OF PUBLIC
WORKS

SAFETY AND SWITCHING
PROCEDURES

FOR

ELECTRICAL INSTALLATIONS

JANUARY 2003

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REGULATIONS AND DEFINITION OF COMPETENT PERSON:

1.1 REGULATIONS:

All persons who carry out or arrange for work of any description for the Department in connection with electrical apparatus shall make themselves acquainted with the Occupational Health and Safety Act (Act 85 1993) with particular reference to the Electrical Machinery Regulations, Regulations 1 to 23 inclusive.

Access to the above Act and its Regulations can be arranged with the Regional Manager.

1.2 DEFINITION OF COMPETENT PERSON:

"competent person" in relation to machinery, means any person who—

- (a) has served an apprenticeship in an engineering trade which included the operation and maintenance of machinery, or has had at least five years' practical experience in the operation and maintenance of machinery, and who during or subsequent to such apprenticeship or period of practical experience, as the case may be, has had not less than one year's experience in the operation and maintenance appropriate to the class of machinery he is required to supervise;
- (b) has obtained an engineering diploma in either the mechanical or electrotechnical (heavy current) fields with an academic qualification of at least T3 or N5, or of an equivalent level, and who subsequent to achieving such qualification has had not less than two years' practical experience in the operation and maintenance appropriate to the class of machinery he is required to supervise;
- (c) is a graduate engineer and has had not less than two years' post-graduate practical experience in the operation and maintenance appropriate to the class of machinery he is required to supervise and who has passed the examination on the Act and the regulations made there-under, held by the Commission of Examiners in terms of regulations E5 (2) of the regulations published under Government Notice R.929 of 28 June 1963; or
- (d) is a certificated engineer;

2 SAFETY EQUIPMENT

The following equipment required for working on electrical installations and distribution systems, must be maintained in good order and repair and must be made available:-

Safety belt, overalls, hard hat, safety shoes or boots, rubber gloves, "Men Working" notice boards, locks for locking off switches, buss bar shutters in truck-type switchgear, isolators or earthing links, rubber sheet and length of rope with short circuiting earthing-chains, earthing sticks and testing/phasing sticks rated for the voltage of the equipment to be tested.

Under no circumstances shall work be carried out on electrical apparatus unless the proper safety equipment is used

With regard to overhead linesmen, no work shall be carried out unless use is made of a non-metallic ladder and the appropriate safety belt, rubber gloves, overalls, hardhat and safety shoes or boots are worn. The buddy system must also be implemented.

3 DEFINITION OF OPERATING TERMS

3.1 Alive or live

This means electrically connected to the power system and/or electrically charged.

Consider an isolated overhead line that is not earthed. An overhead line can be electrically connected to the system in the following ways:

- (a) By means of a metallic conductor such as links and breakers or switches. This is the normal way of transmitting electrical energy.
- (b) Electromagnetic induction or transformer action from a nearby current carrying line will induce a dangerous voltage in the isolated lines and are a hazard to all personnel that must work on or with the line.
- (c) Electrostatic induction or condenser action from a nearby live line will induce a dangerous voltage in any isolated, but not earthed, overhead line. Electrically charged means at a potential difference or voltage above zero

3.2 Dead

This means that any apparatus so described is isolated from the power system. Rotating plant shall not be regarded as dead until it is stationary or is being slowly rotated by means of barring gear and is not excited.

The Occupational Health and Safety Act defines dead as: "dead" means at or about zero potential and isolated from any live system. Disconnected has the same meaning as isolated. An overhead line disconnected from all sources of supply but not earthed, cannot be regarded as dead because:

- (a) It can retain a static charge.
- (b) It can acquire a static charge due to atmospheric conditions.
- (c) It can accidentally be made alive.
- (d) Nearby lines continually induce voltage in them.

The regulations recognise only the following devices as disconnects or isolators:-

- (a) Links.
- (b) Fuses.
- (c) Truck type switchgear.

3.3 Earthing

This means the connecting of apparatus electrically to the general mass of earth in such a manner as will ensure at all times an immediate safe discharge of electrical energy. This is done through an earth bar or spike by means of a good metallic conductor.

To fully appreciate this definition we must refer to the Electrical Machinery Regulations, Regulation 3 of the Occupational Health and Safety Act which states:

"Work on Disconnected Electrical Machinery. —Without derogating from any specific duty imposed on employers or users of machinery by the Act, the employer or user shall, whenever work is to be carried out on any electrical machinery which has been disconnected from all sources of electrical energy but which is liable to acquire or to retain an electrical charge, as far as is practicable, cause precautions to be taken by earthing or other means to discharge the electrical energy to earth from such electrical machinery or any adjacent electrical machinery if there is danger if there is danger therefrom before it is handled and to prevent any electrical machinery from being charged or made live while persons are working thereon."

Electrical apparatus and in particular overhead lines may become charged due to:-

- (a) Direct lightning strokes.
- (b) Electro magnetically induced currents due to a lightning stroke in the immediate vicinity of the line.

- (c) Electro statically induced charges on the lines due to the presence of thunderclouds.
- (d) Electrostatic charges imparted to the line by the friction of dust or snow blowing past the conductors.
- (e) Electrostatic charges imparted to the line due to changes in line altitude"

These changes are responsible for tremendously high voltages between overhead lines and earth, in fact, sometimes high enough to cause a flash over on insulators. A spark may span several centimetres of air to a person's hand should he approach too closely to an isolated unearthed overhead line.

An overhead line or apparatus can be made alive by:

- (a) Unauthorised operating, i.e., closing the wrong links and breaker.
- (b) Faulty wiring on consumer's stand-by sets. (Back feed from consumer)
- (c) A broken overhead conductor from a different line falling onto the isolated line.
- (d) Synchronising plugs.

From the foregoing paragraphs it is clear that the purpose of earthing isolated lines and apparatus are:

- (a) To discharge them should there be a residual voltage or charge.
- (b) To prevent them acquiring a static charge.
- (c) To prevent danger to persons working on apparatus in the event of someone accidentally making it alive.
- (d) To dissipate induced voltages continuously and safely.

Earthing gear means the fixed or portable appliances used for earthing electrical apparatus. The dangers from inadequate or improper earth connections are:

- (a) Electrocutation.
- (b) Burns from arcing.
- (c) Electric shock leading to falls.

Earthing may be done by the closing of earthing links, or by the attaching of fixed earthing devices or by the affixing of portable earthing straps. In each case the main idea is to ensure the safety of personnel.

In affixing portable earth straps, the connection to the earthbar or earthed metal or spike must be made first and in removing such earthing straps, the disconnecting from the earthbar or earthed metal or spike must be done last. Also, a link stick or an insulated stick should be used to connect the earth wires to the overhead lines or apparatus.

These requirements are most important because connecting the portable strap first to earth and then to the conductors by means of a link stick avoids the risk of a shock to the operator from static charges or induced voltages.

REMEMBER: Always safety test before applying earths.

3.4 Isolate

This means to disconnect from all Sources of electrical potential by means of opening of links or fuses or the withdrawal of truck-type circuit-breakers.

All sources of electrical potential mean all points or circuits from where the apparatus can be made alive. Links, fuses and truck-type switchgear can be regarded as isolators because:

- (a) They leave a visible air gap in a circuit when open, removed or withdrawn.
- (b) They contain no stored energy and will not close due to defects.
- (c) They can be locked in a physical condition and thus can only be operated by the person with the correct key.

Opening links and locking them in the open position; removing fuses and locking them away; withdrawing truck-type switchgear and locking the buss bar shutters are the only safe methods of isolating.

3.5 Circuit Breaker

This is a device designed to make or break electric current under normal and fault conditions. A breaker can make or break an electric current because it is designed to extinguish the arc very rapidly and effectively. It is also designed to withstand the tremendous forces under short circuit conditions. The arc-extinguishing medium for high-voltage breakers is normally air, oil or vacuum and should this medium be lost, the breaker becomes a link. Never use a breaker without an arc-extinguishing medium to interrupt current flow because the breaker will probably explode or it will sustain severe damage.

A fault condition is any condition that will cause an excessive amount of current flow. The normal fault conditions are:

- (a) Phase faults.
- (b) Earth faults.
- (c) Open circuit in one line of a three-phase system (Single-phasing).
- (d) Too low a voltage. (Motors will draw a large current or even stall).
- (e) Too high a voltage.
- (f) Overloading.

For the following reasons breakers cannot be regarded as isolators:

- (a) They leave no visible gap in a circuit.
- (b) They contain stored energy and can close on their own due to various defects.
- (c) It is normally not possible to lock them in an open position.
- (d) Oil circuit-breakers are subjected to carbon tracking which could cause a flash-over between contacts.

3.6 Link

This is a device for making or breaking a circuit when no load current is flowing.

Links differ from breakers and switches in the following respects:

- (a) They are not equipped with an arc extinguishing medium/device.
- (b) Their movement is very slow.

Should current be interrupted by means of links, an uncontrollable arc will be struck at the points where the contacts part.

The temperature of the arc is so high (+ 2 000°C) that it will simply melt the parting contacts. As the contacts move further apart, the arc will lengthen and burn everything away. Molten metal could splash onto the operator and cause severe injuries.

As the arc lengthens, considerable noise is generated and the light intensity is so severe that the operator could suffer from "welding flash" of the eyes.

When apparatus equipped with earthing links is required to be earthed at more than one place, the earthing links shall always be closed first and thereafter, any necessary portable earthing gear may be affixed to the apparatus.

In removing the earths in readiness for making the apparatus alive, all portable earthing gear shall first be removed and earthing links shall be opened last.

Closing the earthing links first ensures maximum safety to the operator. These links are easily operated, make good contact and the operating handles are at a safe distance from the contact points.

Locks and keys shall also be provided for links. The operating mechanism of all manually operated links shall be fitted with fastenings for locks. The operating mechanisms of each set of manually operated links shall normally be locked whether the links are in the open or in the closed position.

The locking of links provides a safeguard against their being opened or closed in error by other persons apart from the one with the correct key and a written instruction to operate.

3.7 Operating methods

This means switching, linking, safety testing and earthing. This definition also indicates the order of operating when making apparatus safe to work on.

- (a) Switching -
 - (i) Open breaker or switch to interrupt current flow safely, i.e. prevent arcs.
 - (ii) Close breaker or switch to start current flow - the only safe way.
- (b) Linking - open at least one set of links from where the apparatus can be made alive and lock the links in the open position. Always ensure that you are not going to start or interrupt current flow with the links by ensuring that the breaker or switch is open.
- (c) Safety test - test all three phases to ensure that the apparatus is disconnected from all sources of supply and that there is no back-feed from a consumer's standby set or other source.
- (d) Apply earths - ensure safety of the workers by:-
 - (i) Discharging the line or apparatus.
 - (ii) Preventing the line from acquiring a static charge.
 - (iii) Preventing the line or apparatus from being accidentally made alive.

Before applying portable earths, ensure that they are mechanically and electrically in good condition. There should be no broken strands, the clamps should be rigid and without defect and when applied properly, should make intimate contact with the conductors and earthbar or spike. The earthing cable tails should be as short as possible. The current carrying capacity of the portable earth is greatly reduced by broken strands. It will act as a fuse and increase the danger to workmen.

4 GENERAL SAFETY PRECAUTIONS

No person shall carry out work of any description (including maintenance, repairs, cleaning and testing) on any part of electrical apparatus unless such parts of the apparatus are:

- (a) dead;
- (b) disconnected, isolated and all practicable steps taken to lock off from live conductors;
- (c) efficiently connected to earth with the appropriate earthing sticks or gear designed for this purpose at all points of disconnection of supply;
- (d) screened where necessary to prevent danger, and caution and danger notices fixed;

and unless such person is fully conversant with the nature and extent of the work to be done.

It is the duty of the competent person in charge of the work to ensure that the foregoing provisions are complied with. He shall also ensure that when the work has been completed, the apparatus is safe to be made alive and that all earths and temporary danger notices have been removed.

Provided that cleaning and painting of earthed metal enclosures, connections or disconnections of circuits to or from live systems may be carried out in accordance with instructions issued by the competent person concerned.

Provided also that where the design of the apparatus precludes the strict compliance with all details of these precautions, the work shall be carried out to the instructions of the senior competent person present.

When any person receives instructions: regarding work on or the operation of high voltage apparatus he shall report any objection to the carrying out of such instructions to the competent person who shall have the matter investigated and, if necessary, referred to higher authority.

5 ACCESS TO HIGH VOLTAGE ENCLOSURES AND APPARATUS

Enclosures, chambers, cubicles or cells containing high voltage conductors shall be kept locked and shall not be opened except by a competent person.

6 SWITCHING:

- (a) No switching shall be carried out without the sanction of the appropriate competent person except for agreed routine switching or in cases of emergency.

All telephone instructions/messages relating to the switching operation shall be written down and be repeated in full to the sender to ensure that the message has been accurately received.

- (b) When a switch shows any sign of distress after operating, its condition shall be immediately reported to the appropriate competent person, and it shall be examined before further operation.

- (c) The examination of and necessary adjustments including inspection and/or changing of oil of any high voltage oil immersed circuit-breaker which has operated under fault conditions shall be carried out if possible before the circuit-breaker is re-closed, or at the earliest available opportunity thereafter.

7 WORK IN SUBSTATIONS AND SWITCHING STATIONS CONTAINING EXPOSED LIVE CONDUCTORS.

7.1 Safety Clearances to Live Conductors:

Unless the whole equipment is "dead", the section which is made dead for work to be carried out shall be defined by the use of barriers or roping such that the minimum clearance from the nearest exposed conductor to ground level or platform or access way shall be:-

Rated Voltage	Clearance
Up to 11 kV	3.0 m.
From 11kV to 33kV	3.4 m

The area at ground level shall be only that in which the work is to be carried out.

7.2 Insufficient Clearances

If the above clearances are not sufficient to avoid danger, other suitable arrangements shall be made to provide the requisite degree of safety.

7.3 Ladders and Other Long Objects

Ladders and other long objects shall not be used without the permission of the senior authorised person in charge of the work and the movement and erection of such ladders shall be under his/her direct supervision at all times.

8 WORK ON METAL CLAD SWITCHGEAR SPOUTS:

- (i) The section of bus bars on which work is to be carried out shall be made dead and isolated from all points of supply.
- (ii) The shutters of live spouts shall be locked closed.
- (iii) The busbars shall be earthed with approved earthing equipment if possible, at a panel other than that at which work is to be carried out. Temporary earths shall in any case be applied to all phases on the busbar at the point of work. These earths may then be removed one phase at a time for work to be carried out. Each phase earth shall be replaced before a second phase earth is removed.

For the earthing of metal clad switchgear, approved appliances only shall be used. The insertion of the hand or any other tool in contact spouts for this purpose is forbidden.

9 WORK ON TRANSFORMERS:

When work is carried out on transformers, both the primary and secondary switches and isolators shall be opened. The transformer shall also be isolated from all common neutral earthing equipment from which it may become live. This does not require the disconnection of solidly earthed neutrals.

10 WORK ON CABLES, CONDUCTORS AND OVERHEAD LINES:

10.1 Cables and Conductors

- (a) No person shall touch the insulation, which covers or supports any high voltage conductor unless the conductor is dead and earthed.
- (b) Before carrying out work involving cutting into a high voltage cable, the responsible person shall satisfy himself that the cable has been made dead, isolated and earthed where practicable and identified. In all cases of doubt, the cable shall be spiked in an approved manner.

10.2 Overhead Lines

- (a) All persons while at work on towers, poles and high structures or when working on live lines shall make proper use of their safety belts and safety equipment, and no man shall work alone at any tower or high structure, or on live equipment.
- (b) The senior authorised person in charge of the work shall satisfy himself that the line conductors are short circuited and earthed before work is commenced. When work has been completed, the responsible person shall ensure that all temporary earths have been removed and that the line is safe to be made alive.
- (c) When work is carried out on a high voltage line, earths shall be placed at the point or points where the work is being done in addition to the earths provided at the points of disconnection.
- (d) In the event of the near approach of a lightning storm, all work on overhead lines shall cease immediately and the authorised person in general charge of the work shall be informed.
- (e) For the safety of the public, strain insulators shall be placed in all stays on overhead lines.

APPENDIX 1

EMERGENCY FIRST AID, RESCUE AND RESUSCITATION IN THE CASE OF ELECTRIC SHOCK

1. FIRST AID:

1.1 Burns:

Treat with Vaseline to exclude air.

1.2 Shock:

In addition to suffering from electric shock, it is also probable that the patient will be suffering from physical shock and important that this condition be treated.

The patient must be kept warm with blankets and/or coats, and if available, hot water bottles should be applied to the feet.

1.3 Drinks:

Drinks must on no account be administered unless the patient is fully conscious.

Alcoholic drinks should not be administered unless recommended by a doctor.

2. RESCUE

The procedure to rescue persons from contact with a live conductor cannot definitely be laid down for all cases. However, certain principles and methods are outlined which all persons working on electrical apparatus or assisting in such work should know.

3. RELEASES FROM CONTACT WITH LIVE CONDUCTORS

3.1 Low voltage

- (a) Observe quickly the general circumstances of the case, whether special difficulties are involved and if special precautions are necessary. Every second is precious and delay may be fatal; be prepared, therefore, to act promptly. Speed of action must be accompanied with due care.
- (b) Take precautions against receiving a shock your self. Remember that the patient, until released, is electrified at the same voltage of the live conductor.
- (c) In cases where the contact has been made on a live conductor with adjacent switch control, the switch should be opened immediately and then the patient pulled clear. If in doubt about which switch to open, all switches should be opened; but assume all conductors are still alive unless some method is available to determine that the conductors are dead.
- (d) When conductors cannot be de-energised immediately by adjacent switch control, the procedure will depend on the voltage of the live conductor.

In all cases it is necessary for the rescuer to be adequately insulated against shock from a conductor to earth and against shock from a conductor to conductor, or by touching the patient.

For low and medium voltage (up to 650 V) rubber gloves, rubber sheeting or dry cloth, including loose portions of the patients clothing, provide adequate insulation for the rescuer's hands. The use of such insulating guards should always be aimed for; but a dry pole with no associated earthed metal on it provides adequate insulation for the rescuer against shock from a conductor (or patient's body to earth).

- (e) Cutting away a conductor (carrying up to 650 V only) may provide a quick and easy method of release in some cases. It is useful especially when delay might otherwise occur in releasing the patient. This method requires that the rescuer has sound knowledge of what he/she is doing.
- (f) Prevention of patient falling from aloft; when a patient is being rescued above ground level, care must be taken to ensure that he does not fall from a dangerous height when pulled clear or when conductors are de-energised.
- (g) Be prepared to use considerable force when releasing a patient who is holding a live conductor. Punch the wrist heavily on the inner side or strike the back of the hand. It may be easier in some cases to use one's foot to force the patient's hand clear.

3.2 High voltage

For high voltage it is necessary to put an extra long, say 2 m or more, dry insulating material, such as wood or rope, between the rescuer's hands and the patient to enable the patient to be pushed or pulled clear of the conductor, or enable the conductor to be cleared from the patient.

4. **RESUSCITATION AFTER CONTACT WITH LIVE CONDUCTORS**

Immediately after rescue, a rapid but careful examination of the patient must be made to determine the extent of treatment necessary.

Electric shock may cause breathing to stop because of a sudden paralysis of the respiratory centre and it may also cause a failure of the circulation because the shock has affected the heart.

The method of resuscitation will therefore depend on the patient's condition.

4.1 Patient breathing

If the patient is breathing and his heart is beating then in a large majority of cases recovery will be rapid.

Do not apply artificial respiration if the patient is breathing. Let the patient have plenty of fresh air. If the patient is in a collapsed condition, lay him on his back in as comfortable a position as practicable with his head tilted slightly back. This will keep his airway open and assist breathing. A pad, if available, placed under the patient's shoulders will assist in keeping his head back. Loosen any tight clothing.

4.2 Patient not breathing

If breathing has stopped or is very weak or appears to be failing, commence artificial respiration without delay.

4.3 Circulation

In cases of electric shock, failure of the heart should be suspected if the patient does not quickly show some response to artificial respiration. Circulation should be assessed within fifteen seconds after the commencement of artificial respiration.

Feel for a pulse in one of the carotid arteries in the patient's neck. This is done with the pads of the fingers at the level of and at either side of the Adam's apple. Do not feel both carotid arteries at the same time, as this would stop the flow of blood to the brain. If the heart is beating, a pulse will be felt.

If no pulse is felt, lift the patient's eyelids. If the heart is not beating the pupils of the eyes will be large and will not become smaller when exposed to light by the lifting of the eyelids. If the heart is beating the pupils will become smaller when exposed to the light.

The absence of a pulse in the carotid artery and the enlarged pupil of the eye, which does not become smaller when exposed to light, indicate that the heart has stopped beating.

- (a) Patient's heart beating. Do not apply external cardiac (heart) massage when a pulse can be felt.
- (b) Patient's heart not beating. If the heart has stopped beating commence external cardiac (heart) massage without delay.

4.4 General

Immediately resuscitation is commenced, send for medical assistance and an ambulance and notify the hospital if applicable.

If the patient is not breathing and his heart has stopped beating, artificial respiration by the expired air method should be carried out in conjunction with external cardiac (heart) massage.

Every second you wait can cause severe brain damage through lack of blood and oxygen.

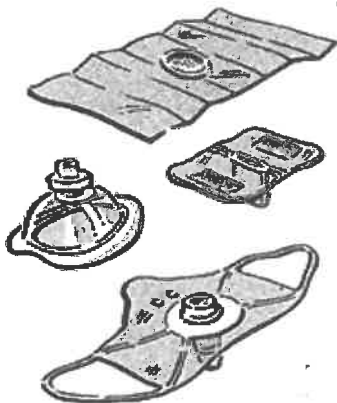
Artificial respiration and external cardiac (heart) massage must be commenced without delay and should be continued until breathing is restored and the heart starts beating or until a doctor advises that further efforts will be of no avail.

Care should be taken to avoid, as far as possible, aggravating any injuries the patient may have sustained.

4.5 Artificial respiration

If available in order to reduce the risk of infection it is recommended that a facemask or shield be used for both mouth to mouth or mouth to nose artificial respiration. However, time should not be lost in getting a face mask/shield.

Examples of Masks



Alternatively a clean cotton handkerchief can be used to cover the mouth.

It is not necessary to be highly trained in resuscitation methods to carry out artificial respiration effectively.

Simply stated, artificial respiration is a means of supplying oxygen to the patient's lungs, and thus, through the blood, to his brain to keep him alive while his own breathing is suspended.

The expired air method of artificial respiration is recommended as the best universally applicable field type of artificial respiration.

For artificial respiration the patient's head must be kept well back to ensure a free passage to the lungs. Exact rhythm and timing in carrying out artificial respiration are unimportant. The only purpose of artificial respiration is to get oxygen into the patient's lungs.

Artificial respiration must be continued until breathing is restored or until a doctor advises that further efforts will be of no avail.

4.5.1 Expired air artificial respiration

In the expired air method of artificial respiration the rescuer breaths his own exhaled breathe into the patient's lungs.

The normal air we breathe in contains 20 per cent oxygen. The air we exhale contains about 16 per cent oxygen and this is ample to keep the oxygen content in the patient's blood normal if it is breathed into him at about the rate of normal breathing.

Therefore, quickly ensure that the patient's throat is free from foreign matter. Next place him on his back and tilt the head well back (Fig.A1.1) this ensures an open passageway to the lungs. Placing a pad under the patient's shoulders will make the tilting of the head easier. However, time should not be lost in getting a pad.

The rescuer may then breathe into the patient's mouth or nose.

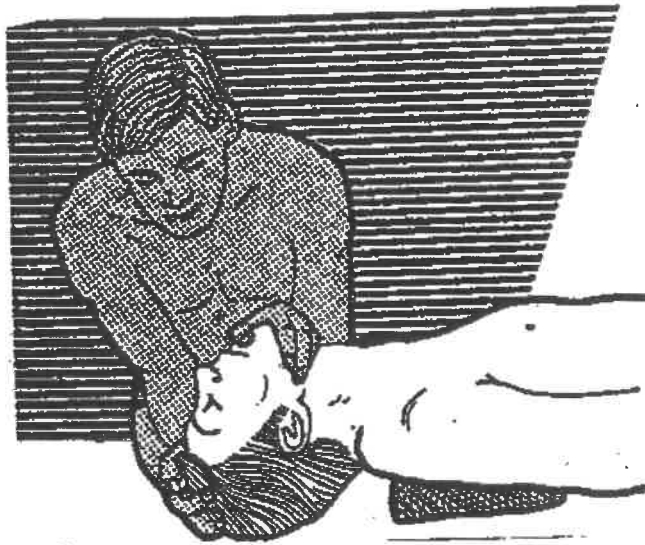


Figure A1.1

Lift the neck and tilt the head back. Hold the head tilted so that the skin over the throat is stretched tight. With one hand push the crown of the head down, remove the other from below the neck and use it to pull up the chin. This prevents the tongue from causing an obstruction.

4.5.2 Mouth-to-mouth method

The patient's head is tilted well back as in Figure A1.1 his mouth is opened and the rescuer opens his mouth wide and makes an air-tight seal around the patient's mouth as shown in Figure A.1.2. The rescuer's cheeks will normally seal the patient's nostrils, but if necessary the nostrils must be pinched closed with the fingers. The rescuer then breathes into the patient. The resistance to the rescuer's breath is about the same as that experienced when blowing up a balloon. The chest should be seen to rise.

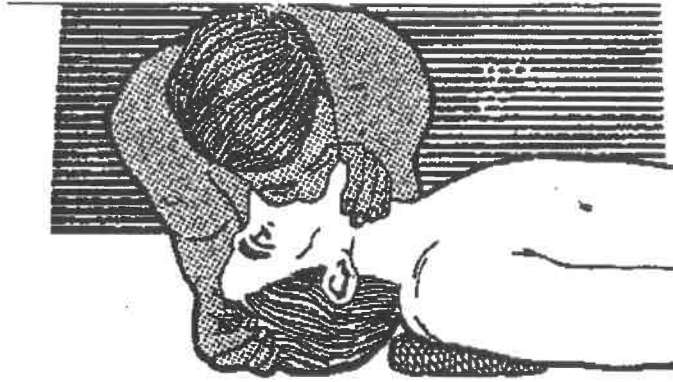


Figure A1.2

Seal your lips widely around the victim's mouth. Fold his lower lip down to keep his mouth open during inflation and exhalation. To prevent leakage, press your cheek against his nostrils during inflation. Blow air into the victim until you see the chest rise. Then remove your mouth to let him breathe out. Take your next breath as you listen to the sound of his breath escaping. Re-inflate his lungs as soon as he has exhaled.

Having breathed into the patient's lungs, the rescuer removes his mouth and, turning his face to one side to avoid the patient's exhaled breath, takes another deep breath and again breathe into the patient's lungs. This is kept up at a steady rate of from ten to fifteen times per minute.

One rescuer can take over from another. Remember rhythm and timing are not important but the patient must under no circumstances be left without air for longer than a minute.

4.5.3 Mouth-to-nose method:

The patient's head is tilted well back as in Figure A1.1. The rescuer opens his mouth and places it right over the patient's nose making an airtight contact (Figure A1.3) The lips do not contact the nostrils as this would tend to close them. The patient's mouth is held closed and the rescuer breathes into his patient as in the mouth-to-mouth method.

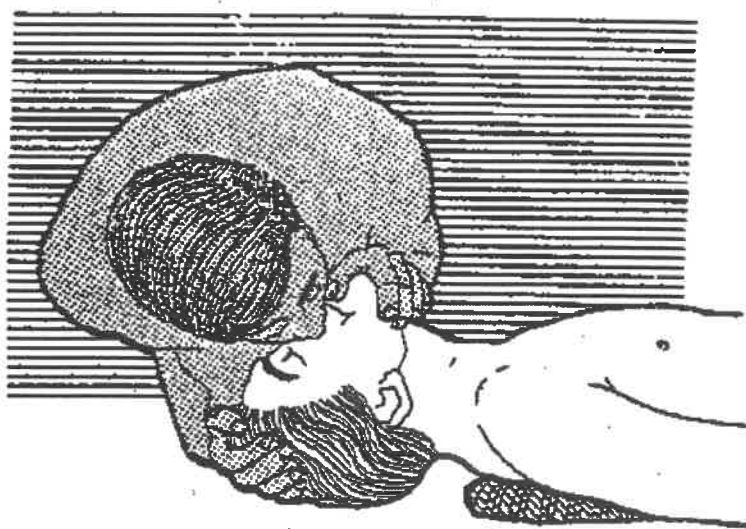


Figure A1.3 ~ Mouth-to-nose method

4.5.4 Filling the lungs:

The rescuer blows steadily and firmly, not with a jerk, and the patient's chest should be seen to rise. If air does not appear to be entering the lungs, quickly look for any blockage in the air passage, check the head again, making sure the jaw is well forward and the head tilted well back, and commence blowing again.

About ten good quick breaths should first be breathed into the patient as soon as he is reached. This will oxygenate his blood and give the rescuer a minute or so to get his patient into a more convenient location for continuing artificial respiration, for example, to lower a linesman from a pole.

5. EXTERNAL CARDIAC (HEART) MASSAGE

The lives of people whose hearts have ceased to function can often be saved by the prompt application of a form of resuscitation known as external cardiac (heart) massage (for example, massage of the heart without opening the chest). This massage may be performed by anyone.

The heart is in the centre of the chest between the breast-bone and the spine and if pressure is applied to the lower half of the breast-bone, the heart is compressed and the blood is squeezed out of it into the arteries. When the pressure is released the breast-bone springs back into place, the heart, like a rubber ball, resumes its shape and in so doing allows blood from the veins to enter. Valves in the heart prevent blood flowing back into the heart from the arteries.

In this way a heart which has either stopped beating altogether or which has gone into ventricular fibrillation (a state of ineffective quivering often caused by electric shock) can be made to circulate the blood.

This compressing and releasing of pressure on the heart carried out rhythmically at a rate of approximately 60 compressions per minute is called external cardiac (heart) massage. It can keep a person alive if breathing is maintained, until his heart resumes its proper beating. A heart in ventricular fibrillation will require hospital treatment to restore normal heartbeat, but the heart can be made to circulate blood by external cardiac (heart) massage until the necessary medical aid is obtained.

It is desirable that adequate training in external cardiac (heart) massage be given to develop the technique. This can best be achieved with a training aid.

5.1 Technique:

Lay the patient on his back on a firm surface.

Feel for the notch at the top of the breast-bone (sternum) with one hand and for the lower end with the other. It is on the lower half of this bone that the pressure has to be made (see Figure A1 4)

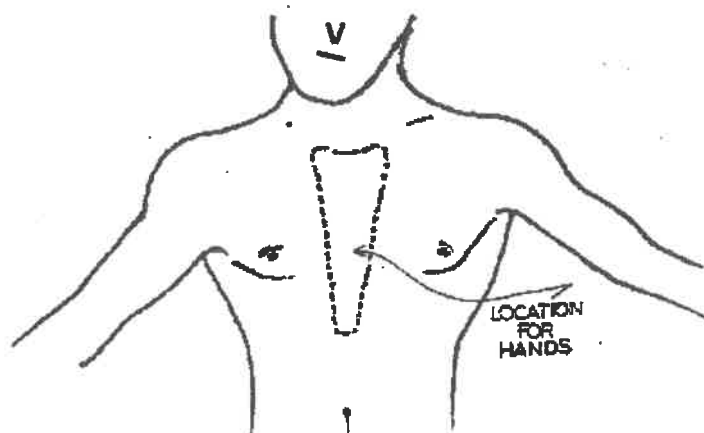


Fig A1.4: Location of the rescuers hands for external cardiac (heart) massage.

The rescuer leans directly over the patient and places the heel of one hand (either hand) on the lower half of the patient's breast-bone and places the heel of his other hand on the back of the first (one hand for a child' two fingers for an infant). The fingers should not press on the patient's chest as this would reduce the effectiveness of the pressure on the heels of the hands.

Keeping the arms straight, the rescuer presses down sharply and firmly to depress the patient's breast-bone from 30 to 50 mm in the case of an adult, depending on his build. Immediately release the pressure to allow the chest wall to recoil. If the technique is correctly applied it will not damage the patient's ribs.

If the patient is not breathing, external cardiac (heart) massage will be of no avail unless artificial respiration (expired air method) is carried out at the same time.

If only one rescuer is available, two breaths are given by the expired air method followed by fifteen chest compressions at the rate of approximately one per second.

Where two rescuers are available, one breathes into the patient and the other gives five chest compressions between each chest inflation. The rescuer giving the breaths should also feel for the pulse in the patient's carotid artery during resuscitation.

The chest should not, of course, be compressed at the same time as it is being inflated.

APPENDIX II

TESTING PROCEDURES AND PRECAUTIONS FOR COMMISSIONING OF ELECTRICAL CABLES

The aim of this section is to create an awareness of the latest standards and testing procedures for the commissioning of new and the re-commissioning of repaired electrical cables.

Before commissioning or re-commissioning cables tests must be carried out to ensure the integrity of the cable/s and to ensure the safety of operating personnel.

1. Low voltage Cables

1.1 Initial Tests

Carry out a meter test to ensure that the insulation resistance complies with the manufacture's and the relevant SABS requirements. For L.V. cables a 500V d.c. meter is adequate for this purpose.

1.2 Voltage Tests

This covers extruded solid dielectric cables (covered by SABS 1507), voltage ranges are as indicated in Table 1

After installation the cable has to be tested to ensure the integrity of the cable and the quality of the work. A.C. testing of solid dielectric cables is preferred. Very low frequency high voltage sinusoidal electrical testing methods are recommended to avoid the use of cumbersome large testing equipment.

Method: The test voltage should be applied between conductors and between each conductor and the metallic protection or earthed surroundings of the cable as appropriate. The voltage to be raised gradually to the specified values in the table and maintained for 15 minutes.

Table1 -Test Voltages After Installation

1	2	3	4
Cable operating voltage	The test voltage is to be applied	Test Voltage V	
		a.c. (r.m.s)	d.c.
300/500	Between Conductors and conductors/earth))
600/1000	Between Conductors and conductors/earth))
1900/3300	Between conductors))
1900/3300	Between Conductors and conductors/earth))

2. Medium/High Voltage

Each section of the cable installation between substations shall be subjected to a preliminary voltage or insulation resistance test to prove the insulation resistance.

The installation resistance can be measured with a high voltage meter with a rating of 5000V.

2.1 Paper Insulated Lead covered Double Steel Tape or Wire Armoured Cable (covered by SABS 97), voltage ranges are as indicated in Table 2

The test voltage should be applied between conductors and between each conductor and the metal sheath, which should be held at earth potential. In each case, the voltage should be increased steadily to the stipulated value and maintained at this value for 15 minutes.

Table 2 in-situ test voltages.

1	2	3	4	5	6	7
Age Rating of Cable kV	Test Voltage					
	Belted Cables				Solid-core and screened cables	
	Between conductors		From conductor to sheath		Between conductor and sheath or screen	
	a.c.	d.c.	a.c.	d.c.	a.c.	d.c.
3.3/3.3	7	9	7	9	-	-
3.8/6.6	13	19	8	11	8	11
6.6/6.6	13	19	13	19	-	-
6.35/11	22	31	13	19	13	19
11/11	22	31	22	31	-	-
12.7/22	-	-	-	-	25	36
19/33	-	-	-	-	38	54

2.2 XLPE-Insulated Cables covered by SABS 0198 Part 13.

NOTE: If circumstances necessitate testing that is not in accordance with the recommendations of this section, the cable manufacturer or a test expert should be consulted before any testing is carried out.

The use of inappropriate or excessive test voltages or of unsuitable fault location methods can damage XLPE-insulated cables. Cables that are particularly prone to damage during testing are those that have water trees and those that have a construction that differs from that specified in the 1981 and in subsequent editions of SABS 1339.

The Types of Test Waveforms to be applied are:

- Very low frequency (VLF): An Alternating waveform that is either sinusoidal or pseudo-square/cosine rectangular, of nominal frequency 0,1 Hz.
- Power frequency: An alternating sinusoidal waveform of frequency in the range 25 Hz to 100 Hz.
- Surge: A step waveform that has a rise time of a few microseconds and that gradually decays to zero within 5 s.

These waveforms are referred to in the various test tables below.

Note: Where the capacity of the test set permits, all three cores of a three-core cable may be tested together.

2.2.1 PRELIMINARY TESTS

2.2.1.1 Leakage Resistance. Before carrying out any testing or fault location, determine and accurately record the leakage resistance to earth and, if relevant, between conductors. Use an instrument that generates a d.c test voltage of not less than 250 V and not more than 5 kV. Typical minimum values of leakage resistance are given in Table 3.

TABLE 3—MINIMUM LEAKAGE RESISTANCE

1	2	3	4	5
Cable Operating voltage U , kV	Minimum leakage resistance, $M\Omega$			
	Cable length, m			
	100	300	1 000	3 000
6,6	150	50	15	5
11	240	80	24	8
22	460	153	46	15
33	680	227	68	23

NOTE:

- 1 The value of leakage resistance multiplied by the cable length should not be less than $(2U + 2) M\Omega.km$, where U is the voltage rating of the cable in kilovolt.
- 2 This test is repeated after the required sequence of tests (see 2.2.2.7).

2.2.2 TESTING

- 2.2.2.1 Over voltage Commissioning Tests. When newly installed cables are being commissioned, they should be tested at the test voltages given in Table 4, appropriate to the test waveforms and test durations given in columns 1 and 2 of the table.

TABLE 4—COMMISSIONING TEST VOLTAGES (r.m.s.)

1	2	3	4	5	6
Test waveform (see 2.2)	Duration, Min	Commissioning test voltage, kV			
		Cable Operating voltage, kV			
		6.6	11	22	33
VLF (0,1 Hz)	60	11	19	38	57
Power frequency	60	8	13	25	38

NOTE:

1. Test sets for the above are commercially available.
2. Where the above test levels cannot be achieved, a reduced voltage for an extended time may be negotiated.

- 2.2.2.2 Overvoltage Maintenance/Repair Tests. When cables are tested for maintenance or repair purposes, they should be tested at the test voltages given in Table 5, appropriate to the waveforms and test durations given in columns 1 and 2 of the table.

- 2.2.2.3 Surge Test Method (see Table 5). The surge test is intended to be a practical basic safety test. It can be used as a non-damaging means of identifying fairly serious existing or potential faults when power frequency or VLF equipment is not available. The test avoids the application of a continuous d.c. voltage (see 2.2.2.4), but it is not as conclusive or rigorous as the other methods.

CAUTION: During the surge test, a peak voltage of up to twice the test voltage can be generated in the cable.

Method. Charge the surge generator to the appropriate test voltage given in Table 5. Using single-shot mode, release a surge into the cable and then soft-discharge the cable (see 2.2.5.5) within 5 s. Repeat the procedure up to five times and then fully discharge the cable by solidly earthing it for at least 5 min.

TABLE 5—MAINTENANCE/REPAIRS TEST VOLTAGES (r.m.s.)

1	2	3	4	5	6
Test waveform (see 2.2)	Duration	Maintenance/repair test voltage, kV			
		Cable operating voltage, kV			
		6.6	11	22	33
VLF (0,1 Hz)	15 min	8	13	25	38
Power frequency	15 min	7	11	22	33
Surge test (see 2.2.1.3)	5 surges, max.	7	11	22	33

2.2.2.4 **D.c. Over voltage Testing.** D.c. over voltage testing is likely to cause irreversible damage to XLPE-insulated cable systems, particularly if the cables have water trees. It often fails to identify potentially hazardous conditions in the cable. If d.c. testing has to be carried out because no other test methods are available, the voltage and duration should be limited to the appropriate values given in Table 6, which are recommended for quick identification of gross faults only. Use a d.c. test set or a surge generator in d.c. mode to apply the test voltage. After applying the voltage, soft-discharge the cable (see 2.2.2.5), using either the d.c. test set or a discharge stick. Fully discharge the cable by solidly earthing it for at least 8 h but preferably for 24 h.

TABLE 6—D.C. TEST VOLTAGES

1	2	3	4	5
Duration, s	D.c. test voltage, kV			
	Cable operating voltage, kV			
	6.6	11	22	33
10	6	10	20	30

2.2.2.5 **SOFT DISCHARGE OF CABLE.** An XLPE-insulated cable should always be soft-discharged through a resistance of at least 200 kΩ, for example by using a discharge stick. Discharging a conductor direct to earth by short-circuiting it with a lead can severely damage the cable. After the initial discharge, a cable should be solidly earthed for at least 5 min. If the cable has been subjected to any form of d.c. test, it should be solidly earthed for at least 8 h, but preferably for 24 h.

2.2.2.6 **CABLE SHEATH TESTING.** To avoid problems caused by the ingress of water into the cable, a cable should be subjected to sheath testing:

- a) at commissioning,
- b) annually, and
- c) after the location and repair of a fault.

Cable sheath testing can also be used to locate conductor earth faults that have punctured the outer sheath, provided that multiple sheath faults are not present. A direct current sheath test voltage of 5 kV should be applied for 1 min, with a leakage current of 1 mA/km being regarded as acceptable.

2.2.2.7 **AFTER TESTING.** After completion of any of the above tests, the leakage test described in 2.2.1.1 should be repeated. A tenfold reduction in the value of leakage resistance could indicate a potential problem.

2.2.3 CIRCUIT-BREAKER CLOSURE

2.2.3.1 Faulty or Unknown Cable Conditions. Closing a circuit-breaker on an untested cable can be hazardous to the operator and can damage the cable. A fault should never be re-established by repeated closing of a circuit-breaker.

2.2.3.2 Voltage Doubling. During switch-in onto open circuit, voltage doubling occurs at the remote end of the cable. Voltages of up to 20 kV can occur on an 11 kV system. Switching onto a load such as a transformer avoids this voltage doubling.

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Department of Labour

GUIDE GENERAL ADMINISTRATIVE REGULATIONS, 2003

Chief Directorate of Occupational Health and Safety

NO: OHC 5

INTRODUCTION

As the name of the regulation indicates, the General Administrative Regulations determines the administrative procedure of the Occupational Health and Safety Act. This procedure was not placed in the Act itself owing to the fact that changes can be made to a Regulation with greater ease than that of a Section in the Act. A change to a Section of the Act needs to be passed by parliament whereas the Minister of the relevant Department can approve a change in a Regulation.

The General Administrative Regulations, as is the case with all other regulations, is an extension of the Act and should therefore be seen as a complete unit.

Terms, which were previously defined in the Act, are not redefined in the Regulations. If a specific definition does not appear in the Regulations, then it should be available in Section 1 of the Act.

DEFINITIONS

All new phrases as well as words (expressions and words which differ from the standard dictionary definitions) that are used in this regulation, which have not been defined in the Act, will be defined in this regulation. Where the Act or regulation refers to "mean" the definition in the Act or regulation must be considered and where there's reference made to "It Includes" definition from the Act and regulation including the oxford dictionary must be considered

ACCESS TO PREMISES

It is prohibited for an employer to refuse an inspector entry to perform his or her function because an inspector is entitled by the law to enter employer's workplace.

Employers should always ensure that inspectors are accompanied by a person who has knowledge and experience of the activities and safety requirements of the workplace.

EXEMPTIONS

Any exemption, which has been granted to any person shall be signed by the Chief Inspector of the Department of Labour. An person who wishes to apply for an exemption should forward his/her application to the office of the Chief Inspector in Pretoria. The application for exemption should indicate proof that the health and safety of persons who are likely to be affected by the exemption will not be prejudiced in consequences of it. Health and safety representatives and committees must be consulted during the whole process and given time to comment.

COPY OF THE ACT

Employees together with employers have certain duties and rights, which have been assigned to them in terms of the Act. In order to comply with the provisions of the Act and regulations, each employee must have access to a copy of the Act. This regulation requires that—

- (a) Each employer with 5 or more employees shall have a copy of at least one Act, which will be made readily available for perusal by the employee. Owing in the fact that a workplace can be made up of a very large area, and that the legislator did not intend to be unreasonable, various concessions are made. For example, a meter-reader in the town of Brits' workplace is the Municipal area of Brits. In such a case it is expected that a copy of the Act be made available at the point where the employee reports for duty in the morning, or any other suitable position as agreed upon with the employer.
- (b) Each employer with less than 5 employees, shall, if requested provide a copy of the Act for perusal by the employees. This includes farm workers and domestic servants.

The copy of the Act may be an electronic reproduction or from a library. The Act and Regulations are amended from time to time, and it is therefore important to remember that one must obtain a copy of the latest amendments to keep up to date with the current legislation.

HEALTH AND SAFETY COMMITTEES

The Health and Safety committees are made up of all the Health and Safety Representatives together with an equal amount of employer appointee representatives to represent the employer (there can be more than one committee to avoid a large congregation of representatives). If more than two committees are established, each health and safety representative must be member of at least one of the committees. These committees are the point around which self-regulation revolves.

Employer should provide necessary equipment, facilities and stationary required by the committee in order them to perform their functions.

It is important to keep the records of the meeting as they can be used as evidence for action taken to eliminate hazards and vice versa

NEGOTIATIONS AND CONSULTATIONS BEFORE DESIGNATION OF HEALTH AND SAFETY REPRESENTATIVES

The regulation prescribe the items which must be agreed upon during negotiations between the employer and employees representatives. If a dispute arises between the employees and employers or his authorised representative, the matter should be referred for arbitration. Both parties shall submit a statement within a prescribed period to both the arbitrator and the other party concerned.

The statement is to contain the following information:

- (a) The proposal for the arrangements and procedures for the nomination of the Health and Safety Representatives.
- (b) The decision which is sought.

The arbitrator should then:

- (a) Determine when and where the arbitration procedure shall be held. The arbitration may be held in the absence of the party who failed to submit a statement to the arbitrator and other party;
- (b) Determine whether a pre-hearing conference shall be held;
- (c) Determine which arbitration procedures shall be followed;
- (d) Determine the procedures for the admission of evidence;
- (e) Determine the admissibility of hearsay evidence; and
- (f) Determine other relevant procedural matters.

In terms of Section 17(2) of the Act both parties are to come to a decision within 14 days as to who the arbitrator shall be. If no decision can be made, the president of the Labour Court is to be notified in writing. The president of the Labour Court in consultation with the Chief Inspector shall appoint an arbitrator, whose decision shall be final. This arbitrator will be entitled to receive remuneration as is payable to an additional member of the Labour Court.

DESIGNATION OF HEALTH AND SAFETY REPRESENTATIVES

The employer must designate Health and Safety Representatives as follows:

- Shops and offices— one for up to 100 employees; and
- Workplaces other than shops and offices— one for up to 50 employees.

The employer shall ensure that employees designated as health and safety representatives meet the following requirements:

- Employed in a full-time capacity in the specific workplace or section thereof;
- Acquainted with conditions and activities at that workplace or section thereof, and
- Taking into account the nature of hazards associated with the activities of the workplace or section thereof, the employer shall provide as far as is reasonable practicable health and safety training to the health and safety representatives on how to identify health and safety risks and how to conduct inspections of the workplace or section thereof.

REPORTING OF INCIDENTS AND OCCUPATIONAL DISEASES

Section 24 of the Act refers to certain incidents occurring at the workplace, or in connection with the use of machinery whereby a person dies or is injured to the extent where he is likely to die or could have resulted in a major incident. Such incidents should be reported to the Provincial Director on a WCL 1 or WCL 2 form within seven days.

Certain other types of incidents must be reported to the Provincial Director telephonically, facsimile or similar means of communication and these types of incidents are as follows—

- (a) Where a person, as a result of the incident;
 - i) Dies;
 - ii) Becomes unconscious;
 - iii) Suffers the loss of a limb or part thereof;
 - iv) Is injured to the extent that he is likely to die;
 - v) Is injured to the extent that he is likely to be permanently disabled;
 - vi) Is injured to the extent that he is likely to be off for a period of 14 days or more;
 - vii) Cannot perform his normal duties (those duties for which he was employed).
- (b) An incident of major consequence arising out of the use of industrial equipment or machinery or industrial practices at a workplace.
- (c) The health and safety of any person is endangered and where –
 - i) A dangerous substance was spilled;
 - ii) The uncontrolled release of any substance under pressure (pressure greater than 1 atmosphere) took place;
 - iii) Machinery or any part thereof fractured or failed, resulting in flying, falling or uncontrolled moving objects; or
 - iv) Machines, which ran out of control.

These incidents should also be recorded and investigated in accordance to Regulation 8 of the General Administrative Regulations.

If an injured person is to die as a result of an incident, which has already been reported in terms of the above, the employer or user should report such death to the Provincial Director.

Any registered medical practitioner should, in terms of Section 25 of the Act, report all (to the employer and Chief Inspector) cases of occupational diseases or any other disease, which he believes arose out of a person's employment, which he/she has treated. This must be done within 14 days in the form of a WCL 22 form.

Any other person may in writing, give notice of any disease suspected to be an occupational disease, to the employer and chief inspector.

RECORDING AND INVESTIGATION OF INCIDENTS

The employer or user of machinery should keep record and investigate all incidents referred to in terms of Section 24 of the Act together with any other incident, which resulted in the person concerned having had to receive medical treatment other than first aid.

These incidents must be recorded in the form of Annexure 1 of these regulations and be kept for a period of at least 3 years. This record shall be kept on the premises and available for perusal by an inspector.

The employer, a designated person, a health and safety representative or a member of the health and safety committee must investigate the above-mentioned incidents. This investigation should take place within 7 days from the date of incident and completed as soon as is reasonable practicable or within the contracted period of contract workers. The employer should record the result of the investigation in the Annexure 1. The purpose of the investigation is to establish the cause of the incident together with the safety measures that can be implemented to prevent the re-occurrence of such incidents in the future.

The health and safety committee shall examine this record at their next meeting.

WITNESS AT AN INQUIRY

The chief inspector can, in terms of Section 32, direct an inspector to hold a formal inquiry as a result of an incident reported in terms of Section 24 (refer to Regulation 6). In such an instance, the inspector shall inform the employer or user of machinery of his intentions, and request the following from him/her:

- a) That all persons witness to the incident; and
- b) That any other person as required by the inspector,

be notified in connection with the time, date and venue of the formal inquiry.

The employer or user of machinery is to establish which persons are likely not to attend the inquiry, and shall advise the inspector of the names and addresses of such persons to allow the inspector to subpoena such persons.

RETURNS

An employer or user shall furnish the inspector with such information as requested for the purpose of the Administration of the Act.

(FOR HEALTH & SAFETY ASPECTS ONLY)

The contractor is to add all the important contact information about essentials services, support and assistance.

SERVICE

NUMBER

CONTACT PERSON



Hospital		



Ambulance		



Water		
Electricity		



Police		



Fire Brigade		



Engineer		

ADD OTHER IMPORTANT HEALTH & SAFETY CONTACT DETAILS AS MAY BE FOUND NECESSARY.