

PART B

ELECTRICAL AND MECHANICAL INSTALLATION

ADVENTURE PROVINCE

Eastern Cape

PARKS & TOURISM AGENCY

CLIENT:

EASTERN CAPE PARKS & TOURISM AGENCY

**SPECIFICATION AND BILLS OF QUANTITIES FOR THE ELECTRICAL AND
MECHANICAL INSTALLATION AT DWESA NATURE RESERVE**

(PART B)

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PART B: ELECTRICAL AND MECHANICAL WORK

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6. Proof of registration with Electrical/Mechanical Contracting Board of South Africa
7. LP Gas Installer Registered with SAQCC
8. Registered with CIDB Category 4EB and 2ME or Higher
9. Proof of CIDB grading

ELECTRICAL AND MECHANICAL WORK

NOTICE TO TENDERERS

1. The tenderer for the principal contract shall submit additional information regarding the installer of the Electrical/Mechanical Installation together with the returnable enclosed with the tender enquiry documents
2. The Contractor, on acceptance of his tender for the principal contract shall submit within the period stated, the information indicated on the forms following immediately after the Summary of the bills of quantities for this installation.

SPECIFICATION FOR ELECTRICAL AND MECHANICAL WORK

PART 1 - GENERAL

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PART 1 - GENERAL

1 TESTS

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

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

2 MAINTENANCE OF INSTALLATIONS

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

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

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

3 REGULATIONS

The installation shall be erected and tested in accordance with the Acts and Regulations as indicated in the scope of works

The latest issue of SANS 10142: "Code of Practice for the Wiring of Premises",
The Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended,
The Local Government Act 1998(Act 10 of 1998) as amended and the municipal by-laws and any special requirements of the local supply authority,
The National Building Regulations and Building Standards Act 1996 (Act 29 of 1996) as amended,
The Electricity Act 1996 (Act 88 of 1996) as amended and
The Regulations of the Local Gas Board Where Applicable
The Fire Brigade Service Act 1993 Act 99 of 1987 as amended.

4 NOTICES AND FEES

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

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

5 SCHEDULE OF FITTINGS

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

6 QUALITY OF MATERIALS

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

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

Materials wherever possible, must be of South African manufacture.

7 CONDUIT AND ACCESSORIES

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

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

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

- 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

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

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

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

For light and socket outlet circuits, the conduit used shall have an external diameter of 20mm. In all other instances the sizes of conduit shall be in accordance with the "Wiring Code" for the specified number and size of conductors, unless otherwise directed in part 2 of this specification or indicated on the drawings.

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

Running joints in screwed conduit are to be avoided as far as possible and all conduit systems shall be

set or bent to the required angles. The use of normal bends must be kept to a minimum with exception of larger diameter conduits where the use of such bends is essential.

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

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

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

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

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

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

8 CONDUITS IN ROOF SPACES

Conduit in roof spaces shall be installed parallel or at right angles to the roof members and shall be secured at intervals not exceeding 1,5m by means of saddles screwed to the roof timbers.

Nail or crampets will not be allowed.

Where non-metallic conduit has been specified for a particular service, the conduit shall be supported and fixed with saddles with a maximum spacing of 450 mm. The Contractor shall supply and install all additional supporting timbers in the roof space as required.

Under flat roofs, in false ceilings or where there is less than 0,9m of clearance, or should the ceilings be insulated with glass wool or other insulating material, the conduit shall be installed in such a manner as to allow for all wiring to be executed from below the ceilings.

Conduit runs from distribution boards shall, where possible terminate in fabricated sheet steel draw-boxes installed directly above or in close proximity to the boards.

9 SURFACE MOUNTED CONDUIT

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

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

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

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

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

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

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

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

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

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

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

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

10 CONDUITS IN CONCRETE SLABS

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

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

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

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

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

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

11 FLEXIBLE CONNECTIONS FOR CONNECTING UP OF STOVES, MACHINES, ETC.

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

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

Aluminium and zinc alloy connectors will not be acceptable.

12 WIRING:

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

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

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

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

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

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

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

13 SWITCHES AND SOCKET OUTLETS

All switches and switch-socket outlet combination units shall conform to the Department Quality Specifications, which form part of this specification.

No other than 20 A 3 pin sockets are to be used, unless other special purpose types are distinctly specified or shown on the drawings.

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

14 SWITCHGEAR

Switchgear, which includes circuit breakers, iron-clad switches, interlocked switch-socket outlet units, contactors, time switches, etc., is to be in accordance with the Departmental Quality Specifications which form part of this specification and shall be equal and similar in quality to such brands as may be specified.

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

15 SWITCHBOARDS

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

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

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

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

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

16 WORKMANSHIP AND STAFF

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

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

All inferior work shall, on indication by the Department's inspecting officers, immediately be removed and rectified by and at the expense of the Contractor.

17 CERTIFICATES OF COMPLIANCE

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

18 EARTHING OF INSTALLATION

Main earthing

The type of main earthing must be as required by the supply authority if other than the Departments, and in any event as directed by the Department's representative, who may require additional earthing to meet test standards.

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

Alternatively, or additionally earth rods or trench earths may be required as specified or directed by the Department's authorised representative.

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

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

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

Roofs, gutters and down pipes

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

Sub-distribution boards

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

Sub-circuits

The earth conductors of all sub-circuits shall be connected to the earth busbar in the supply board in accordance with SANS 10142.

Ring Mains

Common earth conductors may be used where various circuits are installed in the same wire way in accordance with SANS 10142. In such instances the sizes of earth conductors shall be equivalent to that of the largest current carrying conductor installed in the wire way, alternatively the size of the conductor shall be as directed by the Engineer. Earth conductors for individual circuits branching from the ring main shall be connected to the common earth conductor with T-ferrules or soldered. The common earth shall not be broken.

Non-metallic Conduit

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

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

Flexible Conduit

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

Connection

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

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

19 MOUNTING AND POSITIONING OF LUMINAIRES

The Contractor is to note that in the case of board and acoustic tile ceilings, i.e. as opposed to concrete slabs, close co-operation with the building contractor is necessary to ensure that as far as possible the luminaires are symmetrically positioned with regard to the ceiling pattern.

The layout of the luminaires as indicated on the drawings must be adhered to as far as possible and must be confirmed with the Department's representative.

Fluorescent luminaires installed against concrete ceilings shall be screwed to the outlet boxes and in addition 2 x 6mm expansion or other approved type fixing bolts are to be provided. The bolts are to be $\frac{3}{4}$ of the length of the luminaires apart.

Fluorescent luminaires to be mounted on board ceilings shall be secured by means of two 40mm x No.

10 round head screws and washers. The luminaires shall also be bonded to the circuit conduit by means of locknuts and brass bushes. The fixing screws are to be placed $\frac{3}{4}$ of the length of the fitting apart.

Earth conductors must be drawn in with the circuit wiring and connected to the earthing terminal of all fluorescent luminaires as well as other luminaires exposed to the weather in accordance with the "Wiring Code".

Bulkhead luminaires are to be screwed directly to outlet boxes in concrete slabs. Against board ceilings the luminaires shall be secured to the bracing or joists by means of two 40mm x No. 8 round head screws.

20 PUMP AND MOTOR DETAILS

Contractor to install pump for borehole as per civil engineers drawing. The pump and motor details should be vansan VSP404/27 with 2.2kw, 220/230 volts power supply and the size of 2" complete pump and motor.

The pump must have complete M521/M531 control box complete with full protection and all required accessories such as Protection functions (overload protection, pump stalled protection, under and over voltage protection), Applications and Control Characteristics (control and protection universal pump, pressure switch to control pump stop and start), and other features such as push-button calibrator and LCD screen displaying pump running status.

This borehole pump is to be powered by solar panels mounted in a free-standing structure.

PART 2: INSTALLATION DETAILS

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PART 2: INSTALLATION DETAILS

1 CABLE SLEEVE PIPES

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

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

2 NOTICES

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

3 ELECTRICAL EQUIPMENT

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

4 DRAWINGS

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

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

5 BALANCING OF LOAD

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

6 SERVICE CONDITIONS

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

7 SWITCHES AND SOCKET OUTLETS

The installation of switches and socket outlets must conform to clause 13 of Part 1 of this specification. All plug points and switches to be Crabtree diamond range, white in colour.

8 LIGHT FITTINGS AND LAMPS

The installation and mounting of luminaires must conform to clause 19 of Part 1 of this specification.

All fittings to be supplied by the Contractor shall have the approval of the Department; all lamps shall bear the approved mark of the SANS, and shall have the British light centre length.

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

9 EARTHING AND BONDING

The Contractor will be responsible for all earthing and bonding of the building and installation. The earthing and bonding are to be carried out strictly as described in clause 18 of Part 1 of this specification and to the satisfaction of the Department's representative.

10 MAINTENANCE OF ELECTRICAL SUPPLY

All interruptions of the electrical supply that may be necessary for the execution of the work will be subject to prior arrangement between the Contractor and the user Department and the Department's representative.

11 SCOPE OF WORK

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

The Works involved and for which the Electrical/Mechanical Contractor must allow is briefly as follows, namely: -

- Liaison with the Supply Authority for Any Alterations to the existing incoming Supply Kiosk including the Switching Off/On of the mains.
- The supply and installation of complete roof-top solar system including the inverters and back-up system.
- The supply and installation of main kiosk and sub distribution boards as detailed in the single line diagrams
- The supply and installation of LV cables from meter kiosk to the main Distribution Board.
- The supply and installation of PVC conduiting and wall boxes where necessary.
- The supply and installation of complete area lighting, lighting and small power outlets as specified and shown on the drawings.
- The supply and installation of the complete lightning protection and other associated earthing systems.
- The supply and installation of the wire ways for cameras, access control and alarm system.
- The supply and installation of cameras, access control and alarm system to be done by specialist
- The supply and installation of LP gas in Chalets and this item to be done by specialist.
- The supply and installation of gas stove complete with cooker-hood to the Chalets.
- The supply and installation of gas bottles complete with gas cage as shown to the drawings.
- The supply and installation of hot water vessels complete with all necessary accessories as detailed and shown on the drawings.
- The supply and installation of fire fighting equipment as shown on the drawings.
- The supply and installation of borehole pump complete with solar panels
- Testing and issuing of the Certificates of Compliance for the overall gas installation
- Testing and issuing of the Certificates of Compliance for the overall electrical installation.
- Testing and issuing of the Certificates of Compliance for the overall lightning protection installation
- Provision of Record drawings and operating and maintenance manuals where required
- Supervision of sleeves crossing the road installed by others
- Demolishing of electrical installation to the existing environmental education centre.

All other materials, equipment, labour and services necessary for the complete, safe and efficient operation of the Works in full accordance with the specifications as laid down in this document.

The following work is excluded and shall be executed by others: -

- Patching and plastering conduit chases (chasing to be carried out and left in a suitable manner).

17 CONDUIT AND WIRING

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

All conduits, regardless of the system employed, shall be installed strictly as described in the applicable paragraphs of clauses 4 to 8 of Part 1 of the specification. Wiring of the installation shall be carried out as directed in clause 9 part 1 of this specification.

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

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

18 ICT INSTALLATION

The Contractor shall allow for the complete installation of all conduits, outlet boxes, ICT Wireways, sleeve pipes, etc., required for the ICT system as shown on the drawings.

End boxes must consist of a 50mm x 100 mm x 100mm outlet box fitted with suitable blank cover plates, flush mounted 0,4m above floor level.

19 EXCAVATIONS AND RELATED WORKS

For further details refer to clause 15 "Low Voltage Cables".

PVC sleeves shall only be installed where the cable installation passes beneath paved walkways / parking area, etc., as indicated on the attached drawings.

The sleeves shall be manufactured from a high-density polyethylene with a double wall construction, allowing a corrugated outer wall finish and a smooth inner wall finish.

20 CABLES

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

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

The cable-trenches shall be excavated to a depth of 0,6m deep below ground level and shall be 300mm wide for one to three cables, and the width shall be increased where more than three cables are laid together so that the cables may be placed at least two cable diameters apart throughout the run. The bottom of the trench shall be level and clean and the bottom and sites free from rocks or stones liable to cause damage to the cable.

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

In the trenches the cables shall be laid on a 75mm thick bed of earth and be covered with a 150-mm layer of earth before the trench is filled in.

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

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

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

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

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

20.1 LAYING, JOINTING AND MAKING OFF OF ELECTRICAL CABLES

[The requirements specified hereafter, are aimed essentially at high tension cable but are also valid for low tension cable, where applicable.]

1. The use of the term "Inspector", includes the engineer or inspector of the Department or an empowered person of the concerned supervising consulting engineer's firm.
2. No cable is to be laid before the cable trench is approved and the soil qualification of the excavation is agreed upon by the Contractor and inspector.
3. After the cable has been laid and before the cable trench is back-filled the inspector must ensure that the cable is properly bedded and that there is no undesirable material included in the bedding layer.
4. All cable jointing and the making off of the cables must only be carried out by qualified experienced cable jointers. Helpers of the jointers may not saw, strip, cut, solder, etc. The cable and other work undertaken by them must be carried out under the strict and constant supervision of the jointer.
5. Before the Contractor allows the jointer to commence with the jointing work or making off of the cable (making off is recognized as half a joint) he must take care and ensure:

- 5.1 that he has adequate and suitable material available to complete the joint properly and efficiently. Special attention must be given to ensure the cable ferrules and cable lugs are of tinned copper and of sufficient size. The length of the jointing lugs must be at least six times the diameter of the conductor,
- 5.2 that the joint pit is dry and that all loose stones and material are removed,
- 5.3 that the walls and banks of the joint pit are reasonable firm and free from loose material which can fall into the pit,
- 5.4 that the necessary coffer-dams or retaining walls are made to stop the flow of water into the joint pit,
- 5.5 that the joint pit is provided with suitable groundsheets so that the jointing work is carried out in clean conditions,
- 5.6 that the necessary tents or sails are installed over the joint pit to effectively avert unexpected rainfall and that sufficient light or lighting is provided,
- 5.7 that the necessary means are available to efficiently seal the jointing or cable end when an unexpected storm or cloudburst occurs, regardless of how far the work has progressed,
- 5.8 that the cables and other materials are dry, undamaged and in all respects are suitable for the joint work or making off,
- 5.9 that the heating of cable oil, cable compound, plumbers' metal and solder is arranged that they are at the correct temperature when required so that the cable is not unnecessarily exposed to the atmosphere and consequently the ingress of moisture (care must be taken of overheating)

Flow temperatures of cable oil and compound must be determined with suitable thermometers. Cable oil and compound must not be heated to exceed the temperatures given on the containers and precaution must be taken to ensure that the tin is not overheated in one position. The whole mass must be evenly and proportionally heated.

(Temperatures of solder and plumbers' metal may be tested with brown paper (testing time: 3 seconds). The paper must colour slightly - not black or burnt).

6. Before the paper-insulated cables are joined, they must be tested for the presence of moisture by the cable jointers test. This consists of the insertion of a piece of unhandled insulated impregnated paper tape in warm cable oil heated to a temperature of $130 \pm 5^{\circ}\text{C}$.

Froth on the surface of the oil is an indication that moisture is present in the impregnated insulation and the amount of the froth gives an indication of the moisture present.

7. If the cable contains moisture or is found to be otherwise unsuitable for jointing or making of the inspector is to be notified immediately and he will issue the necessary instruction to cope with the situation.
8. The joint or making off of paper insulated cables must not be commenced during rainy weather.

9. Once a joint is in progress the jointer must proceed with the joint until it is complete and before he leaves the site.
10. The jointer must ensure that the material and his tools are dry at all times, reasonably clean and absolutely free from soil.
11. Relating to the jointing of the cable the following requirements apply:
 - 11.1 All jointing must be carried out in accordance with recognized and tried techniques and comply strictly with the instructions given by the supplier of the jointing kit.
 - 11.2 The cables must be twisted by hand so that the cores can be joined according to the core numbers. If necessary, the cable is to be exposed for a short distance to accomplish this. Under no circumstances may the cores in a joint be crossed so as to enable cores to be joined according to the core numbers. If it is not possible to twist the cables so that the preceding requirements can be met, then cores are to be joined in the normal way without any consideration of the core numbers.
 - 11.3 Normally the cables will have profile conductors. The conductors shall be pinched with gas pliers to form a circular section, bound with binding wire so that they do not spread, and then tinned before jointing.
 - 11.4 Jointing ferrules, the length of which are at least 6 times the diameter of the conductors, must be slid over the conductor ends to be joined and pinched tightly. Then they are soldered by means of the ladle process whilst being pinched further closed.

Use resin only as a flux. The slot opening in the ferrule must be completely filled, including all depressions.

Remove all superfluous metal with a cloth dipped in tallow. Work during the soldering process must be from top to bottom. Rub the ferrule smooth and clean with aluminium oxide tape after it has cooled down to ensure that there are not any sharp points or edges.

NB: The spaces between the conductor strands must be completely filled by soldering process and must be carried out quick enough to prevent the paper insulation from burning or drying out unnecessarily.
 - 11.5 After the ferrules have been rubbed smooth and clean, they and the exposed cores must be treated with hot cable oil (110°C) to remove all dust and moisture. These parts are to be thoroughly basted with the oil.
 - 11.6 The jointer must take care that his hands are dry and clean before the joint is insulated. Also, the insulating tape which is to be used must first be immersed in warm cable oil (110°C) for a sufficient period to ensure that no moisture is present.
 - 11.7 After the individual cores have been installed, they must be well basted with hot cable oil and again after the applicable separator and/or belt insulation tape is applied before the lead joint sleeve is placed in position.
 - 11.8 The lead joint sleeve must be thoroughly cleaned and prepared before it is placed on the cable

and must be kept clean during the whole jointing process. Seal the filling apertures of the sleeve with tape until the sleeve is ready for compound filling.

- 11.9 The plumbing joints employed to solder the joint sleeve to the cable sheath, must be cooled off with tallow and the joint sleeve is to be filled with compound while it is still warm. Top up continuously until the joint is completely filled to compensate for the compound shrinkage.
- 11.10 The outer joint box must be clean and free from corrosion. After it has been placed in position it must be slightly heated before being filled with compound. Top up until completely full.
12. As far as cable end boxes are concerned the requirements as set out above are valid where applicable.

21. DISTRIBUTION BOARDS

All electrical distribution boards shall be purpose made boards; supplied and installed in accordance with the attached Standard Technical Specifications and the single line diagrams and shall comply with SANS 10142.

All circuit breaker sizing and design has been done using CBI specifications for Heinemann 5 kA breakers.

Each DB shall have sufficient ways for each circuit neutral and each circuit earth wire. Doubling up of circuits will not be accepted. Each DB shall have 20% additional spare space for future circuits.

All Main Switches shall be clearly marked "MAIN SWITCH" and the necessary warning labels installed at the switch.

All circuit breakers for mechanical equipment to be of D curve type with orange handle.

Each section of the DB shall be provided with a legend card holder with a clear Perspex front. Each circuit breaker shall be clearly numbered in accordance with the single line diagrams. Corresponding numbers and circuit descriptions shall be clearly printed or typed on the legend cards.

Where existing DB's are to be modified to accommodate new switchgear, such work shall be neatly carried out and paint work reinstated on completion.

Sufficient matching paint shall be provided to allow for the touching up of scratches etc. encountered on site.

In addition to clause 14 and clause 15 of Part 1 of this specification the following shall be applicable to switchboards required for this installation.

Refer to the Summary of Switchgear and Circuits for the minimum fault level rating of specified equipment.

22 SCHEDULE OF LIGHT FITINGS

The Departmental Quality Specification for the relevant luminaires must be included in Part 3 of the specification.

The light fittings and accessories are to be according to the quality specifications in Part 3 and shall be approved by the Department.

- Type A: LED Track Light Fitting with Two Spot Lights
- Type A2: LED Track Light Fitting with Three Spot Lights
- Type OP: 2 X 18W LED lamps, 1200 long, Open Chanel Fluorescent Light fitting.
- Type U/D: Up and Down Facing, Outdoor Wall Mounted Stainless Steel Light Fitting
- Type D: 1 X 13W CFL, Aluminum Reflector, Flush Mounted Downlight Fitting.
- Type BL: 29W LED Bollard Luminaire
- Type P: 50W LED Postop Light Fitting

23 SCHEDULE OF CABLES, CONDUIT AND WIRING

Supply, install and connect the following cable, conduit and wiring:

FROM	TO	SIZE AND TYPE
Existing Kiosk	Kiosk 2	25mm ² 3-core PVC SWA PVC cable and 16mm ² earth wire
Kiosk 2	Kiosk 3	25mm ² 3-core PVC SWA PVC cable and 16mm ² earth wire
Kiosk 2	DB-EDC	10mm ² 3-core PVC SWA PVC cable
Kiosk 2	DB-CS	10mm ² 3-core PVC SWA PVC cable
Kiosk 3	DB-CH2&CH4	10mm ² 3-core PVC SWA PVC cable

24 SCHEDULE OF DISTRIBUTION BOARDS

BOARD	TYPE	FAULT LEVEL	LOAD kW
Kiosk 2	Free standing (grey/Sand)	5	17.3
Kiosk 3	Free standing (grey/Sand)	5	14.4
DB-EDC	Surface mounted (white)	2.5	6.7
DB-CS	Surface mounted (white)	2,5	2.6
DB-CH2	Surface mounted (white)	2.5	3.2 X 2
DB-CH4			4.2 X 2

25 SCHEDULE OF SWITCHGEAR AND CIRCUITS

The single line diagrams show all circuits and types of switchgear are as shown to the drawings.

26 LIGHTNING PROTECTION

GENERAL SPECIFICATION

1. SATISFACTORY INSTALLATION

The whole of the installation shall be carried out in accordance with:

- (a) The latest SANS Code of Practice for the Protection of Structures against Lightning – SANS 03, SANS 61024-1, 61024-1-1, SANS 61312-1, SANS 61662 & NRS 042
- (b) The Municipality By-Laws and any other special requirements as deemed necessary by the Local Supply Authority;
- (c) Local Fire Regulations.

2. S.A.N.S. APPROVED DRAWINGS

SANS Approved drawings are not required for this project.

3. TEST ON COMPLETION

Upon completion of the lightning protection system, the following tests shall be witnessed by an appointed representative of the Employer. The results shall be recorded on suitable test certificates which must be signed by both the Contractor and the Employers representative. A sketch must be included on each test certificate indicating the positions of each electrode in relation to some permanent reference point. It must also indicate the positions at which tests were carried out, the type of test and the results of these tests.

3.1 Earth Resistance Test

The Earth Resistance Test shall involve measuring the resistance to earth of each rod-type electrode, or group of rod type electrodes, or trench earth which would normally be connected to one down-conductor or earth terminal. This test must be made with the electrodes completely disconnected from any part of the structure or lightning protection system.

Electrical Continuity Tests

(a) External Down-Conductors

Electrical continuity between the lower ends of external down-conductors which must all be disconnected from the earthing system during the test shall not exceed 1 (one) ohm.

(b) Metallic Services

Electrical continuity between any metallic structures of service (e.g. rainwater pipes) which form an

integral part of the lightning protection system shall not exceed 1 (one) ohm. These tests should be carried out with all other components of the lightning protection system disconnected from the component being tested.

4. DESCRIPTION OF MATERIAL

4.1 Air Terminals and Down-conductors

All conductors must be in accordance with the requirements of BSS 1474 or American Standards Specification 6063. All aluminium conductors shall have a cross-section area of not less than 30mm² (domestic dwelling only) or 50mm² for all other applications. The dimensions of flat section conductors to be 20mm x 3mm. Where conductors are mounted in stand-off guides, the cross-section area of the conductor must be not less than 70mm² to give adequate mechanical strength.

4.2 Conductor Guides

The conductor must be mounted in aluminium alloy guides conforming with the material specification given in 4.1 above. The guides must allow for free longitudinal movement of the conductor to cater for expansion and contraction of the system caused by temperature variation. The minimum thickness of any part of the guide shall not be less than 3mm. The guides must be securely attached to the structure using two stainless steel screws and plugs, the use of plated screws is not permitted.

The conductor system shall be supported in guides so that an air gap exists at all times between the aluminium and the surface of the structure, the guides being seated upon plastic or other similar insulation material. Should conductors be installed directly upon the surface of concrete or cement plaster, an insulating strip is to be installed over its whole length to prevent contact between the two surfaces. Guides shall be installed to support the conductor at intervals no exceeding 1,2 meters horizontally or 1,5 meters vertically.

N.B. No part of an aluminium conductor system must be allowed to come into direct contact with concrete or cement plaster as this may cause the aluminium to corrode.

4.3 Expansion Loops

Where conductors are installed horizontally without deviation from a straight line over long distances, expansion loops must be provided at distances not exceeding 30 meters. These expansion loops must have a cross-sectional area which is at least equal to that of the conductor.

4.4 Protection of Down-conductors

Where external down-conductors are installed in areas which are readily accessible to the public, the lower ends of the conductors shall be enclosed in a semi-rigid insulating material. In the case of a circular section conductor this shall comprise a 2-meter length of 20mm diameter P.V.C. conduit. This conduit shall be securely attached to the wall by means of galvanized steel saddles fixed with stainless steel screws and plugs, spaced at intervals not exceeding 1m. Where a flat section conductor is used this shall be covered by a similar length of 25mm P.V.C. conduit. The lower end of the conduit shall be positioned as close as practicable to ground level, i.e., immediately above an aluminium to copper joint. The ends of the conduit shall not be sealed.

4.5 Earthing Electrodes

Earthing electrodes must consist of either copper-clad steel rods not less than 12mm in diameter and having a minimum copper thickness of 0,20mm driven into the ground, or a 50mm² (35mm² for domestic dwellings) bare copper conductor buried in a trench, or a combination thereof. Where copper clad steel electrodes are used, they must have a suitable bond between the steel core and copper exterior to prevent moisture ingress between the two metals.

Where it is necessary to extend earth rods, an electrolytically compatible corrosion resistant, coupling device, which prevents ingress or moisture into the joint shall be used. The copper conductor below the down-conductor joint shall be covered by a semi-rigid P.V.C. conduit for a distance of approximately 200mm above ground and 400mm below ground.

4.6 Joints Above Ground

Circular section aluminium conductors shall be joined by aluminium ferrules or lugs which are securely crimped into place. Aluminium lugs must be bolted together using 10mm diameter aluminium bolts and washers. The material specification for these components must conform with that laid down in paragraph 4.1. Alternatively, heavily tinned copper lugs and ferrules may be used. The lugs should be joined together by means of 10mm diameter copper, brass or bronze bolts and washers. Care should be taken to inhibit corrosion where dissimilar metals are used by thoroughly cleaning the surfaces of the metal before assembly and subsequently sealing the joint with an inert tenacious compound or tape.

Flat section aluminium conductors shall be joined by double riveting, using aluminium rivets which comply with the material specification laid down in 4.1. Alternatively, 2 x 6mm diameter stainless steel bolts, nuts and washers may be used. Fold over type bends will not be permitted.

Down-conductors are to be terminated approximately 200mm above finished ground level. Circular section aluminium is to be jointed to a 50mm² (35mm² in the case of domestic dwellings) stranded copper conductor by securely crimping in place two heavily tinned lugs and bolting these together using 10mm diameter copper, brass or bronze nuts, bolts and washers.

N.B.: Under no circumstances shall aluminium conductors be buried in the ground

4.7 Joints Below Ground

A joint in the standard copper conductor which forms part of the earthing system must be made by using a crimped copper ferrule clamping (not lugs) using two copper line taps of suitable dimensions, or exothermic welding.

The copper earth conductor must be joined to an earth rod by either clamping, using a standard earth rod clamp or copper line tap or by exothermic welding. Joints which are made between dissimilar metals (i.e., copper conductor to galvanized steel water main), must be thoroughly cleaned before assembly. They shall be rendered watertight using waterproof adhesive tape on a suitable compound for a minimum distance of 200mm in all directions from the joint.

4.8 Bonds

Where it is necessary to bond the aluminium conductor to any other metallic surface, this must be done by bolting or riveting. When attaching aluminium to a dissimilar metal the joints are to be thoroughly cleaned and sealed to prevent corrosion.

5. GENERAL INSTALLATION PROCEDURE

5.1 **Air Terminals for Non-metallic Pitched Roofs**

Aluminium conductors are to be installed along all ridges of roofs and projections such as dormer windows, etc., terminating at the ends with conductors running downwards over the surface of the roof and the eaves. Non-metallic chimneys must be protected by means of a finial of sufficient length to cover the chimney within a 45°-angle struck downwards from its point. Alternately it should have a conductor installed in the form of a closed loop upon the upper surface. The conductors are to follow the outer contour to the stack and must be bonded at a convenient point to the nearest component of the air terminal system.

N.B.: This bond may run in a horizontal or downward direction, but under no circumstances must any part of it run above horizontal.

Conductors may be dead-ended (i.e. have one end free and unbonded), providing that the length of such a conductor does not exceed 10 meters and that the unbonded end is either at the same level or higher than the bonded end. This technique may be used where ridge conductors are installed over dormer windows, etc.

In all cases where metallic gutters have been installed along the eaves of a pitched roof, these must be bonded to the air terminal system. Where metallic gutters do not exist, however, a conductor must be installed over the surface of the roof at eaves level to which the remainder of the air terminal system is to be bonded, with the following exceptions:

- (a) Where the maximum distance from the ground level to the eaves of the building is less than 4 meters and the pitch of the roof is more than 1 in 2 (27° from the horizontal).
- (b) Where the maximum distances from ground level to the eaves is less than 7 meters and the pitch of the roof is more than 1 in 1,5 (34° from the horizontal).
- (c) Where the distance from the ground level to the eaves is more than 7 meters and the pitch of the roof is more than 1 in 1 (i.e., the included angle at the apex of the roof is less than 90°).

Under these circumstances eaves conductors need not be installed.

Any non-metallic objects which protrude above the general roof lines, such as Cape Dutch gable ends, must be protected as described above with a suitable air terminal system. Any metallic objects which protrude above the general roof line such as hot water expansion pipes must be bonded as directly as possible to the nearest eaves conductor, gutter or other part of the lightning system.

N.B.: These bonding conductors must run in a horizontal or preferably a downward direction, from the vent pipe, etc, to the lightning protection system.

5.2 **Air Terminals for Metallic Pitched Roofs**

Buildings with roofs covered with electrically continuous metal sheets do not require separate air terminals but must be earthed via down conductors generally as described in 5.6 and 5.7. Any non-metallic objects projecting above the general roof line must be separately protected as described in 5.1 and bonded to the metal roof covering.

5.3 **Air Terminals for Non-metallic flat or Mono-pitched Roofs**

For flat or mono pitched roofs of non-metallic construction the air terminal system must consist of aluminium alloy conductors installed around the outer perimeter of each section of the roof structure. These conductors must be installed on top of parapet walls if these exist. Lift motor rooms, tank rooms, penthouses, etc., which protrude above the general roof line must have air terminal conductors installed around the outer perimeter of each roof slab or parapet wall. Any metallic objects which protrude above the roof line, such as expansion pipes, signs, flag poles, handrails, etc., must be bonded directly to the nearest component of the lightning protection system as described in 5.1.

N.B: It is not permissible for the ends of conductors to be bonded directly to the perimeter air terminal system if the latter is installed upon a parapet wall having a height exceeding 500mm above roof slab level. In these circumstances the conductors are to be bonded directly to the down conductors.

5.4 **Air Terminals for Non-metallic flat or Mono-pitched Roofs**

Metallic flat or mono pitched roofs do not require separate air terminal conductors, providing that there is electrical continuity between the metallic roofing sheets, (see 5.2). A metallic roof surrounded by a non-metallic parapet wall shall have conductors installed at the top of the parapet wall and these must be bonded to the metallic roof at intervals not exceeding 20 meters. If the parapet wall is clad with metal over its upper surface or a handrail is installed which affords good electrical continuity, separate air terminal conductors need not be installed. Under these circumstances the metal handrail or cladding must be bonded to the metal roof covering at intervals not exceeding 20 meters.

All non-metallic covering such as slates, tiles, asbestos cement sheeting, etc., supported by a steel structure being electrically continuous throughout may be treated as being of a complete metal construction. In these circumstances no separate air terminal system need be installed providing the steel roof structure is bonded to earth at intervals given in 5.5.

5.5 **Down Conductors for Non-metallic Structures**

Down conductors must be installed at regular intervals around structures and to run as directly as possible between the air terminal and earthing system. They must, where practicable, be positioned at the external corners of the structure. The maximum separating distance between down conductors around the perimeter of the structure must not exceed 30 meters. In the case of very tall buildings having a slender base, (i.e. chimney stacks, water towers, etc.) a minimum of two down conductors must be installed.

The lower ends of down conductors are to be terminated and bonded to the earthing system approximately 200mm above finished ground level. Under no circumstances must aluminium conductors be buried underground. Test joints must be provided between the down conductors and earthing system. Down conductors must run vertically between the air terminal and earthing systems. Where this is impracticable, their course may be deviated to run at any angle up to and including horizontal.

Where it is necessary to run conductors horizontally over the upper surface of a structural protrusion, such as an exposed concrete slab, the conductor may run down vertically over the edge of the slab and return to the main structure, so that the distance between the upper and lower conductors exceeds one third of the length of the horizontal run. Looped down conductors are not permitted. Down conductors must not run over the underside of large overhangs which are less than 6 meters above ground level, or other areas where people are likely to be present during a thunderstorm.

External or internal metallic rainwater pipes may be used as down conductors providing these are of substantial section and are joined by screwing one length into another or welding. Thin gauge galvanized steel pipes whose sections are held together by friction, rivets or screws must not form part of a lightning protection system.

5.6 **Down conductors for reinforced concrete framed structures**

The steel reinforced of this type of structure may be used in place of down conductors. Where the reinforcing system is used, the air terminal system must be bonded to it a maximum of 30-meter intervals using steel clamps. This bond may be achieved by clamping, with steel clamp, a steel conductor to a selected reinforcing bar, the opposite end of this conductor must terminate at a corrosion resistance metallic terminal such a Grade 316 stainless steel.

The reinforced system of prefabricated concrete buildings must not be used unless special provision is made for bonding the various prefabricated sections together.

The terminals should be mounted flush with the face of the concrete. An aluminium alloy bond must then be taken from the air terminal system and be connected to the stainless-steel terminal by means of a heavily tinned crimp lug for circular section aluminium, or a suitable bi-metallic joint in the case of flat section aluminium. A similar system must be used to bond the reinforcing system at ground level to the earthing system at points directly below the air terminal bonds. Here copper conductors must be used as the external bonding material.

Under no circumstances must copper or other non-ferrous material be allowed to come to contact with steel reinforcing bars, as this may cause severe corrosion and subsequent structural damage. The lightning protection system must not be bonded to any part of the structure which is electrically isolated from the remainder of the building, i.e. cantilevered sections. In these circumstances, or where it is otherwise impracticable to use the reinforcing system, external down conductors must be installed as described in 5.5.

5.7 **Down conductors for steel framed structures**

Where the framework of a building is constructed of structural columns, these may be used in place of down conductors providing the separating distance between them does not exceed 30 meters. The upper ends of the columns must be bonded to the air terminal systems and the lower ends to the earthing system.

5.8 **Earthing by means of vertically installed rod type electrodes**

Rod-type electrodes must be driven into the ground at a position directly below each down connector. The maximum earthing resistance of each electrode or number of electrodes bonded to any one down conductor shall not exceed $N \times 30$ ohms, where N equals the total number of down conductors which are bonded to a common air terminal system or 200 ohms whichever is the lower value.

The minimum horizontal separating distance between rod-type electrodes bonded together must not be less than their installed depth. The upper ends of installed rod-type electrodes are to be terminated approximately 500mm below finished surface level. A 50mm² copper bonding conductor must be installed to run between each earthing electrode system and the lower ends of the adjacent down conductors.

A joint is to be made between each of these bonding conductors and the down conductors at a position approximately 200mm above finished ground level. These bonding conductors must be installed in P.V.C. conduit

securely affixed to the wall (see 3.4). The length of this P.V.C. conduit must be approximately 600mm and must be installed so that approximately 200mm protrudes above ground level, the remainder being buried into the soil.

5.9 **Earthing by means of metallic water mains**

Where two or three down conductors are installed the water mains may serve as an earth terminal for one of these. Where three or more down conductors are installed the water, mains serve as an earth terminal for two of these. Regardless of whether the water mains are used as an earth terminal or not, the incoming metal water pipe must be bonded to the lightning protection earthing system underground.

5.10 **Earthing by means of trench type electrodes**

Where the soil conditions prevent the satisfactory installation of rod-type electrodes, a trench earth system must be installed. This method is to comprise a 50mm² stranded copper conductor installed horizontally into a trench at a depth of 500mm below finished ground level. The conductor is to follow the general outline of the structure to be protected and be installed 1 meter away from the outside walls. Where the building stands on rocky ground, the trench earth may be attached to the lower part of the wall in areas where rock protrudes through the soil. The conductor must, however, be buried wherever possible as described above.

Each down conductor must be bonded to the trench earth system as directly as possible by means of a copper conductor.

Trench earth systems must have a maximum earth resistance of 30 ohms. An isolated length of trench earth mat must be bonded to the down conductor system in such a way as to reduce the length of dead-ends to the minimum.

Should trench earths be installed beneath pathways where people are likely to be present during a thunderstorm, a plastic, bitumastic or ceramic pipe must be installed having a length similar to the width of the pathway and the trench earth conductor run inside it.

N.B: The maximum useful length of a dead-ended trench earth is 80 meters

27 SPECIFICATION FOR FIRE PROTECTION

27.1 According to SANS 10400-T requirements the fire protection system for Dwesa Nature Reserve are portable fire extinguishers.

Fire-fighting equipment or protection system shall be installed and maintained as to be ready for their purpose at all times. The position of fire-fighting equipment should be clearly marked and be visible at all times and comply with the requirements in SANS 1186-1.

- Fire protection design shall comply with SANS10400-T
- Portable fire extinguisher in a building shall comply with the requirements of SANS 10400-T, installation, maintenance, and service shall comply with SANS 1475-1 and SANS 10105-1.

27.2. Portable fire extinguisher shall bear a certification mark from an accredited certification body.

28 LP GAS INSTALLATION IN CHALETS

- 28.1. There will be 2x19Kg gas bottles connected to four x four stock pot burner gas stove. The height of the gas stove must be 700-1100mm and the diameter for the plate must be 250-500mm diameter. The gas bottles have to be placed outside but closer to the kitchen. A dual manifold with change-over valve shall be installed and connected to the manifold.
- 28.2. The manifold and bottles shall be housed in a galvanised, expanded metal cage constructed with hinged pad lockable doors for ease of replacing the bottles. The cage shall be firmly bolted to the wall.
- 28.3. The gas piping shall be installed between the manifold and the gas stove overhead below the ceiling.
- 28.4. The gas copper pipes must be according to SANS 460 Class 2. An emergency isolation valve must be placed in a practical position in the main line complete with 11 manifolds. The gas stove isolation valve must be installed or positioned behind the stove. The flexible hose from the isolation valve to the stove must not exceed 2m. The gas system must be colour coded and the signage must be as per SANS10087-1 2013. COC must be provided on completion of the installation. The LP Gas installer must be registered with SAQCC.

PART 3: QUALITY SPECIFICATION FOR MATERIALS AND EQUIPMENT OF ELECTRICAL AND MECHANICAL INSTALLATIONS

“Part 3: Quality specification for materials and equipment” manual of the Department of Public Works is applicable for this Contract and the manual can be obtained from the Department of Public Works.

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PART 4: BILLS OF QUANTITIES

GENERAL NOTES/PREAMBLES

1 Conditions of Contract

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

2 Descriptions

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

3 Unit Rate

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

4 Ordering

The bills of quantities shall not be used for ordering purposes. The Contractor shall check the lengths of cables and overhead conductors, as well as all other items described, on site before ordering. Any allowance for off-cuts shall be made in the unit rates.

5 Value Added Tax

The rates shall exclude value added tax and the total carried over to the final summary in Part A.

6 South African Manufacture

All materials covered by this specification shall, wherever possible, be of South African manufacture.

7 Provisional Sums

Where Provisional Sums are allowed, these shall be expended only as directed by the Client or the Client's Representative and any balance remaining shall be deducted from the amount of the Sub-contract sum. No work for which Provisional Sums are provided shall be commenced without written instructions from the Engineer.

All Provisional Sums may be utilised in full or in part. These Provisional Sums may be deleted in full or in part if not required.

BILL SUMMARY – DWESA NATURE RESERVE - COST FOR ELECTRICAL & MECHANICAL INSTALLATION		
	Description	Amount
	Bill N° 1 - Cables	
	Bill N° 2 - Distribution Bards and Switchgears	
	Bill N° 3 - Luminaires	
	Bill N° 4 - Switches and Sockets Outlets	
	Bill N° 5 - Conductors and Wireways	
	BILL N° 6 - Earthing and Lightning Protection	
	BILL N° 7 – Mechanical Items	
	BILL N° 5 - Provisional Sums	
	SUB - TOTAL	
	Preliminary and Generals	
	SUB - TOTAL CARRIED TO SUMMARY PAGE (EXCLUDING VAT)	

PART 5: ANNEXURES

ANNEXURES

The following annexures are to be completed and submit together with the tender.

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Annexure	Description	Page Number
A	Schedule of Proposed Sub-Contractors	A.1
B	Similar Types of Installations	B.1
C	Details of Installation Electrician	C.1
D	Registration as Electrical/Mechanical Contractor	D.1
E	Schedule of Equipment	E.1 – E2

ANNEXURE A

SCHEDULE OF SUB-CONTRACTORS PROPOSED BY THE TENDERER

PROJECT NAME: DWESA NATURE RESERVE – ELECTRICAL AND MECHANICAL INSTALLATION

The Tenderer shall state hereunder the names and particulars of all sub-contractors he proposes to employ on the Works. He shall also define the duties and relevant experience of each sub-contractor listed.

NAME OF SUB-CONTRACTOR	CONTACT NUMBER	PROPOSED DUTIES	EXPERIENCE

SIGNATURE OF TENDERER

DATE

ANNEXURE B

SIMILAR TYPES OF INSTALLATIONS CARRIED OUT BY THE TENDERER

PROJECT NAME: DWESA NATURE RESERVE– ELECTRICAL AND MECHANICAL INSTALLATION

The Tenderer shall list below all similar works carried out by him including Client details and value of the Works. Please state below brief details of all projects completed during the past 5 years. Failure to comply may invalidate the tender.

NAME OF CONTRACT	YEAR	CLIENT	CONSULTING ENGINEER	CONTRACT PERIOD	VALUE [R]

SIGNATURE OF TENDERER

DATE

ANNEXURE C**DETAILS OF INSTALLATION ELECTRICIAN****PROJECT NAME: DWESA NATURE RESERVE– ELECTRICAL INSTALLATION**

I/We certify that: -

Is a registered installation electrician in terms of the Occupational Health and Safety Act (Act 85 1994 and is permanently employed by my/our company trading as:

I/We further certify that the abovementioned person will be appointed as the responsible person in charge of the installation, which person shall personally supervise the whole of the electrical works as tendered for from inception to completion inclusive of signing all commencement / completion / cost certificates necessary as part of the Works.

I/We further certify that I/We am/are fully aware of the provisions of the Occupational Health and Safety Act (Act 85 1994), and that my/our company is trading as a registered electrical contracting organisation.

SIGNATURE OF
INSTALLATION
ELECTRICIAN:

DATE: _____

REGISTRATION
NUMBER OF
INSTALLATION
ELECTRICIAN

DATE: _____

COMPANY STAMP:

NOTE: it is an offence to employ a registered single-phase electrician on a poly-phase installation and it may be necessary to submit a certified copy of the licence of the person to be employed on any poly-phase project

SIGNATURE OF TENDERER

DATE

ANNEXURE D**REGISTRATION AS ELECTRICAL/MECHANICAL CONTRACTOR****PROJECT NAME: DWESA NATURE RESERVE – ELECTRICAL/MECHANICAL INSTALLATION**

The Tenderer must be registered as an Electrical/Mechanical Contractor with the Electrical/Mechanical Contracting Board of South Africa and must also be registered with the Workmen's Compensation Commissioner and the Unemployment Insurance Commissioner to qualify for this tender.

Tenderers must complete the following questionnaire and submit it with this tender.

Has the company been registered with the Electrical Contracting Board of South Africa?

YES / NO

Registration no:

Date of issue :

b) Has the company been registered with the Department of Manpower for the following:

i) The Workmen's Compensation Commissioner YES / NO

Registration no:

Date of issue:

ii) The Unemployment Insurance Commissioner. YES ? NO

Registration no:

Date of issue:

I / We certify that the above information is correct

Signature:

Name of Signatory:

Name of Firm represented:

Address:

Date:

NOTE: IN TERMS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND ELECTRICAL INSTALLATIONS REGULATIONS, FAILURE TO COMPLY WITH THIS CLAUSE OF THE SPECIFICATION MAY RESULT IN DISQUALIFICATION AND REJECTION OF THE TENDER.

SIGNATURE OF TENDERER

DATE

ANNEXURE E

SCHEDULE OF EQUIPMENT

PROJECT NAME: DWESA NATURE RESERVE – ELECTRICAL AND MECHANICAL INSTALLATION

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

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.

Item	Material	Make or trade name	Country of origin	SABS
1	Distribution boards			
2	Circuit breakers 1P, 2P, 3P			
3	Contactors 1P, 2P, 3P			
4	Earth leakage relays 1P & 3P			
5	Daylight sensitive switch			
6	Conduit			
7	Conduit boxes			
8	Surface switches			
9	Watertight switches			
10	16A single/duo flush socket outlets			
11	16A single/duo dedicated socket outlets			
12	20A DP rotary isolator switch			
13	Weather proof enclosure			
14	Luminaires: Type P			

Item	Material	Make or trade name	Country of origin	SABS
15	Luminaires: Type A			
16	Luminaires: Type A2			
17	Luminaires: Type U/D			
18	Luminaires: Type PT			
19	PVC SWA cable			
20	Metal Detector			
21	Earth Rods			
22	Finials (lightning protection)			
23	Roof and down conductors (lightning protection)			
24	Fire Extinguishers			
25	Gas Stove			
26	Cooker Hood			
27	Solar Geyser			
28	Undercounter Geyser			
29	Pump for Borehole			
30				

NOTE: Under no circumstances will the tenderer be permitted to deviate from the materials specified above unless agreed in writing, by the Engineer, prior to award of tender.

SIGNATURE OF TENDERER

DATE

PART 6: DRAWINGS

Drawings listed below, whether separate or bound into the document, form part of the complete tender specification issue and are to be read in conjunction with the rest of the document.

DRAWING NO	REVISION	DESCRIPTION
EL020/LP, ICT, FF	0	CURIO SHOP
EL020/LP, FF	0	2 SLEEPER
EL020/LP, FF	0	4 SLEEPER
EL020/LP, ICT, FF	0	ENV EDU CENTER
EL020/LPG&DW	0	2 SLEEPER
EL020/LPG&DW	0	4 SLEEPER
SLD 01	0	DB-CS
SLD 02	0	DB-EDC
SLD 03	0	DB – CH2
SLD 04	0	DB – CH4
SLD 05	0	KIOSK 3
SLD 06	0	KIOSK 2

PART 7: RESPONSIVE CRITERIA

Certified copy of CK document
Certified copies of Identity Documents members
Valid original Tax Clearance Certificate
Certified copy of valid Wiremen's Licence
Certified copy of BBBEE Certificate
Proof of registration with Electrical Contracting Board of South Africa
Letter of good standing from the Compensation Commission
Registered with CIDB Category 4EB and 2ME or Higher
Proof of CIDB grading
LP Gas Installer Registered with SAQCC

CERTIFIED COPY OF CK DOCUMENT

**CERTIFIED COPY OF IDENTITY
DOCUMENTS MEMBERS**

TAX CONFIRMATION CERTIFICATE

**CERTIFIED COPY OF WIREMEN'S
LICENCE**

**CERTIFIED COPY OF BBBEE
CERTIFICATE**

**PROOF OF REGISTRATION WITH
ELECTRICAL/MECHANICAL
CONTRACTING BOARD OF SOUTH
AFRICA**

**LETTER OF GOOD STANDING FROM
THE COMPENSATION COMMISSION**

**PROOF OF REGISTRATION WITH
CIDB**