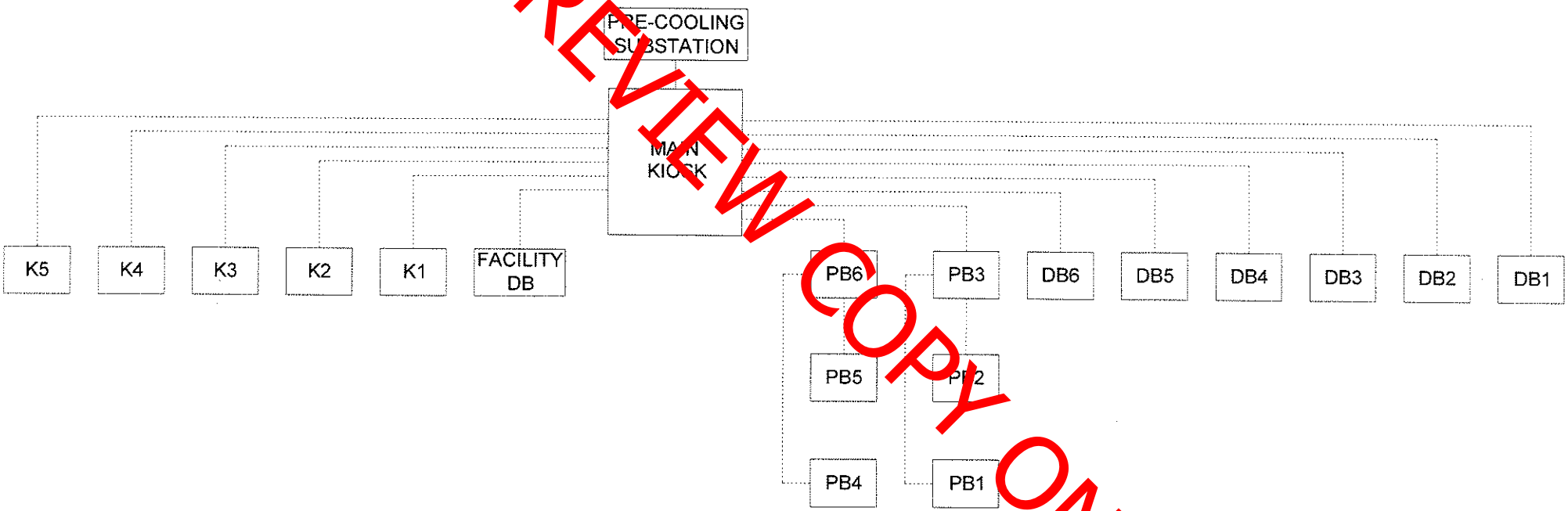


NOTES

1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED
2. THE CONTRACTOR SHALL VERIFY ALL CONDITIONS, DIMENSIONS AND LEVELS ON THE SITE AND NOTIFY THE RES SUPERVISOR OF ANY VARIATIONS BEFORE CONSTRUCTION
3. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL AND OTHER CONSULTANT'S DRAWINGS

REFERENCE DRAWINGS

DRAWING NO. | REFERENCE

Bergstan South Africa

CONTRACTOR / CONSULTANT | TRANSNET CAPITAL PROJECTS

REVISIONS

Transnet Freight Rail (PME)

TRANSNET

WORK IN CAPE TOWN

PRE TRIP INSPECTION FACILITY FOR REEFER CONTAINERS IN THE PORT OF CAPE TOWN.

OVERALL SCHEMATIC

TRANSNET FREIGHT RAIL RME NUMBER: 1214915.001
WORKS DESCRIPTION: THE CONSTRUCTION OF A NEW PRE TRIP INSPECTION FACILITY OF REEFER CONTAINERS FOR TRANSNET AT PORT OF CAPE TOWN

TRANSNET

ELECTRICAL PROJECT SPECIFICATION
SECTION C

TRANSNET

INDEX

4.0 SCOPE OF CONTRACT

Transnet require this washing facility in order to clean reefer containers within the container terminal.

The scope of this contract covers the works to be completed as specified below:

a. Supply and installation a new Main Kiosk fed from the existing Pre Cooling Substation as shown on drawings.

b. Supply and installation of all sub-distribution boards, sub distribution kiosks, cable trays, wiring channels, conduits, wiring, power skirting, small power outlet points and lighting forming part of the electrical installation.

c. Supply and installation of all distribution cables to the sub distribution boards and distribution kiosks.

d. Supply and installation of lighting on the Washbay platform.

e. Supply and installation of power supplies to Air conditioning units, fans and other equipment and co-ordination of installation with other contractors.

f. Supply and installation of a Kiosk to the Processing plant.

g. Remove and reinstall of two existing lighmast in new their new positions.

h. Supply and Install cable joints where required.

I Supply and installation of all earthing systems required to achieve compliance with the local supply authority's stipulations.

j. Testing, commissioning and handover of the electrical installations described above to the complete satisfaction of the Engineer. This shall include the submission of three sets of operation and maintenance manuals.

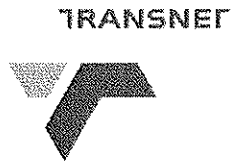
5.0 OTHER CONTRACTORS AND SPECIALISTS

It will be required of the Contractor to work according to the Main Contractor's programme, in close liaison with the other contractors and specialists appointed by the Main Contractor or nominated by the Employer. Other specialist's contractors shall in no way exonerate the Contractor from his obligations in terms of this contract.

6.0 PROGRAMME

A copy of the Main Contractor's construction programme shall be issued to the successful tenderer. The electrical contractor shall be expected to conform to the overall milestones as contained in this programme.

Contract completion date : Refer to the main contractor's programme



PROJECT SPECIFICATION

1.0 SITE

The facility is located at the Port of Cape Town's Container Terminal on the north eastern corner of the empty stacking area. Access to the terminal is off Marine Drive into Container Road or alternatively from Cape Town's side via Duncan Road into Container Road.

2.0 VISIT TO SITE

Tenderers shall acquaint themselves with local site conditions such as access to the site, size and type of site, supply of labour, workshop space, transport, loading and unloading facilities, scaffolding, tackle and tools needed for the erection of the installation. Additional claims by the Contractor, which may arise from ignorance of the site conditions, will not be considered and Tenderers are requested to visit and inspect the site, before submitting a tender.

3.0 COMPLIANCE WITH REGULATIONS

The installation shall be erected and carried out in compliance with:

a. The Occupational Health and Safety Act 85 of 1993 and as amended incorporating SANS 10142.

b. The local Municipal by-laws and regulations as well as the regulations of the local Supply Authority.

c. The local Fire Regulations.

d. The Standard Regulations of any Government Department or public service company where applicable.

The Contractor shall at his cost issue all drawings and notices in respect of modification of the installation to the local authorities, and shall indemnify and exempt the Employer from all losses, costs or expenditure which may arise as a result of the Contractor's negligence to comply with the requirements of the regulations stipulated above. No work shall be commenced by the Contractor prior to the approvals by the local authority of the relevant drawings or applications to perform work.

It shall be assumed that the Contractor is conversant with the abovementioned requirements. Should any requirement, by-law or regulation, which contradicts the requirements of this document, apply or become applicable during erection of the installation, such requirement, by-law or regulation shall overrule this document and the Contractor shall immediately inform the Employer of such a contradiction. Under no circumstances shall the Contractor carry out variations to the installation in terms of such contradictions without obtaining the written permission to do so from the Employer.

7.0 BUILDER'S WORK

The Contractor will provide, within the scope of his supply and installation undertaking, for all chasing required for the flush installation of conduit, conduit fittings, outlet boxes or trays but the Main Contractor will repair all chases and shall re-instate structural surfaces to the final finishes required. The Main Contractor shall also provide the following:

a. The supply and installation of all manholes and sleeves or ducts.

b. Cutting of holes in ceiling tiles for the installation of luminaires.

c. Pre drill of holes for fixing luminaires at Wash Bay Platform.

The Contractor shall liaise closely with the Main Contractor in the above regard and the Contractor shall remain responsible for the correct and accurate location of manholes, sleeves, and penetrations.

8.0 ELECTRICAL SUPPLY

The Electrical supply to the Wash Bay Facility and surrounds will be from an existing LV substation located on the precinct. The existing circuit breaker in the substation must be upgraded from a 400A to a 500A circuit breaker. A new supply cable must be installed along the route indicated on the drawings to the new Main LV Kiosk on the Pre Trip inspection Bay.

The electrical supply at the main LV DB shall be 4-wire, 420V, 50 Hz, 3-phase supply.

9.0 WORKMANSHIP

The contractor shall employ only competent artisans to perform construction and installation work on the site.

The contract shall be executed with the best workmanship in a workmanlike manner to the satisfaction of the Employer. Should any workmanship not be to the satisfaction of the Employer it shall be rectified at the cost of the Contractor.

The Contractor shall remain responsible for the correct and complete delivery of the installation. Inspection by the Employer shall not release the Contractor from his responsibility.

10.0 QUALITY OF MATERIAL

Only material of high quality and suitable for the climatic conditions of the site shall be used and shall be subject to approval of the Employer. All material shall conform in respect of quality, manufacture, tests and performance, with the requirements of the SANS or where no such standards exist, conform to the appropriate current Specifications of the British Standards Institution. Materials manufactured in South Africa shall as far as possible be used and where applicable shall bear the SABS mark. Imported materials shall comply with the requirements of the appropriate B.S. or I.E.C.

specification. All materials shall be suitable for the conditions under which the materials are installed and used.

Should the materials or components not be suitable for temporary use under site conditions, then the Contractor shall at his own cost provide suitable protection until these unfavourable site conditions cease to exist.

11.0 LOW-VOLTAGE CABLES

The Contractor shall supply and install all the low voltage cables as indicated on the drawings and cable schedules.

The low voltage cables shall be of the 600/1000 volt PVC insulated steel, steel wire armoured copper cables suitable for general use and manufactured in accordance with the latest revision of SANS 1507.

11.1 Termination of Low Voltage Cables

All accessories that are used shall be suitable for operation at 400/231 volts 50 Hz.

All cable ends shall be terminated with approved brass glands complete with shrouds ensuring a watertight connection between the sheath, gland and equipment.

Gland lock nuts shall be of brass or stainless steel.

The shanks of all LV cable lugs shall be shrouded with colour coded heat shrink sleeves.

Exposed armouring shall be covered with bitumen-base paint.

Cable ends shall be supplied with the necessary earth connection.
A wiring channel or other approved means of support shall be provided to remove mechanical stress from the cable glands.

The individual cable cores shall be connected to busbars or to the connecting terminals by means of crimped cable lugs of the correct size. The correct size of crimping die shall be used in the crimping apparatus for the connection of conductors to the cable lugs.

Only lugs of an approved type shall be used and hydraulic crimping tools shall be used in crimping. No hand crimping tools will be allowed.

The cable tails shall be arranged in such a fashion that a clip-on ammeter can readily be placed around any core.

11.2 Terminating and Jointing of Low Voltage Cables

All accessories which are used shall be suitable for operation at 400/231 volt 50 hertz.

Joints
Joints in cable runs will not be allowed unless it is authorised by the Engineer.

Cable joints shall be of the Pratley, Scotch-Cast or similar approved type and shall be applied in accordance with the manufacturers recommendations. Earth continuity must be maintained at all joints.

In the case that only the outer sheath of a cable is damaged the Contractor shall repair the damaged section with "Raychem" thermofit " heat shrink permanent cable repair sleeve. Any repair work of this kind shall be at the contractor's cost.

12.0 WIRE MESH CABLE TRAYS

The Contractor shall supply and install all cable trays required for electrical cables as well as for data/telephone cables. The Contractor shall also supply and install all the necessary supports, clamps, hangers, fixing materials, bends, angles, junctions, reducers, T-pieces, etc.

Wire mesh trays
Wire mesh trays shall be a minimum of medium duty hot-dipped galvanised type.

Supports
Trays shall be supported at maximum intervals of 1000mm. In addition trays and ladders shall be supported at each bend, off-set and T-junction.

Joints
Joints shall be smooth without projections or rough edges that may damage the cables. The Contractor will be required to cover joints with silicon or other hardening rubberised or plastic compounds if in the opinion of the Engineer joints may damage cables. Joints shall as far as possible be arranged to fall on supports. Where joints do not co-coincide with supports, joints shall be made by means of wrap- around splices of the same thickness as the tray and at least 450mm long.

The two cable tray ends shall butt tightly at the centre of the splice and the splice shall be bolted to each cable tray by means of at least 8 round head bolts, nuts and washers. Splices shall have the same finish as the rest of the tray.

Fixing
Trays shall be securely bolted to supports to avoid cables being damaged during installation.

Fixing to the structure
The supports for cable trays shall in all cases be securely fixed to the structure by means of heavy duty, expansion type anchor bolts. It is the responsibility of the Contractor to ensure that adequate fixing is provided since cable trays that work loose shall be rectified at his expense.

Accessories
Horizontal and vertical bends, T-junctions and cross connections shall be supplied by the Contractor. The dimensions of these connections shall correspond to the dimensions of the linear sections to which they are connected. The inside dimensions of bends shall be large enough to ensure that the allowable bending radii of the cables are not exceeded. Sharp angles shall have a 45^0 cornice. All accessories shall be galvanised.

Installation of cables
Electrical cables shall be installed adjacent and parallel to each other on trays. Horizontal trays shall in general be installed below slabs, ceilings, etc. with sufficient clearance to facilitate access during installation.

Data/telephone cables shall be supplied and installed by others.

Earthing
Metal trays shall be bonded to the earth bar of the switchboard to which the cables are connected. Additional bare copper stranded conductors or copper tape shall be bolted to the tray, where the electrical continuity cannot be guaranteed.

Painting
No painting of trays or ladders shall be required.

13.0 SWITCHBOARDS

This part of the document should be read in conjunction SA Port Operations manual reference no.EEAM –Q-012. SEE Appendix YYYY

13.1 Supply of switchboards

The Contractor shall supply and install all the distribution boards as shown on the schematic drawings.

13.2 General

All switchboards shall be of ample size to accommodate all the specified switchgear with an allowance for 20% spare space for future switchgear. The DB will be manufactured of 3cr12

The Contractor shall ascertain the exact position of switchboards and shall arrange timeously for the installation of cable sleeves, openings in the structure and flush draw trays behind switchboards where applicable.

In general wall mounted switchboards shall be fixed at 1400mm above finished floor level measured to the centre of the switchboard. The upper ends of switchboards may not be higher than 2.3 metres above finished floor level.

13.3 Construction of surface mounted switchboards

Switchboard tray
Surface mounted switchboards shall be equipped with a 1.6mm sheet steel re- enforced tray. Securing lugs shall be provided to fix the tray to walls or any other structure. A solid brass or cadmium plated steel connection stud and nut shall be provided.

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

The requirements for chassis, panels and doors shall be as specified for flush mounted switchboards. The doors shall be hinged and shall fit flush in the frame in the closed position.

13.4 **Mounting of equipment**

Access

All equipment, busbars and wiring shall be completely accessible when the front panels are removed.

Mounting of chassis

The chassis of flush mounted and surface mounted boards shall be mounted on the tray, leaving sufficient space for wiring between rows of equipment and on the sides. This space shall also be adequate to pass the supply cable behind the chassis to connect to the main switch without making use of sharp bends.

Mounting of circuit breakers

All moulded case circuit breakers shall be flush mounted with the toggles only protruding. Miniature circuit breakers may be installed in clip-in trays mounted on the frame. All other circuit breakers shall be bolted to the frame. Special provision shall be made for large main switches when designing the framework. Circuit breakers shall be installed so that the toggles are in the up position when "ON" and down when "OFF".

Instrumentation

All metering instruments shall be mounted flush in the front panel unless otherwise specified. In certain instances it may be required that instruments be mounted flush in the door. In these instances the back of meters shall be covered by removable covers of isolating material fixed to the door to protect the terminals of instruments and to prevent accidental contact.

Fuses for instrumentation shall be mounted in an easily accessible position and marked clearly. Equipment normally mounted on the surface, such as time switches and relays, shall be mounted behind the front panel. In these cases hinged access panels shall be provided in the front panel.

Mounting of fuses

Fuse holders shall be mounted semi-recessed in the front panel so that fuses can readily be changed without removing the front panel.

Control equipment

All equipment performing control functions, e.g. control relays, not requiring adjustments, shall be mounted behind the front panel.

Mounting of busbars

All busbars shall be installed horizontally or vertically with the longer side of the section in the vertical plane. Busbars must be supported on resin insulators. It is of prime importance that mechanical stressing under short circuit conditions be considered when busbar supports are designed.

All busbars other than main busbars shall be mounted on suitable insulators or directly on circuit breaker terminals.

Busbars shall be mounted at least 150mm away from the nearest equipment. Special attention should be given to spacing between fuse switches and busbars.

Covering
The main busbars shall be covered with coloured heat-shrinkable PVC. The colour shall correspond to the colour of the supply phase. Busbars may alternatively be covered with two coats of coloured insulation paint if approved by the Engineer.

Connections
All conductor ends shall be fitted with crimped lugs, which are bolted to the busbar.

Neutral busbars
Neutral conductors for circuits protected by a single pole circuit breaker of fuse switch shall be connected to a neutral busbar mounted in a suitable position. The neutral busbar shall have a cross-section of at least 6 x 25mm and shall be long enough for the lugs of all the neutral conductors to be bolted separately to the busbar without overlapping the lugs.

Earth busbar
Each switchboard serving socket outlets identified as dedicated outlets on the drawings shall be provided with separate earth bars, which shall be referred to as a Building Earth and a Clean Earth respectively. Earth busbars shall be installed in convenient positions along the entire length of the switchboard. Building Earth busbars shall be bolted directly to the framework but

Clean Earth busbars shall be mounted on resin insulators. Earth busbars shall have a minimum cross-section 6 x 20mm and shall be installed in a suitable and easily accessible position over the full width of the board. 6mm Dia. Holes shall be provided in the busbar at 25mm centres.

All earth conductors shall be connected individually to the earth busbars. The holes provided shall be drilled on site to accommodate the bolts and nuts. Spare bolts and nuts need not be supplied.

All non current carrying metal parts of the board, e.g. framework, panels, transformer cores, metal covers, etc. shall be bonded to the Building Earth busbar.

Bolts and nuts
Cadmium-plated steel bolts only may be employed at connecting points. All bolts shall be provided with spring washers. Hexagonal nuts shall be used. The largest possible size of bolts that will fit into holes in lugs and fixing holes of equipment shall be used in every instance. Bolts shall be of sufficient length so that not more than two threads protrude beyond the nut.

Circuit breakers
Circuit breakers and earth leakage units supplied and installed by the Contractor shall be ABB, MERLIN GERIN or CBI rated minimum 5Ka r.m.s.

13.5 **Wiring**

Current ratings

The current rating of conductors for the internal wiring shall be sufficient to carry the maximum continuous current that can occur in the circuit. This value shall be determined from the circuit breaker or fuse protection of the circuit.

Internal wiring

Standard 600V grade PVC insulated stranded annealed copper conductors to SANS 150 shall be employed for the internal wiring of switchboards.

All wiring shall be arranged in horizontal and vertical rows and shall be bunched and strapped using "Hellerman" or similar strapping.

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 harnesses shall be so arranged that they are adjacent to the chassis.

These conductors shall first be led in the same direction as the conductors in the harness and shall then be bent over the top of the harness and progress to its final destination.

Conductors to hinged panels and doors shall be secured on both the door and the frame and shall be looped between the two points. The loop shall be arranged to produce a twisting motion when the door is opened or closed. A flexible protection sleeve shall be installed over the conductors.

All wiring between different panels within the same switchboard shall be separately bunched.

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

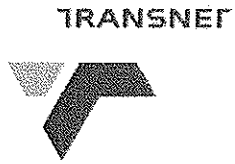
All wiring shall be installed away from terminals, clamps or other current carrying parts. Wiring shall also be kept away from exposed metal edges or shall be protected where they cross metal edges.

Conductors may be joined at equipment terminals or numbered terminal strips only. Ferruled and taped or other connections are not acceptable.

Where conductors change direction, smooth bends shall be formed with a radius of at least 5 times the outside diameter of the conductor 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 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 be confined to the front portions of switchboards as far as possible for ease of access. This requirement is important for wiring between circuit breakers with a rating of less than 30A and the associated main circuit breaker as well as the wiring from circuit breakers to lighting and socket outlet circuits.



Load End Connections

The supply end connections to equipment shall as a rule be at the top and the load end connections at the bottom. Where the load and supply ends of the mains circuit breaker of a switchboard are not indicated the load may be connected to the top end only if the wording "LINE" and "LOAD" is correctly indicated on the circuit breaker.

Wiring to circuit breakers

Loop connections may only be installed for a maximum of two outgoing circuits. Where there are more than two outgoing circuit busbars shall be used and equipment connected individually to busbars. Where MCB's are mounted in a continuous row and supplied by busbars connected to each MCB, a separate conductor shall supply each busbar. This conductor shall be connected to the busbar by means of a separate lug and not via an MCB terminal.

Conductor terminations

Connections to circuit breakers, isolators or contactors shall be installed by one of the following methods:

- a ferrule of the correct size, soldered to the end of the conductor, or
- winding a conductor strand around the end to totally cover the end.

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

Identification

The colour of the conductors for all 220V 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 terminal strips and all conductors used for the internal wiring of the switchboard, shall further be identified at both ends by means of double cable marking ferrules. PVC or other tape is not acceptable. The numbers on the markers shall also be shown on the wiring diagrams.

13.6 **Paint finish**

Finish Required

Metal components of the framework, panels and chassis shall be finished with a high quality paint applied according to the best available method. Baked enamel, electro-statically applied powder coating or similar proven methods may be used. Care shall be taken to ensure that all edges and corners are properly covered.

Colour

The colour shall be as requested by the Engineer.

Before the installation is handed over the Contractor shall ensure that all paint surfaces are clean and undamaged.

Labelling
Care shall be taken to ensure that all equipment is fully labelled and that accurate descriptions appear in the English language.

Material
Engraved plastic or ivory strips shall be used throughout. The strips shall bear white lettering on a black background.

Equipment identified
All equipment on switchboards shall be identified with the necessary labels. The circuit numbers shall appear at all grouped single pole circuit breakers. The abovementioned circuits shall be identified on a legend card, which shall be installed on the inside of the switchboard door, or in any other position where it can conveniently be observed.

All fuses including instrument fuses shall have labels stating function, fuse rating and duty or type where applicable. All other equipment shall be identified separately and their functions shall be clearly indicated.

Where cascading of circuit breakers occurs in a distribution board, a suitable label of notification must be provided.

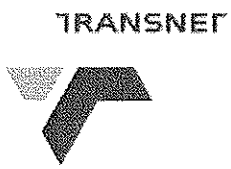
Fixing of labels
Engraved strips shall be secured by means of brass nuts and bolts or slotted label holders. Self-tapping screws will not be allowed. Labels shall not be glued to the switchboard. Sufficient fixing bolts shall be provided to prevent labels from warping.

Tests
The Engineer shall be notified when the mechanical construction of the switchboard i.e. frame, panels and base frame, is completed in order that he or his representative may inspect it at the factory.

Function tests of all equipment, control and interlocking circuits shall be conducted to the satisfaction of the Engineer. The proper functioning of all protection relays and ammeters shall be proved by means of current injection on the primary side of the relevant current transformers.

The Contractor at no extra cost shall provide testing equipment and facilities including instruments, dummy loads and additional switchgear and cables, at the factory or on site. The Engineer shall be notified in writing two weeks in advance of any tests to be conducted, to allow him or his representative to be present at such tests. A complete report on the tests shall be handed to the Engineer. The Contractor shall allow in his tender for all costs of travel and accommodation out of inspection by the Engineer should the boards not be manufactured in Cape Town.

13.7 **Drawings**



Drawings for approval

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

- A complete wiring diagram of the equipment in the boards.
- A complete layout drawing of the distribution board clearly indicating arrangement of all equipment, dimensions, construction and method of busbars fixing.
- All labelling information in English.
- The make, catalogue number and capacity of all equipment such as isolators, circuit breakers, fuses, contactors, etc.

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

Final Drawings

A complete set of "as-built" drawings of all switchboards shall be submitted to the Engineer immediately after completion of the installation.

Manuals

Two sets of manuals for all switchboards shall be forwarded to the Engineer at no extra cost. These manuals shall include the following information :

- Complete information on the operation of the equipment,
- Complete information for maintenance of the equipment,
- Brochures and ordering information, and
- A complete material list indicating quantities and relevant catalogue numbers.

Completion

The Contract shall be regarded as incomplete unless all tests have been conducted successfully and all drawings and manuals have been handed to the Engineer.

14.0 LV DISTRIBUTION KIOSK

14.1 General

The kiosks housing shall be fitted with doors at the front and back. The front of the kiosks shall contain the switchgear as indicated on the electrical schematic diagrams for the kiosks.

The kiosk shall consist of a steel frame with a treated mounting blockboard on which switchgear and busbars can be mounted. The frame shall be bolted onto a steel cable gland plate which will in turn be bolted onto a steel mounting pole. The equipment shall be housed in a housing manufactured from glass fibre and consisting of a top and bottom section. A door shall be provided in the top section.

The finish shall be of a very high standard.The kiosk shall have a neat appearance with a high quality finish and shall be strong. All components including sharp edges and joints shall be finished smoothly.

The kiosk shall be rain and splash-proof. The door shall seal thoroughly in such a way that water will not penetrate the kiosk when closed.

The upper portion of the housing shall fit tightly onto the lower portion in order to seal properly.

Kiosk shall be fully equipped and wired as indicated on the drawings.

Plastic seals shall be provided in all the cable glands openings in the cable gland plate.

14.2 Steel Components

All steel components, i.e. the mounting pole, the cable gland plate, bolts, nuts and washers as well as the frame of manufactured from steel shall be galvanised.

The components shall be cleaned thoroughly by means of sand blasting, acid treatment or any other effective method after which it shall be galvanised by means of a hot-dip process in accordance with SABS 763 after finishing all welding and machining.

Threaded holes shall be under-cut before galvanising after which it shall be cut to the right depth.

All treated components shall be finished neatly and smoothly.

Bolts, nuts and washers shall be galvanised or may alternatively be manufactured from stainless steel.

14.3 The Frame

The frame shall be bolted solidly onto the baseplate (Cable gland plate).

The switchgear and the busbars shall be bolted onto the mounting blockboard with a minimum thickness of 19mm.

The busbars shall be bolted solidly onto the blockboard.

The insulators shall be manufactured from a glass fibre based material.

The final product will be finished smoothly and shall be free from air pockets or openings.

The mounting studs shall consist of galvanised or brass bolts, nuts and washers of the appropriate size and length.

The bolt in the insulator shall be capable or withstanding a torque of 75 N.m, without yielding.

The insulator shall be capable of withstanding and operating voltage of 600V under normal and humid air conditions and shall be capable of withstanding a high-voltage test of 2000V for at least 5 minutes.

A sample of the insulator shall be submitted to the Engineer for approval before commencing with production.

The busbars shall be manufactured from tinned or nickel-plated electrolytic copper.

Galvanised stainless steel or brass bolts, nuts or washers shall be provided for the terminations of the cables to the busbars. The bolts and nuts shall be consistent in size.

14.4 **The Name-plate**

A 50mm x 100mm Trafolite nameplate, fitted onto the circuit breaker cover with two screws, shall be provided.

The nameplate shall not be engraved.

The nameplate shall be easily removable to allow engraving after installation of the cubicle.

14.5 **The Busbar Cover**

The busbar cover shall fit around the busbar and shall be manufactured from galvanised sheet steel of a thickness of 1.5mm.

It shall not be closer than 40mm from the busbars or busbar bolts.

14.6 **The Glass-fibre Housing**

The housing shall be manufactured from Type F Glass re-inforced polyester laminated material covered with a weather resistant gel layer of a thickness varying from 0.4 to 0.6mm. The housing shall bear the SABS mark.

The gel layer shall be of Epoxy type 7812 or equivalent and shall be smooth and free from cracks, holes, air pockets etc., with all joints neatly and smoothly finished and sealed.

The glass-fibre used as re-enforcing shall be in the form of cut bundles.

The material shall be of uniform thickness with re-inforcing where required.

The laminated construction of the upper portion shall consist of one layer of 300g/m² glass-fibre after which 3 layers of 450g/m² glass-fibre shall follow and the outer housing consisting of at least 5 layers of 450g/m² fibre.

The glass fibre shall be saturated with unsaturated polyester epoxy in such a way that no air pockets or openings shall exist in the final product and all layers shall be bonded thoroughly. The epoxy/glass fibre ratio shall not be less than 2.5:1 and shall not exceed 3:1. Spray application will not be accepted. The epoxy shall not contain any thinners or filling compound except for the outer gell layer which may be coloured.

The gell layer shall be coloured to a cloud grey (colour F48 in accordance with SABS 1091). The housing shall not be painted.

After the heat curing process, the inside of the housing shall be finished and covered with a layer of white epoxy to seal the glass fibre.

The product shall be resistant to normal acids contained in urine as well as against mineral oil and calcium and normal acids which exist in natural soil. The resistance tests shall be carried out at 40°C.

The product shall be resistant against rapid wear and tear and shall also be resistant to abrasion.

Splash-proof ventilation holes covered with gauze shall be provided underneath the roof overhang.

The door shall be located in a such a position that the two nuts holding the housing can be easily removed and it shall also be of adequate size to allow easy reading of the meters.

The door shall be located in such a position that the two nuts holding the housing can be easily removed and it shall also be of adequate size to allow easy reading of the meters.

The door shall be provided with a standard type lock. Information in this regard may be obtained from the Engineer.

A galvanised sheet steel plate of minimum thickness of 1.5mm and of 25mm width shall be cast into the kiosk for the fixing of the housing to the frame of the kiosk.

The upper portion shall be designed that no live equipment shall be closer than 40mm from the top, the door or the lock after the cables have been terminated.

The hinges shall be manufactured from metal which rust proof and of adequate strength and it shall not be possible to be loosened from the outside.

Steel plate re-inforcing shall be provided where the hinges are fixed to the frame and to the door.

14.7 **Danger Signs and Headings**

Appropriate danger signs of approximately 100mm x 150mm size and in accordance with the Machinery and Occupational Safety and as approved by the Engineer shall be cast into the front of the door. The sign shall be fixed thoroughly

15.0 POWER SKIRTING

Power skirting shall be supplied and installed in the positions indicated on the relevant drawings. The power skirting shall be similar or equivalent to Jupiter 801 PVC type in standard WHITE.

The Contractor shall be responsible for the complete supply and installation of all power skirting accessories and associated connections, 90⁰ bends, tees and end caps shall be purpose manufactured units and all sections of ducts and lids shall be cut square and have their edges "faced" to the approval of the Engineer.

Socket outlet, telephone outlets and infill plates shall be purpose made accessories stamped to receive respective outlets, all as detailed on the drawings.

Power skirting will only be installed after all wet trades have been completed and the Contractor shall be responsible for protecting the power skirting to the approval of the Engineer.

Conduit links indicated on the drawings shall rise out of the floor slab directly behind the power skirting. Linking conduits shall not be closer than 150mm throughout their length.

Where applicable all cut-outs for service connections shall be grommeted with "U" section neoprene trim secured to the Engineer's approval.

16.0 CONDUIT INSTALLATION

16.1 **General**

Conduit may be installed as follows:

- In open roof spaces, (Bosal)
- cast in concrete, (PVC)
- surface mounted against walls, concrete slabs, etc. (Bosal) and
- in wall chases.(PVC)

Conduits are to be installed in concrete shall be done while the building work is still in progress and according to the Main Contractors programme.

Surface fixed conduits shall only be installed after the Engineer has given his written consent to do so.

16.2 **Other Services**

Conduits shall be installed at least 150mm away from pipes which are intended for gas, steam, hot water or any other material which may affect the conduit. Where doubtful situations of this nature

occur or where there are installation incompatibilities the matter shall be reported to the Engineer without delay.

16.3 **Debris**

Care shall be taken to prevent any debris or moisture from entering the conduit during and after installation of the conduits. All conduit ends shall be sealed.

16.4 **Defects**

Each length of conduit shall be inspected for defects and all burrs shall be removed. All conduits that are split, dented or otherwise damaged or any conduits with sharp internal edges shall be removed from site. The Contractor shall ensure that conduits are not blocked.

16.5 **Continuity**

Electrical continuity shall be maintained throughout the conduit installation by provision of bare copper or PVC insulated earth wires which shall be drawn in simultaneously with circuit drawing.

16.6 **Inspection Type Accessories**

All outlet boxes and draw boxes shall be of the inspection type.

16.7 **Positions of Outlets**

All accessories such as socket outlets, switches, lights, etc. shall be accurately positioned. It is the responsibility of the Contractor to ensure that all accessories are installed level and square at the correct height from the floor, ceiling or roof level as specified. It shall be the responsibility of the Contractor to determine the correct final floor, ceiling and roof levels. Draw boxes shall not be installed in positions where they will be inaccessible after completion of the installation.

Draw boxes shall be installed in inconspicuous positions to the approval of the Engineer. All installed draw boxes shall be pointed out to the Engineer. The positions of all draw boxes shall be indicated on the "as built" drawings.

16.8 **Draw Wires**

Galvanized steel draw wires shall be installed in all unwired conduits eg. Conduits for future extensions, data/telephone conduits, security installations and other services.

16.9 **Bends**

A maximum of two 90^0 bends or the equivalent displacement will be allowed between outlets and/or draw boxes. Draw boxes shall be installed at maximum intervals of 9m in straight conduit runs. All bends shall be made without reducing the diameter of the conduit.

16.10 **Wall Sockets**

Where more than one socket outlet is connected to the same circuit, the conduit shall be looped from one outlet box to the following on the same circuit. Where a metal channel is used, the conduit may be installed from the channel directly to the outlet box on condition that the conductors can be looped from one outlet to the next without making any joints in the wires.

16.11 **Light Fittings**

Conduit ends may not be used to support light fittings. In all cases light fittings must be supported by the structure against or in which they are installed.

16.12 **Withdrawal of Conductors**

To ensure that all electrical conductors shall be easily withdrawable from conduits, the Engineer reserves the right to have the conductors of any circuit removed at his discretion and replaced at the cost of the Contractor. If the conductors are damaged during removal, the damaged conductors shall be replaced and the cost of the replacement shall be borne by the Contractor.

16.13 **Flush Mounted Outlet Boxes**

The edges of flush mounted outlet boxes shall not be deeper than 10mm from the final surface. Where this is not the case, an extension box which ends flush with the surface, shall be screwed to the outlet box. This method shall be used in partitions and cladded surfaces.

16.14 **Roof or Ceiling Spaces**

Sequence of Work in Roof or Ceiling Spaces (where applicable)

Conduit and wiring in spaces above ceilings other than concrete shall be installed before the ceilings and walls are painted and before removable ceiling tiles are installed. In roof spaces where access is limited after installation of the ceiling, conduits and wiring shall be installed prior to installation of such ceilings. It is the responsibility of the Contractor to ensure close liaison with the other Contractors is done in connection with the above-mentioned work.

Fixing

All conduits in roof or ceiling spaces shall be installed parallel and at right angles to the roof members and shall be fixed to the structure at intervals not exceeding 1 metre. Approved saddles shall be used throughout. Clout nails, clamps or wood screws shall be used to secure the saddles to wooden roof members. Suitable saddles shall be used to secure conduits against concrete slabs.

Written permission shall be obtained to secure conduits to steel beams in which case saddles shall be fixed by means of bolts, nuts and lock washers or purpose made saddles shall be used.

Draw Boxes

Draw boxes with PVC cover plates shall be installed where required. Draw boxes shall as far as possible be installed near walkways. Socket and switch boxes will not be accepted as draw boxes in open roof spaces.

Conduit Ends

All conduit boxes for lighting outlets in ceilings shall be securely supported.

16.15 **Installation in Concrete**

In order not to delay building operations, the Contractor shall ensure that all conduits and accessories that are to be cast in concrete are placed in position within good time. The Contractor or his representative shall be in attendance when the concrete is cast.

Draw Boxes

Draw boxes, expansion joints and round ceiling boxes shall be installed where required and shall be neatly finished to match the finished slab and wall surfaces. In columns where flush mounted draw boxes are installed, the conduits shall be offset from the surface of the column immediately after leaving the draw box.

Elbows
Elbows for conduits of 32mm dia. And smaller and sharp bends will not be allowed in concrete slabs.

Cover Plates
Draw boxes and/or inspection boxes shall where possible, be grouped together under a common approved cover plate. The cover plate shall be secured by means of screws.

Neutral Axis
All conduits shall be installed as close as possible to the neutral axis of concrete beams, slabs and columns. The conduits shall be rigidly secured to the reinforcing to prevent movement towards the surface of the concrete.

Fixing to the Shuttering
All conduits, draw boxes, etc. shall be securely fixed to the shuttering to prevent displacement when concrete is cast. Draw boxes and outlet boxes shall preferably be secured by means of a bolt and nut installed from the back of the box through the shuttering. Fixing lugs may also be used to screw the boxes to the shuttering.
Wire will not be accepted for securing boxes to the shuttering where off-shutter finishes are required.
All draw boxes and outlet boxes shall be plugged with wet paper before they are secured to the shuttering.

Expansion Joints
As far as possible, conduits shall not be installed across expansion joints. Where this is unavoidable and expansion joint shall be provided.

Screeds
The installation of conduits in floor screeds shall be kept to a minimum. Where conduits are installed in screeds, the top of the conduit shall be at least 20mm below the surface of the screed. Where the screed is laid directly on the ground, galvanised conduits shall be used. This ruling will always be applicable to the lowest floor of a building. A minimum distance of twice the outside diameter of the conduit shall be left free between adjoining conduits.

Conduits shall be secured to the concrete slab at intervals not exceeding 2.0 metres. The Sub-Contractor shall ensure that conduits are not visible above the screed where the conduits leave the screed.

Structural Steel
Supports, brackets, hangers, etc. may only be welded to structural steel members where prior permission of the Engineer has been obtained. "CADDY" or similar fasteners may be used to fix equipment to structural steel members.

16.16 **Surface Conduits**
Surface conduits shall only be allowed when authorised in writing by the Engineer.

16.17 **Flexible Conduit**

In installations where the equipment has to be moved frequently to enable adjustments during normal operation, for the connection of motors or any other vibrating equipment, for the connection to thermostats and sensors on equipment, for stove connections and where otherwise required by the Engineer, flexible conduit shall be used for the final connection to the equipment.

The lengths of flexible conduit shall be as short as possible to comply with the requirements of the particular connection but shall not exceed 600mm, except when specified or approved by the Engineer.

Flexible conduit shall preferably be connected to the remainder of the installation by means of a draw box. The flexible conduit may be connected directly to the end of the conduit if an existing draw box is available within 2000mm of the junction and if the flexible conduit can easily be rewired.

Flexible conduit shall consist of metal-reinforced plastic conduit or PVC covered metal conduit with an internal diameter of at least 15mm, unless approved to the contrary. Connectors for coupling to the flexible conduit shall be of the gland or screw-in type manufactured of either brass of cadmium or zinc plated mild steel.

Where the possibility exists that the conduit can come into contact with moisture, suitable covering and/or packing shall be installed to isolate the conduit from the moisture.

Flexible conduit connections shall be provided with an internal or external earth wire connection as required by the local Supply Authority, with preference given to internal earth wires where no specific local regulations apply.

17.0 WIRING

Except in cases where cables are specified, all wiring shall be PVC insulated, single core stranded copper conductors and bare stranded or green PVC insulated copper conductors for earth continuity in compliance with SABS 1507.

All conductors shall be installed in conduits, trunking or power skirting and shall under no circumstances be installed without mechanical protection.

Wiring in partitioning systems may be done using suitably rated 'Twin & earth' cable.

Wiring shall only be carried out after the conduit or trunking installation and plasterwork is completed, but before painting has commenced. No conductors shall be installed before the conduits have been cleaned of all debris and moisture.

Conductors that are connected to different switchboards shall not be installed in the same conduit or trunking.

The wiring of one circuit only will be allowed in 20mm dia. Conduit with the exception of the wiring between switchboards and fabricated sheet metal boxes close to switchboards in which case more than one circuit will be allowed.

All wiring shall be carried out according to the loop-in system. If a conductor joint is found necessary in an isolated case, jointing will only be accepted in trunking and not in conduits. Conductor jointing shall be executed by approved ferruling, properly covered with heat shrink sleeving.

The number of conductors that may be drawn through a conduit shall comply with the requirements of the SABS 0142. The total cross-sectional area of the conductors (including insulation) in trunking or power skirting shall not exceed 40% of the cross-sectional area thereof.

In cases where the conductors of more than one circuit are installed in trunking or power skirting, the conductors of each separate circuit (earth conductor inclusive) shall be taped at intervals of one meter with PVC insulation tape. The conductors of different circuits shall however remain separate in order that any given circuit can be withdrawn. Conductors entering switchboards or control boards shall be grouped and bound by means of plastic binding.

When conductors are drawn through conduit, care shall be taken that they are not kinked or twisted. Care shall also be taken that the conductors do not come into contact with materials or surfaces that may damage or otherwise adversely affect the durability of the conductor.

With the exception of three phase outlets, circuits of different phases shall not be present in lighting, switch or socket outlet boxes.

Conductors installed in vertical conduit or trunking shall be secured at intervals not exceeding 15m to support the mass of the conductors. Clamps shall be provided in suitable draw boxes for this purpose.

The insulation of conductors shall only be removed over the portion of the conductors that enter the terminals of switches, plugs or other equipment. When more than one conductor enters a terminal, the strands shall be securely twisted together.

When earth continuity conductors are looped between terminals or equipment, the looped conductor ends shall be twisted together and then soldered or ferruled to ensure that earth continuity is maintained when the conductors are removed from a terminal.

Cutting away of conductor strands will not be allowed.

The colours of conductor insulation for wiring purposes shall comply with the wiring regulations. The colours of conductors for sub-circuits shall as far as possible correspond with the colour of the supply phase. The colours of conductors for wiring to two-way and intermediate switches shall differ from phase conductors.

Single pole switches shall be connected to the phase conductor and not to the neutral conductor.

The following **minimum** conductor sizes shall be used :

- Lighting circuits — 2.5mm² plus 2.5mm² earth conductor
- Plug circuits — 2.5mm² plus 2.5mm² earth conductor

- Stove circuits — 10mm² plus 6mm² earth conductor
- Motor circuits — 4mm² plus 2.5mm² earth conductor

When wiring is installed in partitioning, the vertical and/or horizontal supports of the walls may be utilized for fixing wiring on condition that 'SURFIX' type cable is used as an alternative to wiring in conduit.

18.0 SWITCHES AND SOCKET OUTLETS

18.1 Flush switches

All switches shall comply with SABS 163 of 1951 as amended and shall bear the SABS mark.

Switches shall be rocker or toggle action and shall be rated at minimum 16A.

Light switches shall be of the Crabtree or Clipsal type.

Single or double gang switches shall be installed in such a fashion that the toggle or rocker action is vertical.

18.2 Surface mounted switches

Surface mounted switches shall consist of single or multi-gang switch units mounted in a common box. Rocker or toggle action shall be vertical.

The box and cover shall be of heavy gauge approved metal with all corners and sides rounded. The cover shall fit neatly over the box and shall be fixed by means of at least two chromium plated counter-sunk screws.

The switch toggle or rocker shall be shrouded where it protrudes through the cover.

The switch units shall bear the SABS mark and shall comply with SABS 164 of 1953 as amended and SABS 163 of 1951 as amended where applicable and with the test requirements of SABS 109 of 1950 as amended.

18.3 Installation of light switches

Mounting height

All light switches shall be installed 1400mm above the finished floor level unless specified to the contrary. Mounting heights given shall be measured from the finished floor level to the centre of the switch.

Doors

Unless otherwise specified switches adjacent to doors shall be installed on the side containing the lock. If the position of the lock is not shown on the drawings, the position shall be verified before the switch box is installed. Switch boxes in brick or concrete walls, shall be installed 150mm from the doorframe. Light switches installed in partitions or doorframes shall be of the type designed for that purpose.

Walls
Where the wall is plastered, light switches must be installed flush with the plaster finish.

Cover plates
Bevelled cover plates which overlap the switchbox and which fit tightly against the wall finishes shall be installed in the case of flush mounted switch-boxes. Suitable spiral type steel wire spacers shall be used to fix the cover plate to deep-set flush switch-boxes. All fixing screws in cover plates and switch grids shall be supplied and securely fitted. The colour of cover plates shall be to the Architect's choice.

Cover plates shall under no circumstances be cut unless specifically authorised in exceptional cases by the Engineer.

Switch boxes and cover plates shall be installed parallel to the relevant horizontal and vertical building lines.

Partitions
Light switches installed in partitions shall be of the type designed for this purpose to be accommodated in the partition design. Switches installed in the metal support do not require switch boxes. Switches may not be flush mounted in partition walls without switch boxes.

Multiple switches
Where specified, multi-gang switches shall be installed in a common box. Switches controlling different circuits shall be installed in separate switch boxes.

Appearance
The sides of adjacent switches, plugs, pushbuttons, etc. shall be parallel or perpendicular to each other and uniformly spaced. A common escutcheon plate shall be used for flush mounted outlets and accessories where the cover plates do not cover the cut-outlets in the finishes.

18.4 **Socket outlets**
The following different types of socket outlets will be supplied by the Contractor and installed in the building as shown on the drawings :

- General purpose socket outlets – These shall be 16 Amp 3-pin switched type to SABS 164. They shall either be mounted in power skirting, flush mounted in 100 x 100 boxes or surface mounted as described below.

- Dedicated socket outlets – These shall be 16A 3-pin switched type, with a half round earth pin. These outlets shall be red.

The earth conductors of all of these sockets will be Green/Yellow insulated PVC earth conductors wired back to the "Building Earth" bar for general purpose sockets and to the "Insulated Earth" bar for dedicated sockets on the nearest switchboard.

All socket outlets shall be of the Crabtree or Clipsal where not installed on the power skirting.

18.5 **Flush socket outlets (SABS Type)**

Flush socket outlets shall each consist of a switch and 3 pin plug receptacle with 2 shuttered poles and an earth socket suitable for mounting in a standard pressed steel box under a common cover plate.

Sockets and switches shall be rated at 250V, 16A unless clearly specified to the contrary. Switches shall comply with SABS 163 and sockets shall comply with SABS 164.

18.6 **Surface mounted socket outlets (SABS Type)**

Surface mounted socket outlets shall consist of a switch and 3 pin plug receptacle with 2 shuttered poles and an earth socket contained in a pressed steel box suitable for surface mounting.

The box and cover plate shall be manufactured of 1.6mm steel with all corners rounded. The lid shall fit neatly over the box and shall be fixed by means of two counter-sunk screws. A knockout shall be provided on each side of the box for the termination of 20mm conduits.

The switch toggle shall be shrouded where it protrudes through the cover plate.

Sockets and switches shall be rated at 250V, 16A.

The unit shall comply with SABS 163 and SABS 164 where applicable and shall be tested in accordance with SABS 109 of 1950 as amended.

18.7 **Installation of socket outlets**

Mounting heights, unless otherwise specified, outlets shall be installed at the following heights above finished floor level:

➢ Flush mounted socket outlets in general	300mm
➢ Surface mounted socket outlets in general	1400mm
➢ Kitchens surface or flush mounted	1150mm
➢ Plantrooms, stores, parking garages and workshops – surface or flush mounted	1400mm
➢ Passages – surface or flush mounted	300mm
➢ Office areas – surface or flush mounted (Excluding power skirting)	300mm

All mounting heights shall be measured from finished floor level to the centre of the outlet box.

Cover plates

Cover plates for flush socket outlets shall be manufactured from a non-ferrous metal with a thickness of not less than 1.2mm. The colour of cover plates shall be to the Architect's choice.

19.0 LIGHT FITTINGS

19.1 **Supply of light fittings**

All light fittings as shown on drawings and specified in the bill of quantities shall be supplied and installed by the Contractor.

The Contractor shall allow in his tender for the cost of administration, offloading on site, storing, handling, installing, cleaning and commissioning of all luminaires. The Contractor shall be held liable for any damage to luminaires from the date of receipt until date of handover to the Client.

19.2 **Installation of light fittings**

The various type of light fittings required in the execution of the contract is shown on the drawings.

Positions
The mounting positions of light fittings shall be verified on site. All fittings shall be placed symmetrically with respect to ceiling panels, walls, columns or other architectural features of the space.

The layout as shown in the drawings shall generally be adhered to but any discrepancies or clashes with structural or other features must be referred to the Engineer before commencing erection of the installation. Should the Contractor neglect to refer such discrepancies to the Engineer, cost incurred as a result of subsequent alterations to suit the architectural features will be to the Contractor's account.

Hangers and supports
Where provision has not been made for the support of fittings, the Contractor shall supply the necessary supports, hangers, conduit extensions, angle brackets or any fixing method approved by the Engineer.

Ceilings
In all cases where light fittings are installed in ceilings, the ceiling shall be capable of carrying the weight of the fittings. Ceilings shall either be of the open 'T' acoustic tile or plaster board type.

When installing fluorescent fittings in ceilings, a gap shall not be visible between the fitting and the ceiling. Fittings shall be constructed for installation from below.

Continuous rows of light fittings
In cases where fluorescent fittings are installed in tandem, only one connection point needs to be supplied per circuit. All fittings shall be coupled to one another by means of nipples or bushes and lock nuts to ensure that the wiring is not exposed and that earth continuity is maintained.

Fittings on the same circuit may be wired through the channel formed by the fitting canopies. In this case silicon-rubber insulated conductors shall be used and internal connections shall be made at terminal blocks, Screw connectors are not acceptable. The wiring for any other circuits or outlets, even though these may be in the same row may not be installed through the fitting canopies. The Contractor shall ensure that continuous rows are straight and parallel to the relevant building lines.

Recessed light fittings
Where recessed light fittings are indicated the Contractor shall maintain close liaison with the ceiling Contractor. In the case of tiled ceilings, the fittings shall be installed while the metal supports are being installed and before the tiles are place in position.

The Contractor shall be responsible for the co-ordination of the cutting of ceiling tiles or plasterboard with the ceiling Contractor. All mounting rings and other accessories shall fit closely into cut-outs to ensure a proper finish.

Waterproof light fittings
Waterproof and flameproof fittings shall be screwed directly to the conduit end. Draw boxes that may be required must be approved by the Engineer beforehand.

Bulkhead fittings
Surface mounted bulkhead fittings shall not be screwed directly to conduit ends. The conduit shall terminate in a round draw box at the back of the fitting. The PVC insulated conductors shall terminate in a porcelain terminal block in the draw box.

Silicon-rubber insulated conductors shall be used from the terminal block to the fitting lamp holder. Screw connectors will not be allowed.

20.0 AIRCONDITIONING OUTLETS

The Electrical Contractor shall be responsible for the following:

- Supply and installation of all conductors to AC fans and isolators.

21.0 FIXING OF MATERIALS

Responsibility
It is the responsibility of the Contractor to position and securely fix conduits, trunking, cables and cable ladders, switchboards, fittings and all other equipment or accessories required for the installation. The Contractor shall provide and fix all supports, clamps, brackets, hangers and other fixing materials.

Welding
Supports, brackets, hangers, etc. may only be welded to steel structural members where prior permission has been obtained.

Screws and bolts
Where holes in equipment to be fixed already exist, bolts and fixing screws shall be used.

Wall plugs
Where the fixing holes in brick or concrete walls are smaller than 10mm dia. And where the mass of the equipment is less than 15kg, wall plugs may be used to fix conduits, cables and other equipment. Aluminium, fibre or plastic plugs only may be used. Wooden plugs are not acceptable. Plugs installed in seams between bricks are not acceptable. A masonry drill of the correct size shall be used to drill holes for plugs. Round-headed brass screws shall be used throughout.

Anchor bolts
Where the fixing holes are 10mm and larger or where the mass of the equipment is 15kg or more, equipment shall be fixed by means of expanding anchor bolts.

22.0 CONNECTIONS

22.1 Connections to light fittings

Connectors

Connections to the wiring of light fittings and other appliances where connectors are used shall be effected by means of brass screw couplers shrouded in porcelain, neoprene or PVC or by means of approved spring steel locking connectors insulated in unbreakable material. Other types of connectors are not acceptable.

Knock-outs

Where the wiring to light fittings and other appliances passes through knock-outs, brass bushes or rubber grommets shall be used to protect the insulation against fabrication.

Fluorescent fittings

Connections to fittings with fluorescent lamps other than those provided with flexible leads and plugs may be installed inside the metal body on condition that the frame and/or diffuser holder where applicable can be removed without disconnecting the conductors.

Screwed lamp holders

The central terminal of Edison Screw (E.S.) lamp holders shall be connected to the phase conductor (i.e. conductor with red insulation) and the screwed housing to the neutral conductor (i.e. conductor with black insulation).

23.0 EARTHING

General

The installation shall be earthed properly in accordance with the latest revision of SANS 10142 and separate earthing systems shall be provided for the Building Earth and the Clean Earth. All earth conductors for the Building Earth shall be bare stranded copper conductors except that stranded conductors with Green/Yellow PVC insulation shall be used in trunking or power skirting. Earth conductors for the Clean Earth system shall be stranded conductors with Green/Yellow insulation.

A separate earth connection shall be supplied between the Building Earth busbar in each switchboard and the earth busbar in the Main LV Board. These connections shall consist of bare stranded copper. In turn the Main LV Board shall be earthed in accordance with SANS 10142.

Similarly a separate earth connection will be supplied between the Clean Earth busbar in each switchboard and its earth spike or mat.

The earth conductors of all circuits shall be connected to the appropriate earth busbar of the supply board. All single-phase socket outlet circuits shall be supplied with 2.5mm^2 earth conductors. All fluorescent lighting circuits shall be supplied with 2.5mm^2 earth conductors. All single phase and three phase outlets, electrical appliances, equipment, electrical motors, etc. shall be earthed as stipulated in SANS 10142. All outlets in the building identified on the drawings as dedicated socket outlets shall be provided with Green/Yellow insulated earth wires and earthed to the Clean Earth bar in the appropriate switchboard.

Connections
Under no circumstances shall any connection points, bolts, screws, etc. for earthing be utilized for any other purpose. It will be the responsibility of the Contractor to supply earth terminals or clamps where not provided by others. All earth connections shall be tinplated and fixed with approved ferrules. The entire connection shall then be soldered.

Power skirting
All power skirting to accommodate socket outlets shall be earthed with 2.5mm² Green/Yellow PVC insulated earth conductor.

This conductor shall be installed over the entire length of the power skirting and connected to the Building Earth busbar in the nearest switchboard. The conductor shall be bolted to the skirting on both sides. The conductor may not be used as an earth conductor for the plug circuits and shall be independent of any other conductor.

Wiring channel, cable trays and ladders
The ends of all metal channels, cable trays and ladders containing cables or conductors under load shall be earthed to the Building Earth busbar in the nearest switchboard with copper strapping or 2.5mm² stranded conductors. Adjoining sections shall be connected at joints with copper strapping or 2.5mm² conductors.

Flexible conduit
An external earth conductor shall be installed together with all non-metal flexible conduits. The earth conductor shall be connected securely to the metal parts.

Water pipes
Metal cold water mains shall be connected with solid 12 x 1.6mm copper strapping to the earth busbar in the Main LV Board. All other hot and cold water pipes shall be connected with 12 x 0.8mm perforated or solid copper strapping (not conductors) to the nearest switchboard. The strapping shall be fixed to the pipe work with brass nuts and bolts and against walls with brass screws at 150mm centres.

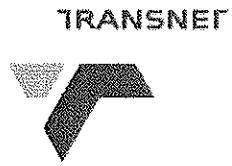
In all cases where metal water pipes are positioned within 1.6m of switchboards an earth connection consisting of copper strapping shall be installed between the pipe work and the board. In the vertical building ducts accommodating water pipes all the pipes shall be earthed to the nearest switchboard.

24.0 EXTERNAL LIGHTING

The Contractor will be responsible for the supply and installation of all the external lighting as described in the Bills of Quantities.

25.0 INSPECTION AND TESTING

On completion of the entire installation or any particular section thereof, as may be decided by the Engineer, tests shall be carried out in full accordance with the current edition of the "Code of Practice for the Wiring of Premises", in the presence of the Engineer or his authorised Representative.



The Contractor should note that where applicable at least the following tests must be carried out:

LV Installation

1. Insulation test
2. Continuity test
3. Loop Line Earth Impedance test
4. Polarity test
5. Earth leakage Circuit Breaker test
6. Any further test to meet the local Supply Authority Agreements or as deemed necessary by the Engineer.
7. Earth termination test.

Note:

1. All instrumentation necessary for testing shall be provided by the Contractor.
2. The results of the above tests must be clearly recorded, signed and handed to the Engineer.
3. Once the Engineer has inspected the complete installation and satisfied himself that all testing has been completed and the Sub-Contract is complete in all respects, may the Engineer be approached in writing with the above documentation with a view to arranging a hand-over date.
4. On completion of the Contract, the Contractor shall provide the Engineer with a complete and signed Certificate of Compliance for Electrical Installations as required by the Occupational Health and Safety Act as amended.

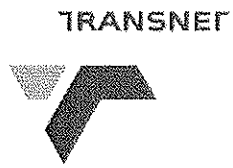
26.0 TESTING AND COMMISSIONING DOCUMENTATION

On completion of the Electrical installation and after testing and commissioning, a set of documents shall be compiled and presented to the Engineer. This set shall include the following:

- CAD copy of all drawings marked up "as built"
- Completed set of workshop drawings.
- Completed set of test and commissioning sheets.
- Set of schematic wiring and function diagrams
- File of distribution board legends.
- Operating and maintenance instructions on all electrical equipment.

27.0 COMPLETION OF INSTALLATION

Before the commencement of any tests or commissioning procedures, the Contractor is to ensure that all nuts and bolts are securely fastened, and that paintwork on all items supplied has been touched up where damaged has occurred.

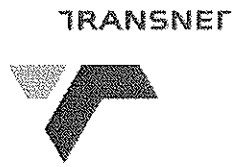


27.0 SCHEDULE

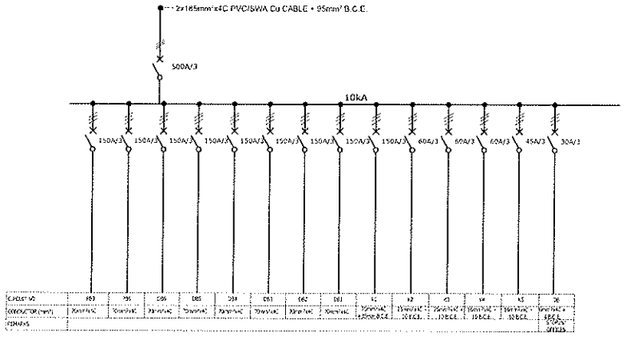
A Drawing Register

SCHEDULE A

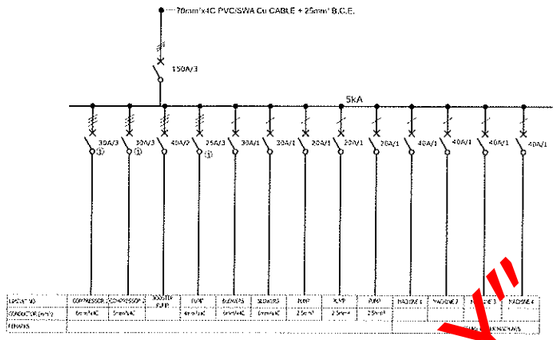
DRAWING REGISTER



APPENDIX A



MAIN KIOSK
(MK)



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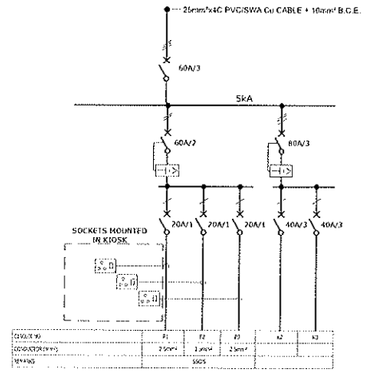
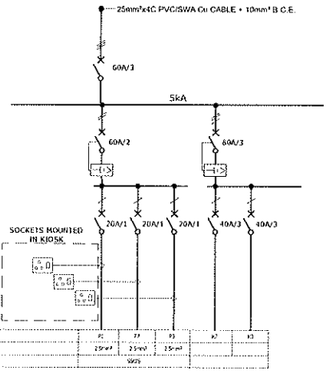


KIOSK 2



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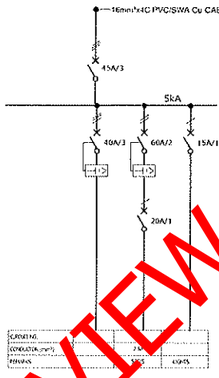

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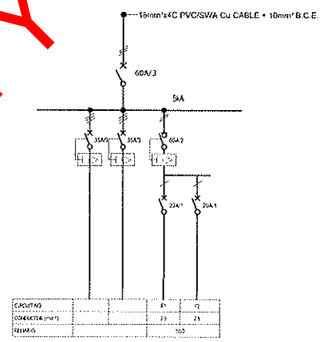
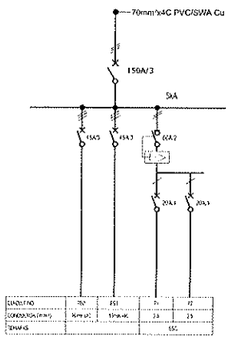
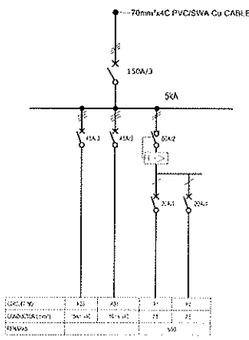


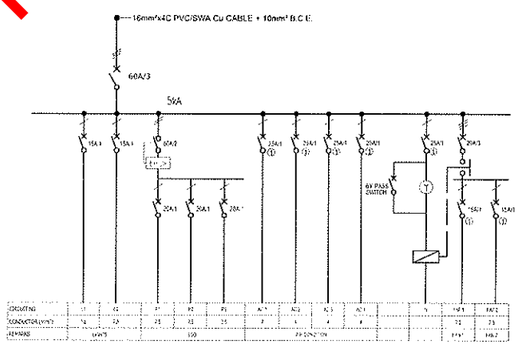
PILLAR BOX 1, 2, 4 & 5



PILLAR BOX 3

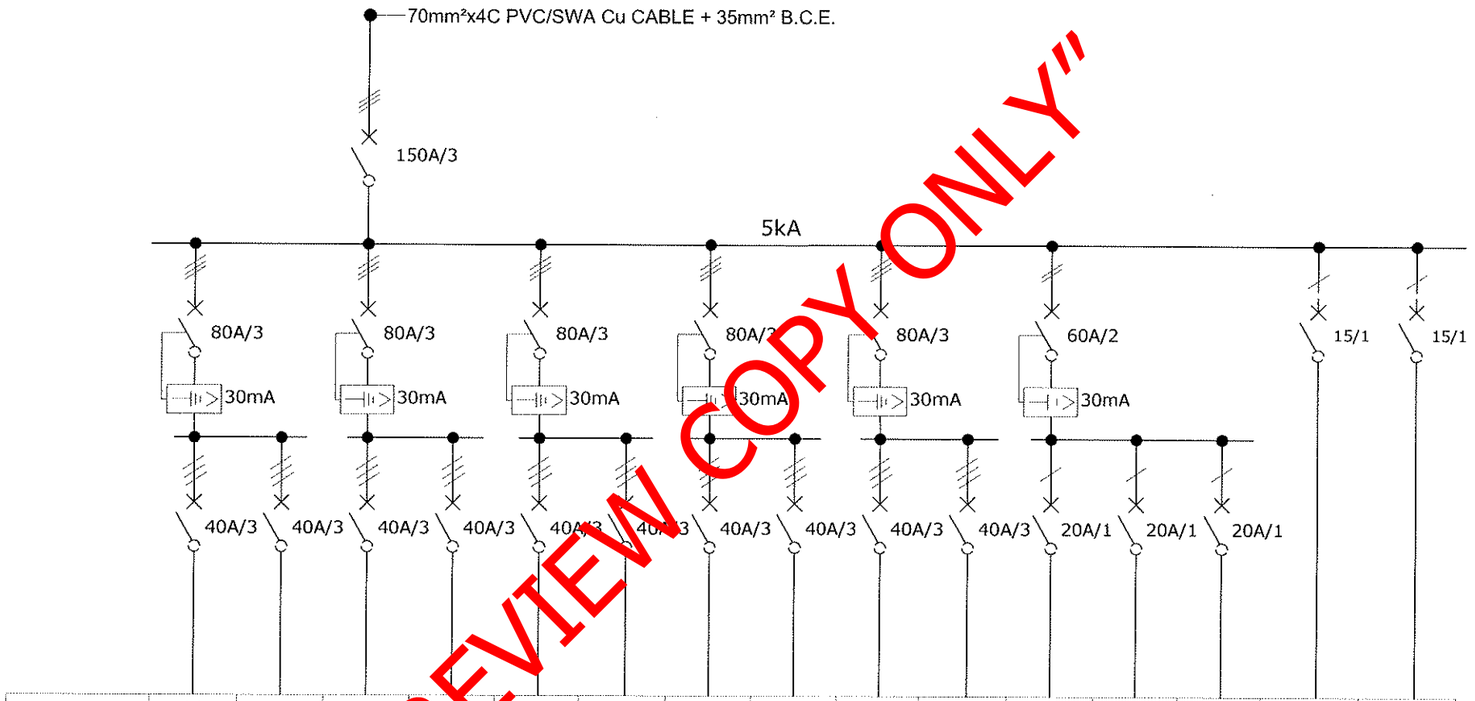


PILLAR BOX 6



OFFICE DB

DISTRIBUTION BOARD INFORMATION			
CONSTRUCTION		LIMITING DIMENSIONS	
Recessed		Width :	2000 mm
Semi-recessed		Height:	N/A
Surface		Depth :	400 mm
Free Standing		COLOUR SABS 1091	
Floor Standing	*	Normal Section (N)	
Doors		WHITE	
No Doors		TYPE: M&G / ABB / CBI	
Separate Cubicles			
Spare Space	30%		
		VOLTAGE	380 Volt
SERVICE ACCESS Front:		Rear :	Both:
ENTRY Top		Bottom	Side:
Incoming:			
Outgoing:			
Busbar Rating	Rating (N)	Rating (F)	Fault Level
Phase			
Neutral		Half	Full



CIRCUIT NO.	PP1	PP2	PP3	PP4	PP5	PP6	PP7	PP8	PP9	PP10	P1	P2	P3	L1	L2
CONDUCTOR (mm²)	10mm² x4C	10mm² x4C	10mm² x4C	10mm² x4C	10mm² x4C	10mm² x4C	10mm² x4C	10mm² x4C	10mm² x4C	10mm² x4C	2.5mm²	2.5mm²	2.5mm²	2.5mm²	2.5mm²
REMARKS	SSO'S				SSO'S						SSO'S			LIGHTS	

REFERENCE DRAWINGS

DRAWING NO. | REFERENCE

NOTES:
1. DO NOT SCALE DRAWING - ONLY DIMENSIONS SHOWN TO BE USED.
2. THE CONTRACTOR SHALL VERIFY ALL CONDITIONS, DIMENSIONS AND LEVELS ON THE SITE AND NOTIFY THE SUPERVISOR OF ANY VARIATIONS BEFORE CONSTRUCTION.
3. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL AND OTHER DISCIPLINE'S DRAWINGS.

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P O Box 4233, Cape Town, 8000
tel: (021) 487 4949 fax: (021) 424 7155
e-mail: mail@bergston.engineering.co.za

NO.	DESCRIPTION	BY	CHKD	APPD	DATE
00	FOR CAPE PEAK	P.J	P.J	P.S	25-06-2014

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE
DRAWN	P.J		02/06/14
CHECKED	R.J		02/06/14
ICONED	P.J		02/06/14
CHECKED	R.J		02/06/14

OPERATING DIVISION

TITLE	NAME	SIGN	DATE
DRAWN			
CHECKED			
APPROVED			
CHECKED			

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
DRAWN			
CHECKED			
DESIGNED			
CHECKED			

BUILDING / PIPELINES / RAIL ARCH

NAME & ADDRESS | DATE

SIGNATURE

REG. NUMBER

SCALE AS SHOWN

Transnet Freight Rail (RME) TRANSNET
BUILDING SERVICES
ROBERT MANGAUNG ROAD
BLOEMFONTEIN

PORT OF CAPE TOWN

PRE TRIP INSPECTION FACILITY FOR REEFER CONTAINERS IN THE PORT OF CAPE TOWN.

PLATFORM DB

PROJECT NUMBER	DISC	TYPE	SUB	TYPE	DRAWING NO	SHEET	SHEET NO.
12/1/15/5/0/6	E	DB	X		0/0/2	R01	0/0