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Department of
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FREE STATE PROVINCE

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ELECTRICAL DETAILED SPECIFICATION

APPOINTMENT OF A CONTRACTOR FOR THE REPAIR OF
STRUCTURAL DEFECTS AND REPLACEMENT OF BUILDINGS IN
UNSATISFACTORY CONDITION AT POPANO SECONDARY SCHOOL ON
BEHALF OF FREE STATE DEPARTMENT OF EDUCATION

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DETAILED ELECTRICAL SPECIFICATION

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DETAILED ELECTRICAL SPECIFICATION

ELECTRICAL INSTALLATION

1. COMPLIANCE WITH REGULATIONS

The entire installation shall be carried out in accordance with the latest revision and amendments of the following:

- The Code of Practice for the Wiring of Premises as issued by the South African Bureau of Standards – SANS 10142-1, Edition 1: 2001, as amended.
- The Occupational Health and Safety Act No 85 of 1993.
- SANS 204
- The Basic Conditions of Employment Act No 3 of 1983.
- The Municipal By-laws and any special requirements of the Supply Authorities of the area and district concerned.
- The Local Fire Office Regulations.
- Telkom Regulations.
- The applicable SANS Specifications or the BS Specifications where no SANS Specifications exist.
- All equipment, fittings, etc. to be used shall be SABS approved.

No claims for extras in respect of failure by the Electrical Contractor to comply with any of the above regulations will be considered.

Where conflict exists between any of the above regulations and the specifications, the said conflict must be referred to the Engineer in writing for his ruling.

2. NOTICES

2.1 General

The successful Tenderer for this Contract shall, immediately after he has been officially notified that his tender has been accepted, and at any time thereafter as may be necessary, notify all the relevant authorities, pay fees and take any other steps which may be required or prescribed to execute the installation as specified.

2.2 Compliance with Green Buildings Council of South Africa

Commissioning:

Comprehensive pre-commissioning, commissioning, and quality monitoring are contractually

Contractor to provide the following:

- Detailed as-built drawings
- Commissioning reports
- Operations and Maintenance Manuals etc.
- Training of building management staff
- Contractor to provide short report on alternative materials (special consideration to PVC materials)
- Project timeline/program,
- Monthly monitoring-reporting; Corrective Actions; Tuning/Re-commissioning
- Contractor to provide EMP to professional team
- Contractor to implement waste management plan, retain waste records and issue quarterly reports to building owner. Reuse or recycling of 50% of waste

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3. **ELECTRICAL EQUIPMENT AND MATERIALS**

- 3.1 All equipment and fittings supplied must be in accordance with the attached General Electrical Specification, suitable for the relevant supply voltage and frequency and must be approved by the Department's representative.
- 3.2 Materials and equipment used in this Contract must, where possible, be of South African manufacture and shall comply with this specification and SANS 10142-1. Proof of compliance must be submitted prior to installation of any materials or equipment.
- 3.3 The Electrical Contractor shall submit samples of all materials or equipment for approval by the Engineer before installation, unless prior approval to the contrary has been obtained in writing from the Engineer. Such samples will be held for purposes of comparison with equipment and materials installed and will be released on satisfactory completion of the Contract.
- 3.4 All apparatus, components, fittings and materials supplied and/or installed, whether expressly specified herein or not, shall conform in respect of quality, manufacture, tests and performance, with the requirements of the South African Bureau of Standards and/or the appropriate current British Standard Specifications and Addenda thereto.
- 3.5 Where a certain manufacturer's material or apparatus is mentioned in the drawings or specifications, such materials or apparatus shall be provided as specified, excepting where an alternative to this condition is allowed in the specifications. Where a detailed specification for material or apparatus is not provided, it shall be understood that all normal requirements for the use of such materials or equipment shall apply.
- 3.6 Where certain products of a specified manufacturer are unobtainable, substitutes may be offered, but shall only be supplied after written consent by the Engineer.

4. **DRAWINGS**

- 4.1 The Engineer's drawings covering the various sections of the installation are as stipulated in the schedule of drawings herein. The working drawings of the Contract shall, however, consist of:
- The Engineer's drawings.
 - The Architect's drawings.
 - The Reinforced Concrete drawings.
 - The Civil Engineering drawings.
 - The Plumbing, Sprinklers and other Services drawings.
- 4.2 Unless otherwise specified, three sets of the Engineer's drawings will be issued to the Electrical Contractor for installation purposes. Any further copies shall be purchased from the Engineer.
- 4.3 Two copies of shop drawings shall be submitted to the Engineer for approval and to demonstrate compliance with Contract Documents. Shop drawings are drawings, diagrams, illustration, schedules, performance charts, brochures and other data which are prepared by the electrical contractor, manufacturer, supplier or distributor and which illustrate some portion of the work.
- 4.4 The Engineer's approval of shop drawings or samples shall not relieve the Electrical Contractor of responsibility for any deviation from the requirements of this Contract unless the Electrical Contractor has informed the Engineer in writing of such deviation at the time of submission of shop drawings or samples and the Engineer has given written approval for the specific deviation, nor shall the Engineer's approval relieve the Electrical Contractor of responsibility for errors or omissions in the shop drawings or samples.
- 4.5 A complete set of the Engineer's drawings shall be issued to the Electrical Contractor after installation to be marked up by the Electrical Contractor to indicate the "As-Built" installation as a prerequisite to completion.

- 4.6 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 pertaining to the service.

7. **SUPPLY AND CONNECTION**

- 9.1 The Supply Authority is to be confirmed.

9.2 Details of Supply

Application will be made for a 200A three phase, 400V, and 50 Hz supply upgrade to the site.

9.3 Metering

The supply will be metered by the relevant supply authority, within the meter Kiosk located within the premises.

9.4 Application

The electrical applications to supply authority will be made by the electrical sub-contractor. Payment of connection fees will be made by the electrical sub-contractor, and a provisional sum has been allowed for in the bill of quantities to cover this item.

9.5 Existing Services crossing the Site

There are no known electrical services crossing the site.

9.6 Liaison

The electrical contractor will be required to liaise with the relevant supply authority with regard to the timeous supply of power to the site.

8. **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 0,5m deep below ground level and shall be 450mm wide for one to three cables, and the width shall be increased where more than three cables are laid together so that the cables may be placed at least two cable diameters apart throughout the run. The bottom of the trench shall be level and clean and the bottom and sides free from rocks or stones liable to cause damage to the cable.

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

In the trenches the cables shall be laid on a 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 conductors 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.

9. DISTRIBUTION BOARDS

9.1 General

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.

All bus bars, 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.

The Contractor shall supply and install the distribution boards as indicated on the drawings and listed in the drawings schedule. All distribution boards shall be equipped in accordance with the Single Line Diagrams and must be approved by the engineer and department before installation. The doors and architrave of the Distribution Boards shall be painted White. The front inside panels shall be Light Orange, color B26 of SANS 1091.

All distribution boards shall have a minimum of 25% spare space. Where circuit breaker sizes are shown for spare ways on the single line diagrams, these circuit breakers shall be fitted at time of manufacture.

9.2 Internal wiring

Standard 600/1 000 V grade PVC-insulated stranded annealed copper conductors to SANS 1507 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.

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.

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.

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.

All wiring between different Panels within the same switchboard shall be installed in wiring channels.

Grommets shall be installed in each hole in the metal work through which conductors pass.

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 protected where they cross metal edges.

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.

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.

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.

A maximum of two conductors will be allowed per equipment terminal. In the event of more conductors being connected to the same equipment terminal (e.g. a main circuit-breaker feeding other circuit-breakers), stub bus-bars shall be provided for the various conductors.

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.

Wiring to Circuit-breakers

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

Identification

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.

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.

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.

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

9.3 Labelling

All distribution boards shall be provided with a legend card and holder. The legend card shall be typed, and shall indicate as a minimum the Circuit breaker number, the circuit type (e.g. Lighting, Power, Air Conditioning, etc), the Circuit Number as shown on the drawings, and a brief description of the circuit. For example, a lighting circuit shown as L1 on the drawings and fed by circuit breaker number 4 shall be labeled as follows:

4 Lighting – L1 Reception, Offices 2, 3 and 4

All distribution boards shall be labeled with an engraved label, detailing the distribution board name, where the distribution board is fed from, the cable size, the Fault Level and the phase rotation, e.g.

<i>DB Name: DB 4</i>
<i>Fed from: DB 2</i>
<i>Size of cable: 16mm x 4C</i>
<i>Fault Level: 5kA</i>
<i>Phase Rotation: Clockwise</i>

Cascading labels shall be used for all sub-distribution boards with a nominal fault level of over 5kA, as well as on the Main LV Board.

The doors and architrave of the Distribution Boards shall be painted White.

The front inside panels shall be Light Orange, colour B26 of SANS 1091.

All distribution boards shall have a minimum of 25% spare space. Where circuit breaker sizes are shown for spare ways on the single line diagrams, these circuit breakers shall be fitted at time of manufacture.

9.4 Circuit Breakers

All circuit breakers shall be of the same manufacture throughout.

All circuit breakers installed in the Meter Kiosk and Distribution Boards shall have an ultimate breaking capacity suitable for the installation, and shall not rely on cascading. All circuit breakers shall have standard breaking capacity trip curves. Circuit breakers with a nominal current rating of 100 to 250 Amps shall be equipped with an integral thermal magnetic trip unit, with adjustable long time and short time protection

9.5 Schedule of Distribution Boards

Indicated is the minimum fault level rating (kA) of the busbars and all switchgear and the distribution board type.

BOARD	TYPE	COLOUR (BODY & DOORS)	MIN. FAULT LEVEL
Switchboard Admin	Floor Standing	TBC	10kA
DB 1	Recessed	TBC	2kA
DB 2	Recessed	TBC	2kA
DB 3	Recessed	TBC	2kA
DB4	Recessed	TBC	2kA
DB5	Recessed	TBC	2kA
DB6	Recessed	TBC	2kA
DB7	Recessed	TBC	2kA
DB8	Recessed	TBC	2kA
DB9	Recessed	TBC	2kA
DB11	Recessed	TBC	2kA
DB12	Recessed	TBC	2kA

DB13	Recessed	TBC	2kA
DB14	Recessed	TBC	2kA
DB15	Recessed	TBC	2kA
DB16	Recessed	TBC	2kA
DB17	Recessed	TBC	2kA
DB18	Recessed	TBC	2kA
DB19	Recessed	TBC	2kA
DB20	Recessed	TBC	2kA
DB21	Recessed	TBC	2kA
DB22	Recessed	TBC	2kA
DB23	Recessed	TBC	2kA
DB24	Recessed	TBC	2kA
DB-Media Centre	Recessed	TBC	2kA
DB-Nutrition-Block	Recessed	TBC	2kA
DB-Block-A	Recessed	TBC	2kA
DB-Block-B	Recessed	TBC	2kA
DB-Block-C	Recessed	TBC	2kA
DB-Block-D	Recessed	TBC	2kA
DB-Block-E	Recessed	TBC	2kA
DB-Block-F	Recessed	TBC	2kA
DB-Block-F	Recessed	TBC	2kA

10. CABLE LADDER AND TRAY

Cable ladder shall be supplied and installed in all areas where cables run in ceiling voids or down walls.

The Cable ladder shall be galvanized steel. All cable ladders shall come complete with purpose made accessories. The cable ladder shall be suspended from roof trusses at centers not exceeding those specified by the manufacturer, and before and after each bend. Alternatively, cable ladders shall be supported by brackets fixed to the wall, spaced at intervals recommended by the manufacturer.

Cables on the cable ladder shall be spaced such that the separation between the cables is a minimum of twice the cable diameter. The cables shall be properly secured to the cable ladders

11. CONDUIT AND WIRING

11.1 Conduit

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 SANS 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: SANS 1065, parts 1 and 2.

b) Plain-end metallic conduit and accessories: SANS 1065, parts 1 and 2.

c) Non-metallic conduit and accessories: SANS 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.

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 conduit must be done with special bending apparatus manufactured for the purpose and which are obtainable from the manufacturers of the conduit systems. Damage to conduit resulting from the use of incorrect bending apparatus or methods applied must on indication by the 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.

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.

Conduit 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.

Chases and Builders Work

Except where otherwise specified the Builder or Main Contractor shall be responsible for the builder's work related to the installation of conduits, outlet boxes, switchboard trays, bonding trays and other wall outlet boxes and will undertake the necessary chasing and cutting of walls and the provision of openings in ceilings and floors for luminaries and other electrical outlets. The Contractor shall notify the Builder or Main Contractor of his requirements and the responsibility lies with the Contractor to ensure that all builder's work is clearly indicated or marked in accordance with his requirements.

Electrical materials to be built in must be supplied, placed and fixed in position by the Contractor when required to do so by the Builder or Main Contractor. The Contractor shall also ensure that these materials are installed in the correct positions.

Where no Builder or Main Contractor is available, the Contractor must provide all chases and is required to cover conduits installed in chases by a layer of 4:1 mixture of coarse sand and cement, finished 6 mm below the face of the plaster and roughened. Chases shall be deep enough to ensure that the top of conduits are at least 12 mm below the finished surface of the plaster.

Where the Contractor is responsible for the cutting of chases or the building in of conduits and other equipment, he will be held responsible for all damage as a result of this work and will be required to make good to the satisfaction of the Department.

This ruling is particularly applicable but not exclusively to the rewiring and renewal of existing installations. Chases shall be made by means of a cutting machine.

Under no circumstances shall face brick walls or finished surfaces be chased or cut without the written permission of the Department. Where it is necessary to cut or drill holes in the concrete structure, the prior permission of the Department shall be obtained.

Surface Mounted Conduit

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

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

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

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

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

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

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

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

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

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

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

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

Conduit in Concrete Slabs

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

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

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

Draw and/or inspection boxes shall be grouped under one common cover plate and must 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.

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.

11.2 Wiring

Except where otherwise specified, 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 commenced.

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

Wiring for lighting circuits is to be carried out with 2,5mm² conductors and a 2,5mm²-earth conductor. For socket outlet circuits the wiring shall comprise 2.5mm² conductors and a 2,5mm²-earth conductor. In certain instances, the sizes of the aforementioned conductors may be increased for specified circuits. Sizes of conductors to be drawn into conduit in all other instances, such as feeders to distribution boards, power points etc., shall be as specified elsewhere in this specification or indicated on the drawings. Sizes of conductors not specified must be determined in accordance with the "Wiring Code".

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

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

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

12. COMMUNICATION SYSTEMS

12.1 Telephone Installation

The size of all telephone conduits shall be 25mm diameter, and must be installed in the power skirting.

End boxes must consist of a 100mm x 50 mm x 50mm outlet box, flush mounted for access into power skirting or fitted with suitable RJ11 outlets and cover plates at a height above floor level as indicated on the drawings. Telephone outlets on power skirting shall consist of a RJ11 outlet mounted on a suitable cover plate.

12.2 Data Installation

The Contractor shall allow for the complete supply and installation of all conduits, outlet boxes and distribution boards required for the data installation as shown on the drawings.

The size of all data conduits shall be 25mm where one data outlet is supplied, and 32mm diameter for two or three data outlets near each other, and must be installed in the floor slab. Galvanized steel draw-wires shall be installed in all conduits. A maximum of three outlets are allowed per conduit run. Data outlets shall consist of a RJ45 outlet, mounted in a suitable cover plate.

The DATA-DB shall consist of a flush mounted steel distribution board, with a removable door / cover. The size of the distribution board shall be 600 x 600mm.

End boxes must consist of a 100mm x 100 mm x 50mm outlet box, flush mounted for access into power skirting.

13. WIRING CHANNELS AND POWER SKIRTING

13.1 Wiring Channels

Wiring channels shall be used where indicated on the drawings.

Channels shall be manufactured of rolled sheet steel. The covers shall be snap-in PVC covers.

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

Channel sizes are generally as follows, unless indicated otherwise on the drawings:

Suspended Lighting Installations	P 4000
Telephone Reticulation	P 2000
Data Reticulation	P 9000
Security Reticulation	P 9000

13.2 Power Skirting

The Contractor shall be responsible for the supply and installation of all power skirting complete with custom made corner pieces, end pieces, junction pieces, supply conduits, cover plates and power outlets as specified and indicated on the drawings.

The power skirting must comply with SANS 1197. The Contractor must ensure that the power skirting is installed to satisfaction of the client's representative before commencing with the wiring of the power trunking.

The power skirting shall be two compartment, 2 cover, metal power skirting, of a modular type. Power skirting shall measure 55mm x 165mm x 3000mm, and shall be supplied complete with its own cover plate. The color of the power skirting shall be grey. Corporate connections or similar power management to be used. The compartments shall be dedicated to power, telephone services and data services respectively. All panels to be reverted, not spot welded.

In general office space the power skirting shall be installed 20mm above the finished floor level. The power skirting shall be aligned using a chalk line, and not follow the line of the floor. Where power skirting is shown at built in counters or desks, the power skirting shall be installed on the wall, 100mm above the desk or counter, where against a wall, or directly below the counter top, where no wall is present.

14. SWITCHES AND SOCKET OUTLETS

The installation of switches and socket outlets must conform to SANS 10142.

14.1 Switched Socket Outlets and Isolators

All Switched socket outlets shall be flush mounted in 100 x 100mm conduit boxes, or shall be mounted on power skirting, as shown on the drawings. Generally, wall mounted switched socket outlets shall be mounted at +300mm above finished floor level in offices and general admin areas, and at +1200mm above finished floor level in kitchens, staff rooms and stores. Final positing must take into account the furniture layout and drawings of other disciplines as referred to in item 14.

Dedicated Switched socket outlets for computer outlets shall have a red trim and red covers where flush mounted, or cover to suit the power skirting. These outlets shall have shaved earth pins.

Switched Socket Outlets and Flush Mounted Isolators shall be Type Clipsal Range or other approved.

14.2 Light Switches

All light switches shall have white levers / toggles, and a white cover plate.

All light switches shall be Type Clipsal Range or other approved.

All switches shall be suitable for mounting in 100 x 50 x 50mm boxes shall comply with SANS 1663 and shall bear the SANS mark.

Switches shall have protected terminals for safe wiring. Contacts shall be of silver material.

On multi-lever switches, it shall be possible to individually change any of its switches.
The yoke strap shall be slotted to allow for easy alignment.

The covers of surface mounted switches shall have toggle protectors.

14.3 Occupancy Sensors

All occupancy sensors are to be ceiling flush mounted and have a dual movement function (Infrared and Ultrasound movement)

The occupancy sensors shall have a range of 38m² @ 2.5m fitting height and a 360° detection range as well as a 15min delay (variable).

15. LIGHT FITTINGS AND LAMPS

The installation and mounting of luminaires must conform to SANS 10114.

15.1 General

All fittings to be supplied by the Contractor shall have the approval of the Engineer and Client. No Incandescent lamps will be allowed for the entire contract. All luminaires supplied must have the SANS-1464 mark.

All linear fluorescent lamps shall be TL5 cool white or equivalent and approved. The lamps shall be recyclable.

All luminaires shall be submitted for approval, prior to orders being placed. Photometric data shall accompany each fitting.

All luminaires shall be power factor corrected to a minimum of 0.85.

All fluorescent light fittings shall be supplied with electronic control gear.

15.2 Schedule of Light Fittings

The light fittings must be of the type specified in the Schedule of Light Fittings as are generally utilized in a building environment as listed within the following table. All luminaires are to be approved and tested by the South African Bureau of National Standards – (SANS). Luminaire testing certificates are to accompany each proposal by contractor.

Lighting types within the Bill of Quantities under item 3.1.

16. POWER POINTS

Allow for the installation of power points and equipment as listed in BOQ under item 3.3.

16.1 Water Heaters

The contractor shall electrically connect all water heaters by means of flexible conduit connection from the isolator to the geyser.

Details with regard to the exact positions of the isolator for the water heaters must be coordinated with the plumber on site.

All water heaters shall be supplied from a 20 Amp Double pole isolator adjacent to it.

16.2 Air Conditioning Units and Fans

The supply and installation of air conditioning units and fans shall be done by others. The electrical sub-contractor shall allow for the supply and installation of isolators for all units and fans, in accordance with the specification and the drawings. Final connections between the isolators and the equipment shall be done by the air conditioning and ventilation sub-contractor

16.3 Stoves

The supply and installation of stove unit shall be done by others. The electrical sub-contractor shall allow for the supply and installation of isolators for all units, in accordance with the specification and the drawings.

LIGHTNING PROTECTION SYSTEM

17. LIGHTNING PROTECTION

17.1 Lightning Protection System

The provision of a lightning protection system is mandatory for this installation. Prior to carrying out the installation, the specialist sub-contractor shall test the soil resistivity of the area and report to the Engineer on the sufficiency of the design for the site conditions.

The earth termination system shall consist of an earthing arrangement with vertical earth electrodes.

Neither the roof structure nor the gutters are acceptable for use as part of the system, and roof conductors and down conductor will have to be installed.

At least one equipotential bonding bar shall be provided in each building, for the bonding of the lightning protection systems, electrical and telecommunications installations and building steelwork. All buildings shall be bonded together to form an equipotential system.

Test joint boxes are to be supplied above every earth electrode.

17.2 Earth Electrodes

Earth electrodes shall be solid copper rod earth electrodes.

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

The length of the earth electrodes shall suit the soil resistivity of the area.

The installation of the earth electrodes shall include the drilling, excavation and backfilling of holes.

17.3 Couplings and Conductor Clamps

Earthing electrodes shall be supplied with an adequate number of couplings.

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

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

Conductor clamps shall be provided to suit the type and size of rods provided and the size and type of conductor.

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

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

17.4 Testing and Commissioning

The sub-contractor shall be responsible for the testing and commissioning of the system, and the provision of a Certificate of Compliance in accordance with SANS 0313:1999.

The sub-contractor shall provide full test results PRIOR to the installation and AFTER the installation has been completed of the installation, and "as-built" drawings, showing the reading positions, earth electrode length, test readings and conductor sizes.

18. BILL OF QUANTITIES

- (a) All prices shall be quoted in the currency of the Republic of South Africa and shall not be subject to adjustment except in terms of the conditions stated by the Tenderer. In the event of the Tenderer not stating his conditions for price adjustment his prices will be held to be firm and holding throughout the duration of the Contract.
- (b) The work scheduled hereunder is generally more fully described in the Specification or shown on the Drawings, and in pricing his tender the Tenderer is referred to the whole of the Conditions of Contract, Specification, Drawings and Schedule of Quantities, in order to fully comprehend the scope, extent and meaning of each Item scheduled.
- (c) Any costs involved in meeting the obligations and liabilities imposed by the Conditions of Contract and in complying generally with the requirements of the Contract shall be deemed to be apportioned to and included under the various items, and the prices quoted against each item must cover the full inclusive cost of all work to be completed under the item plus such apportionment of the general costs.
- (d) Where there is any discrepancy in the tender between quoted rates, scheduled quantities and totals, the quoted rates shall in all cases be taken as the correct figures and the Tender shall be adjusted accordingly.
- (e) The prices quoted in this Schedule are to be those applicable if the Tenderer is awarded the contract as a whole.
- (f) Value Added Tax is to be included in the appropriate item of the Schedule of Quantities.

Detailed Technical Specification – Standby Generators

1 INTRODUCTION

Standby generators are required for the new India Apron at King Shaka International Airport. Four (4) generators will be provided for the Apron.

2 GENERAL

This Item shall be read with the General Technical Specification (GTS) and provides specific requirements with reference to the GTS.

3 SCOPE OF THIS CONTRACT

The scope of this contract is as follows:

3.1 India Apron:

3.1.1 Four (4) off new 500kVA continues prime rated canopy generator sets each consisting of diesel engine with 500kVA alternator, day tank and sound attenuation intake and exhaust louvers.

3.1.2 Four (4) new LV automatic change-over Kiosks as specified which will include the auto change over gear as well as all control and monitoring functions of the new diesel generators.

4 SPECIFICATIONS

4.1 The general standard requirements for the generator installation components are specified in the “General Technical Specification”.

4.2 In addition, the specific requirements with changes and additions to the standards in the “General Technical Specification”, is specified in the “Detailed Technical Specification”, to suit the specific characteristics of the project. Should discrepancies between the “General Technical Specification” & the “Detailed Technical Specification” exist, the “Detailed Technical Specification” shall govern.

5 SITE INFORMATION

The site is situated at the King Shaka International Airport next to the N2 Coastal highway, La Mercy, Kwa-Zulu Natal, South Africa.

6 POWER SUPPLY

The power supply to the changeover and distribution boards will be 420/242 Volt, 50Hz, 4 wire supply with solidly earthed neutral, fed from dedicated 11 kV supply.

7 AMBIENT CONDITIONS

The installation shall meet the specified requirements under the following ambient conditions:

Item	Description	Details
7.1	Altitude	Approx. 20m AMSL
7.2	Temperature range	-5°C to 45°C
7.3	Pollution	Minimum smog present
7.4	Humidity	65% to 95% RH [Average throughout the year with 10% probability]

8 TESTING AND COMMISSIONING OF THE INSTALLATION

Tests shall be carried out as outlined in the “General Technical Specification”, Item 28.

9 MAINTENANCE AND GUARANTEE PERIOD

- 9.1 The maintenance and guarantee period shall be 12 months.
- 9.2 During this period the generator subcontractor shall carry out routine maintenance as outlined in the “General Technical Specification”, Item 30. Tests however, shall be carried out once a week.
- 9.3 As required in the “General Technical Specification”, Item 30 tenderers must submit detail of a service and maintenance contract for consideration by the Client to enter into such a contract, after expiry of the above 12 months maintenance period. The cost of this seltemate contract must not be included in the tender price. Allowance shall be made for tests to be carried out once a week.

10 TRAINING OF PERSONNEL

Refer to the “General Technical Specification”.

11 SUBCONTRACTING

- 11.1 The contractor shall submit statements from the suppliers of all equipment to the effect that the suppliers are the authorized agents of the manufacturers of the equipment and consequently are fully empowered to support the manufacturer's warranty.
- 11.2 Subcontracting of any part of the work will be subject to approval and the tenderer shall submit full detail of any subcontractors to be employed, at tender stage.

12 MAKING GOOD

The contractor will be responsible for making good in all trades, any damage or disturbance to the building, installation, tarred surfaces, concrete surfaces, paved surfaces, drains and other surfaces his employees or subcontractors may have caused during the construction of the installation.

13 PERSONNEL ON SITE

The contractor shall have a technically competent representative on site at all times when work is taking place. The person shall be required to attend to all technical matters, receive instructions on behalf of the contractor and co-ordinate installation work with other contractors on site.

14 PROGRAM AND CO-ORDINATION

The installation work shall be coordinated with other contractors and services on site as part of this contract.

15 BUILDERS WORK

All builders work will be carried out by others except where work is specifically specified to form part of this subcontract. Where openings for cable trays, pipes and cables through concrete slabs and concrete walls are required and not shown on the drawings, it must timeously be pointed out to the engineer. Where openings are required through brick walls, it shall be the responsibility of the generator contractor. Sufficient allowance shall be made in the tender price for such openings. Should extra openings through concrete not be asked for timeously, it shall become the responsibility of the generator contractor at no extra cost.

16 SITE FACILITIES

- 16.1 The tenderer shall make allowance for all lifting equipment, scaffolding and transport required on the site.
- 16.2 Electrical power and water for construction purposes will be available free of charge to the extent that it will be available to other contractors.

17 GENERATOR OUTPUT AND VOLTAGE

The rating of the generators under the specified site conditions shall be as follows:

- ☐ Voltage : 420/242 V, 4 wire with earthed neutral
- ☐ Power factor : 0.8 lagging
- ☐ Frequency : 50 Hz
- ☐ Rating : X kVA engine with X kVA alternator

18 AVAILABILITIES TO SITE

The contractor shall have free access to the position where the generator units shall be installed on site. Entrance to the site by means of a heavy duty delivery vehicle will be possible.

19 ACCOMMODATION

The units will be accommodated on plinths which form part of this contract.

20 ENGINE (GTS)

- 20.1 A water cooled diesel engine with frame mounted radiator is preferred.
- 20.2 An electronic governor shall be provided.

21 MOUNTING (GTS)

The generator set shall have duplex steel frame base.

22 CONTROL AND CHANGE OVER KIOSKS

The kiosks shall generally comply with GTS, to suit the requirements specified below.

The change-over kiosks, incorporating control and power for change over shall be installed at the India Apron next to the Miniature substation and shall include the following:

22.1 The change-over kiosks shall consist of the following:

- ✦ Normal network supply main ACB circuit breaker (800 Amp) (mechanically & electrically interlocked).
- ✦ The local standby generator ACB circuit breaker (800 Amp) (mechanically & electrically interlocked).
- ✦ PLC with software development.
- ✦ Busbars
- ✦ Cable gland plates.
- ✦ Labelled screw terminals for outgoing control wiring.
- ✦ All switchgear shall have auxiliary contacts and all contacts shall be wired to a common strip.
- ✦ 5 x Schneider NSX 160B – TMD – 160A LV 430300
- ✦ 2 x Schneider NSX 100B – TMD – 100A LV 429540
- ✦ 3 x Schneider NSX 100B – TMD – 32A LV 429545
- ✦ Surge Arrestors
- ✦ 5 x Elster A1700 meters for 400 Hertz ground power consumption monitoring

23 SET MOUNTED CONTROL EQUIPMENT

Refer to GTS.

24 CONTROL OF THE SETS

24.1 Control functions

Refer to GTS.

24.2 Monitoring functions

All monitoring and protection equipment as specified in the general specification shall be provided for each standby generator set.

In addition RS 485 ports on the PLC's shall be provided inside the kiosks from where a communication link for remote monitoring of all alarm functions can be done.

Voltage free contacts NO/NC wired to terminal strips shall be provided in the control board to indicate the following:

- ✦ General alarm

✦ Power failure exists

✦ Alternator on load

25 ALARMS AND PROTECTION

Refer to GTS.

26 RADIO INTERFERENCE AND SUPPRESSION

Refer to GTS.

27 EXHAUST SYSTEM

Refer to GTS.

28 VENTILATION COOLING AND HEATING

28.1 Refer to GTS.

28.2 Noise generated by the equipment, if measured, 7 m from the generator, shall not exceed 65dB.

28.3 As stated previously a water cooled diesel engine with frame mounted pressure type reinforced fan cooled radiator is preferred. Galvanized ducting shall be provided as specified.

28.4 Heating shall be provided in the water cooling circuit of the engine as specified in GTS.

29 FUEL SYSTEMS

29.1 Refer to GTS. Approved tests shall be conducted on all fuel systems and tanks to ensure no leaks will occur, and certificates issued to that effect.

29.2 Reliable fuel filters shall be provided to each engine.

30 SPARES AND TOOLS

30.1 Refer to GTS.

30.2 Tools : As specified in GTS.

30.3 Engine, control board and alternator spares shall be provided as specified.

31 PAINT FINISH

Refer to GTS.

32 NOTICES

32.1 Refer to GTS.

32.2 All notices shall be installed. External notices shall be of the metal type.

33 DRAWINGS FOR APPROVAL

Drawings in accordance with GTS, are required.

34 TESTING

Testing of the installation shall be in accordance with GTS.

35 FABRICATION OF CONTROL AND CHANGE OVER KIOSKS IN GENERAL

The LV panels shall in all aspects conform to SABS 1180, Parts 1, 2 and 3 as applicable.

35.1 GENERAL

The kiosks shall be of adequate size to accommodate the number of outgoing circuits specified.

The kiosks shall have three sections, namely:

- one section containing the auto change over gear with all incoming and outgoing switchgear and cables, and
- one section containing the outgoing cables and circuit breakers,
- and
- one section containing spare space for communication equipment required.

35.2 FRAMEWORK

A metal framework for the kiosk shall be manufactured from angle iron, channel iron on 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. Kiosks shall be of cubicle design with 2mm side panels forming divisions between cubicles. The maximum allowable cubicle width is 1,8m. Joints shall be non-continuously butt welded. Welds shall be ground smooth and the joint wiped with plumbers' metal in order to provide a smooth finish.

35.3 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 chromiuplated 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

35.4 FRONT PANELS

The front panels inside the kiosks shall preferably be hinged except where flush mounted equipment prevents this. Alternatively, panels shall be secured by means of two pins at the bottom and a latch or lock at the top of the panel. The panels shall be arranged in multi-tiered fashion to allow for the logical grouping of equipment.

The hinged front panels shall have a dished appearance with 20mm upturns which fit over a lip on the kiosk frame. Corners shall be welded and smoothed.

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 kiosk. Seltemate panels shall preferably be provided for the mounting of instrumentation and for covering flush mounted switchgear. Enclosed switchgear with front panels eg combination fuse-switch units, may be flush mounted in the board in lieu of seltemate hinged panels.

Hinged panels shall be suitably braced and stiffened to carry the weight of flush mounted equipment and to prevent warping.

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.

A tubular chromium-plated handle shall be fitted on each panel. The handle may be omitted if "DZUS" or "CAMLOC" fasteners are used.

Banking 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.

Front panels containing live equipment such as instrumentation of controls switches, shall be bonded to the kiosk frame with a braided copper earth strap with an equivalent cross-sectional area of at least 4mm².

35.5 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 by "BARKER & NELSON" or similar quick-release fasteners. Selftapping 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 or "DZUS" or "CAMLOC" or similar captive fasteners. 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.

35.6 DOORS

The kiosks shall be fitted with a doors in the front of the kiosk. The maximum width per door shall be 800 mm. The doors shall provide free access to the equipment. The doors shall have well returning edges to fit into the channel of the door entry surrounds. Each door shall have three robust solid brass hinges each of length at least 100 mm. The hinges shall be completely concealed. Doors shall be fitted with lever locks equal or similar to the "Barker & Nelson" type. The locking mechanism shall facilitate three point latching at the top, side and bottom of the doors. In the case of double doors the first door shall be locked with two slides on the inside onto the kiosk shell. The second door shall close over a lip on the first one. Nylon door restraints shall be provided. The fixing points of the restraints at the door and the canopy shall be reinforced. The doors shall be earthed bonded to the frame by means of a copper braided strap, tooth washers, bolts and nuts.

35.7 ROOF

The kiosk shall have a pitched roof that slopes downwards at the front and at the back with an overhang of at least 75 mm all round. The panels shall be of 2mm minimum sheet steel.

35.8 CHASSIS

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

35.9 GROUPING OF SWITCHGEAR

The switchgear shall be logically arranged and grouped as described in GTS. 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 specification.

35.10 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 kiosk to house the glands. A P4000 "UNISTRUT" 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.

35.11 VERMIN PROOFING

The kiosk 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 compound shall be delivered with the kiosk so that these holes can be sealed properly after installation of the cables.

35.12 MOUNTING OF EQUIPMENT

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

35.13 PAINTING OF KIOSKS

CORROSION RESISTANCE

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

EDGES

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

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.

BAKED ENAMEL FINISH

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

Within forty eight (48) hours after phosphatising, a passivating layer consisting of a high quality zinc chromate primer shall be applied, followed by two (2) coats of high quality baked enamel.

The enamel finish on metal components shall comply with SABS 783 type III.

Other metal parts eg 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.

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

COLOUR

The colour of LV switchboards shall be RED for essential power boards and BLUE for critical power boards.

35.14 TENDER PRICE

The tender price for supply, delivery and installation include the complete board with all equipment as specified in the detailed specification.

The tender price for installation include the positioning and mounting of the board termination of all cables and commissioning thereof.

36 EARTHING

36.1 The earth terminal on the alternator shall be connected to the earth bar in the generator control board by means of the busbar earth bar.

36.2 All metal fuel lines, including the day tank metal frame shall be bonded and solidly earthed to the earth bar in the generator control board.

STANDBY GENERATORS

TECHNICAL SCHEDULES

1. SCHEDULE OF TECHNICAL DETAILS

1.1 The trade names and/or catalogue numbers of all equipment forming part of the tender offer must be submitted. The information schedule must be fully completed by the tenderer. Where equipment of a certain manufacture is required in this specification, an alternative may be offered. The item prices of such alternative items must be submitted with the tender offer.

1.2 The total tender price must however be based on the specified equipment and shall be based on offer A. Alternative offers (B and C) may be offered and separate price schedules shall be completed and submitted with the tender clearly marked as alternative B or C.

NO	DESCRIPTION	OFFER		
		A	B	C
2	POWER OUTPUT			
2.1	<u>Engine</u>			
2.1.1	Gross continuous output (kW)			
2.1.2	Less losses for site conditions :			
2.1.3	Height above sea level (kW)			
2.1.4	Ambient temperature (kW)			
2.1.5	Other (kW)			
2.1.6	Less losses for accessories at 1500 rpm :			
2.1.7	Fan (kW)			
2.1.8	DC-generator (kW)			
2.1.9	Water pump (kW)			
2.1.10	NETT CONTINUOUS OUTPUT AT SITE (kW) (X)			
2.2	<u>Alternator</u>			
2.2.1	Required nett output at site (kVA)			
2.2.2	x 0,8 power factor (a) (kW)			

NO	DESCRIPTION	OFFER		
2.2.3	Alternator efficiency (b) (%)			
2.2.4	GROSS REQUIRED INPUT AT SITE (kW) (Y)			
2.2.5	EXCESS POWER X - Y (kW)			
3.	ENGINE			
3.1	Manufacture			
3.2	Country of origin			
3.3	Model number			
3.4	Nominal speed (r.p.m.)			
3.5	Strokes/working cycle (2 or 4)			
3.6	Compression ratio			
3.7	Cyclic irregularity at engine shaft			
3.8	Fuel consumption of the complete generator set at site (in litre/hour) with a generator output of :			
a	full load			
b	$\frac{3}{4}$ load			
c	$\frac{1}{2}$ load			
3.9	Fuel injection system manufacturer			
3.1	Is an oil cooler provided?			
3.11	Are thermostatically-controlled bypass valves provided?			
3.12	Are the oil filters equipped with service indicators?			
3.13	Is a turbo charger fitted? If so, what type?			
3.14	Type of governor			
3.15	Does the governor comply with the specification			
3.16	Mass of engine (kg)			
3.17	Are power curves attached?			
4	ALTERNATOR			
4.1	Manufacture			

4.2	Country of origin			
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NO	DESCRIPTION	OFFER		
4.3	Type of enclosure			
4.4	Nominal speed at an output frequency of 50Hz (rpm)			
4.5	Output voltage at no load and adjustability (eg. 210/245V)			
4.6	Rated output at sea level and power factor of 0,8 lagging (kVA)			
4.7	Percentage output loss due to site conditions			
4.8	Percentage efficiency at :			
a	full load			
b	$\frac{3}{4}$ load			
c	$\frac{1}{2}$ load			
4.9	Transient voltage drop due to application of full load (V)			
4.1	Time for voltage restoration after application of full load (ms)			
4.11	Reactance			
4.12	Transient reactance			
4.13	Is generator tropicalised?			
4.14	Insulation class of stator windings			
4.15	Insulation class of rotor windings			
4.16	Mass of generator			
4.17	Generator short-circuit current (kA)			
4.18	Dimensions of generator (LxWxH) (mm)			
5	EXHAUST SYSTEM			
5.1	<u>Exhaust pipe</u>			
5.1.1	Manufacturer			
5.1.2	Wall thickness (mm)			
5.1.3	Diameter at end (mm)			

5.1.4	Does the diameter vary over the length?			

NO	DESCRIPTION	OFFER		
5.2	<u>Silencers</u>			
5.2.1	Manufacturer			
5.2.2	Type			
5.2.3	Attenuation over the full frequency spectrum (dBA)			
6	COOLING SYSTEM			
6.1	What type of system is it? (eg. air/water, etc.)			
6.2	Air louvers :			
a	manufacture			
b	type			
c	material			
6.3	Air flow required (m ³ /min)			
7	FUEL SYSTEM			
7.1	<u>Day Tank</u>			
7.1.1	Capacity (litre)			
7.1.2	Manufacturer			
7.1.3	Material and thickness			
7.1.4	Does it comply with the specification?			
7.1.5	Type of level indication			
7.1.6	Type of level sensors			
7.1.7	Fuel pumps :			
a	Type			
b	Number			
7.2	<u>Bulk Tank</u>			

7.2.1	Capacity (litre)			
7.2.2	Manufacturer			
7.2.3	Material and thickness			
7.2.4	Dimensions and form			

NO	DESCRIPTION	OFFER		
7.2.5	Does it comply with the specification?			
7.2.6	Type of level indication			
7.2.7	Finish			
7.2.8	Type of level sensors			
7.3	<u>Fuel Pipes</u>			
7.3.1	Material			
7.3.2	Diameter from fuel tank to engine			
8	SWITCHGEAR AND CONTROL EQUIPMENT			
8.1	<u>Control Board & Distribution Board</u>			
8.1.1	Manufacture			
8.1.2	Maximum dimensions			
8.2	<u>Equipment on boards (State manufacturer)</u>			
8.2.1	Circuit breakers			
8.2.2	On-load isolator			
8.2.3	Bypass switch			
8.2.4	Change-over switch			
8.2.5	Contactor			
8.2.6	Relays			
8.2.7	Time relays			
8.2.8	Selector switches			
8.2.9	Alarm indicators			
8.2.10	Push buttons			

8.2.11	Indicator lights			
8.2.12	Volt meters			
8.2.13	Ammeters			
8.2.14	Frequency meters			
8.2.15	Hour meters			

NO	DESCRIPTION	OFFER		
8.2.16	Current transformers			
8.2.17	Voltage/frequency sensor unit :			
a	Type of sensor			
b	Manufacturer of components			
c	Drop-out voltage adjustability (eg. 340/440V)			
d	Pull-in voltage adjustability (eg. 340/440V)			
e	Frequency sensor adjustability (eg. 47/53 Hz)			
8.2.18	Is the control equipment powered by the starter battery? (If not, describe in addendum to tender)			
8.2.19	Type tested to SANS 61439 / Tested according to SANS 61642			
9	BATTERY CHARGER			
9.1	Manufacturer			
9.2	Time to recharge battery after full discharge			
9.3	Maximum charge current			
9.4	Charge voltage (V)			
10	BATTERIES			
10.1	Manufacturer			
10.2	Country of origin			
10.3	Type of battery			
10.4	Voltage of battery (V)			
10.5	Capacity (Amp-hours)			

10.6	Is the battery in one container?			
11	OTHER EQUIPMENT			
11.1	<u>Emergency Lights</u>			
11.1.1	Manufacturer			
11.1.2	Country of origin			
NO	DESCRIPTION	OFFER		
11.1.3	Model number			
11.2	Sound attenuating ventilators			
11.2.1	Manufacturer			
11.2.2	Country of origin			
11.2.3	Model number			
12	SPARES AND MAINTENANCE FACILITIES			
12.1	Approximate value of spares kept in stock for this type of machine			
12.2	Where are the spares kept?			
12.3	Maximum time for service team to reach site after notification of a fault condition			
13	DIMENSIONS OF EQUIPMENT			
13.1	<u>Generator set (complete)</u>			
13.1.1	Control board			
13.1.2	Distribution Board			
13.1.3	Fuel tanks :			
a	Day			
b	Bulk			
13.1.4	Sound Attenuating Air louvers :			
a	In front of radiator			
b	Elsewhere in machine room			
c	% Free air opening			

SIGNATURE OF TENDERER : _____

**NAME AND ADDRESS
OF TENDERER** : _____

DATE : _____

2. DELIVERY AND INSTALLATION

I, we the undersigned undertake to install the generator power supply unit complete as specified in accordance with the following programme.

The information indicated below shall be calculated from the date of official tender acceptance.

Delivery of all equipment	Weeks
Installation	Weeks
Total time required to complete the installation	Weeks
NAME AND ADDRESS OF TENDERER (COMPANY)	
NAME OF COMPANY REPRESENTATIVE	
Signature	Date
Witnesses :	
1.	Date
2.	Date